

FLEXISEEDER "CONTINUOUS-RUN" SEED AND FERTILIZER MODULES FOR SMALL-SCALE USERS

Flexi Technical Note – 002

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SUMMARY (ABSTRACT)

Small-scale continuous-run seed and fertilizer modules are an essential adjunct to cell wheels on plot drills, used also for metering and applying other particulates. For these technologies, there are excellent opportunities for cross-over with commercial systems, to develop affordable and efficient multi-purpose modules. Thian Agri¹ joined the Flexiseeder project⁷ two years ago and since then by working together with S&N International², SLU³ and BACD⁴, has contributed two modules to the Flexiseeder project, as described in this technical note. These modules are easily and simply incorporated into a wide range of custom built small-scale gravity fed boxes, hoppers and/or air delivery systems, as well as Oyjord-type distributors. They match up well with the Thian gearbox, Zero Max Y2 gearbox (with torque delimiter attached) and probably, after further programming and testing, with the Brooks-S&N digital gearbox and the Brooks-S&N electric “vari-speed” unit fitted with an Oyjord-S&N impellor. Individual seeders and other componentry are available commercially. Because they are already registered and part of a larger commercial operation, they can not be put into the public domain.

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⁷www.flexiseeder.com. A voluntary user-group project of the Seed and Seed Drilling Technology Help Group: International Association for the Mechanization of Field Experiments / Global Institute and Agricultural University Internet Hub (IAU Trust).

INTRODUCTION

The utility of plot seeders can be extended substantially by fitting small-scale continuous run equipment modules in addition to cell wheels, for metering seed, fertilizer and other particulates. If designed and set up appropriately, these modules can also serve across a range of equipment, and / or be applied for many other uses⁸. There is a particularly high cross over in these technologies with commercial agriculture, providing excellent opportunities for networking to improve efficiency and affordability of these modules.

This technical note is one of six listed in the attachments prepared as additional technical background to Leuchovius et.al. (2008) and Stevens et al. (2008)⁹.

BACKGROUND

There are three main types of commercial seed and fertiliser *metering systems* used in small-scale equipment (a) star cogs and dual transverse rubber rollers (fertiliser), hard fluted rollers and tooth peg rollers (seed); (b) soft foam plastic (vertical, axial and tangential) rollers and pads (seed and fertiliser, variously); and (c) vacuum systems (seed). Added to this are two main types of *delivery systems*, one *purely gravitational*, the other including **additional forced / compressed air assistance**.

Forced feed systems entrap seeds / fertiliser (either individually or collectively) in discrete cells, and forcibly eject them in a controllable manner during metering and delivery. This creates periodicity of supply. Seed / granule damage often results. However, seeding / fertiliser rates are accurately controlled and ground metering is easily achieved, whereby seeding rate per metre travelled remains constant regardless of forward speed. This is something very difficult to obtain using *gravity assisted metering systems* that allow seed / fertiliser to flow out of variably sized holes assisted only by mechanical agitation. They are, however, low cost and usually free from periodicity problems and product damage.

Stevens et al. (2000) reported that New Zealand designers had successfully found ways of combining the best attributes of **forced feed metering systems** with low product damage and had eliminated periodicity by using foam plastic as the primary metering device in which seeds / fertiliser granules embed themselves according to their variable shapes and sizes. A range of options were reported to be in use including: (a) rubbing a foam disc against a stationary backing plate (radial seed flow); (b) rubbing a foam cylinder against the inside of a stationary backing cylinder (axial seed flow); (c) two counter-rotating foam rollers (tangential seed and fertiliser flow).

THIAN SEED MODULE

The Thian seed module is of type “a”, a radial seed flow achieved by rubbing a foam disc against a stationary backing plate (shown in Plate 1). This is an improved and patented

⁸ The Thian seed module is also used for example, to meter finite quantities of grain to individual animals in New Zealand dairy sheds, during milking.

⁹ Covering the evolution and development of modular components of the Flexiseeder project, under the IAMFE / IAU Seed and Seed Drilling Help Group formed at IAMFE 2004 in St Petersburg.

modular version of the original Aitchison foam feed released during the 1980s which has been sold successfully into Europe as well as many other countries globally for more than 20 years.

Improvements incorporated into the Thian module include:

- Moulded high-density UV light resistant plastic seeder unit with interlocking mounting slides (slide on rails and joiners). When combined with Thian custom spacers, it becomes easy to adapt these seeder modules to a range of box designs and shapes, including "mixing and matching different row spacings / module positions.
- Continuously profiled and smooth inner surface to seeder moulding which provides 100% self clean-out.
- Distribution hose connector / feed totally enclosed and moulded into seeder module to prevent wind drift / cross contamination / seed loss. Besides gravity feed, this makes the module particularly suited for use on auxillary feed boxes on air assisted units.
- Collector trays are not required due to seed hose connecting directly to the seeder module outlet.
- Outer mouldings of seed module enclose exposed edges of sponges, protecting them from vermin and/or environmental damage. As a result, the seeder module is semi sealed, yet leaves the solid backing plate to the foam pad exposed in a way that the pad can be easily prised back when required for cleaning / inspection.
- Pad springs of different tensile pressure are available for over-riding factory setting, where needed for specialist applications / uses / novel products.
- A range of different width spring collars / spacers available, equal to the widths of module spacers supplied, used to ensure even pad pressure across the full width of the drill (all modules / string of modules) even though they may be positioned at different spacings.
- Individual seed units / modules may be used singularly or in strings.

The connecting drive rod for modules comprises a 9/16 inch stainless steel hexagonal shaft. A single agitator (which is supplied as part of the unit) is run above and to the side of each foam pad. The metering system is either driven mechanically from a ground wheel via a manual gear box (Thian box for heavy work and a Zero Max Y2 box for light work) or electrically using the Brooks-S&N digital gear box for example. They can also be used to feed into mechanical / electrically driven Oyjord-type distributors. Both systems have been described by Fraser et al. (2008). Both single and double output versions of the Thian gear box are available. Each output has its own independent speed adjustment.

Sowing rates for seed can be varied from 0.5 to 350 kg/ha, including seed of species considered difficult to meter, for example, chicory (*Cichorium intybus*), sulla (*Hedysarum coronarium*) and prairie grass (*Bromus willdenowii*). The module will also meter a range of other particulates, including fertilizer granules (applied a low rates) and slug bait for example. Individual units may be used singularly or in strings.



Thian (left) and Flexiseeder (right) multi-purpose farmer seed drills fitted with Thian seed modules

A SEMEC rubber tyred roller is being towed behind the Thian seed drill



Assembling a string of modules



Thian vineyard drill also used for research



Thian micro box



Thian seed modules. Note drive unit for agitators on right hand end of string of modules Plate 1. Applied use of Thian seed module with excellent cross over of technology to small-scale continuous seeders for mechanization of field experiments and other small-scale agriculture, horticulture, viticulture, wildlife management and recreation.

THIAN FERTILIZER MODULE

The Thian fertilizer module (Plate 2), also suited for basal applications of small grain cereals, is of a basic fluted roller design. It is simple and affordable, and easy to dismantle and clean out. It comprises a series of ultra high density plastic cylinders (UHMWPE-BR¹⁰) into which either 6 mm or 8 mm deep (half round) flutes have been machined. Cylinders are mounted horizontally on a 7/8 inch hexagonal stainless steel shaft, one cylinder per delivery outlet. Plastic spacers (cut from plastic tube) are placed over the hexagonal shaft to lock the fluted rollers in front of outlet ports in the manifold. The width of spacers may be adjusted very easily and cheaply to accommodate different (row) spacing between the outlet manifold ports.

¹⁰ www.ludoplas.com

UHMWPE is resistant to UV light, hard wearing and has a low coefficient of friction. The same material is used in plastic bearings and under the Flexiseeder S&N Cell wheels (Stevens et.al. 2008, Technical note 005)

A removable face plate is positioned in front of the fluted rollers, into which outlet ports have been machined and to which outlet pipes are welded. An adjustable choke plate is mounted inside the box, above the string of fluted rollers to help bare the weight of the product held in the hopper and to help regulate its fall by gravity into the metering chamber. Replacement / additional manifolds are easily manufactured for different row spacing. The top of the face plate is located in a metal recess running across the top side of the opening in the box, and the lower part is positioned using a locator bar welded to the manifold, and held in place with simple over-centre locks.

A range of flute depths, outlet port sizes and shapes, and row spacing are available. At present, boxes are made from mild steel which is powder coated and the face plate is nylon coated. More expensive boxes and face plates can be supplied as special orders, made from stainless steel. It must be noted that by design, this is not a highly sophisticated unit. It provides value for money. Its main advantage over comparable units is the ease with which it can be cleaned out, its simplicity of operation and maintenance, and straight forward adjustment of application rates.

Large units are powered and the delivery rate adjusted through a Thian heavy-duty gearbox. On smaller units, a Zero Max Y2 gearbox is used fitted with an extended quadrant and torque delimiter. After further programming development, the Brooks-S&N digital gearbox will also be offered as a drive option, by late 2008.



Thian double box drill (seed and fertilizer)



S&N Flexiseeder plot drill (delivered to Norway) fitted with Thian fertilizer box.



Thian fluted rollers and removable face plate. Box manufactured by Geoff Gray Ltd



*Thian heavy duty gear box
(single or double output)*



Zero Max Y2 gear box, quadrant and torque delimiter

Plate 2. Thian fertilizer module including main components.

DISCUSSION AND CONCLUSIONS

The *seed module* is unique in its design and application, whereas the *fertilizer module* meets a need in a simple no-frills way that is affordable while at the same time, lends itself to being used in fertilizer boxes which can be interchanged between machines, or left permanently on a basic tool bar to which other modules are added as required. These modules are easily and simply incorporated into a wide range of custom built small-scale gravity fed boxes, hoppers and/or air delivery systems as well as Oyjord-type distributors. They match up well with the Thian gearbox and the Zero Max Y2 gearbox (with torque delimiter attached).

With further programming and testing we expect that by late 2008, the Brooks-S&N digital gearbox and the Brooks-S&N electric “vari-speed” unit fitted with an Oyjord-S&N impellor (cast in brass or aluminium) will also become suitable for powering these modules. With this, we expect new opportunities in design and use to evolve including being able to coordinate and control a range of linked functions from automatic GPS / driveline systems.

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