1-1-1991

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Narrow-winged seeder points reduce water erosion and maintain crop yields

By Kevin Bligh, Adviser, Division of Resource Management, South Perth

Kevin Bligh (left) is now overseas on a Wesfarmers Churchill Fellowship to study minimum tillage.

Kevin is visiting Massey University, New Zealand to work with John Baker, developer of the Baker Boot, and to study the development of a New Zealand-designed disceder for sowing through crop stubble. He will see the seeder in use in California and Washington State, USA on hilly, erosion-prone wheat land.

Kevin will also visit North Dakota and Kansas to study no-till drills, and Saskatchewan, Canada to study methods of seeding through stubble using tined seeders.

Sowing crops without loosening the topsoil by tillage reduces water erosion. It can increase infiltration of rainfall into loamy soils, thereby reducing runoff and increasing potential crop yields.

Crop yields were maintained after 11 seasons of seeding an Avon Valley loam near Beverley with minimum and no-tillage seeding operations. Infiltration increased significantly from 80 per cent of the 1983 growing-season rainfall under the traditional three tillage operations, to 87 per cent under a single tillage operation using a combine seed drill. Infiltration increased further to 96 per cent under a no-tillage system using a triple-disc drill.

At Gnowangerup, 80 per cent of growing-season rainfall infiltrated into a sand over clay soil under no-tillage techniques, whereas less than 67 per cent infiltrated under both traditional and a single tillage operation in the third season of continuous cropping.

No-tillage seeders

No-tillage seeders are at an early stage of development. Traditional tined seeders can be fitted with narrow points to cultivate only in the sown rows. Newly-developed disceder seeders can also sow into stubble with minimal soil disturbance.

Both tined and disceder no-tillage seeders were tested in a National Soil Conservation Program project during the 1989 and 1990 growing seasons.

The following methods were tested.

- 'Inverted T'-shaped points 55mm-wide were fitted on a 30-tine seeder at 180 mm row spacings.
- A 5 mm-wide front blade cultivating 50 mm below the seed zone was welded on the front of similar points.
- Conventional 213 mm-wide points were included, for comparison in 1990 only, with finger harrows to reduce ridging.
- Lucerne points, 12 mm-wide and without wings, were tested on three soils in 1990.
- Farmers' seeders were included in tests, where possible, with typical prior tillage.

FROM LEFT: Points used in the trials. Conventional 213-mm-wide point; point similar to 55 mm-wide 'inverted T'-shaped point with a 5 mm-wide blade welded on the front for cultivating 50 mm below the level of the wings; cast lucerne point without wings; and 55 mm-wide 'inverted T'-shaped point.
All points were used with or without press wheels to test for benefits from improved seed-soil contact. Solid rubber press wheels 25 mm-wide were loaded at 3 kg per centimetre-width behind narrow points. Double-ribbed 110 mm-wide press wheels at about 1.5 kg per centimetre of effective width were loaded behind conventional points.

Disced no-tillage drills can sow through heavy stubble whereas tined seeders cannot. Two disced no-tillage drills were tested: a John Deere 752 'No-Till Drill', imported from the USA and on loan from the company, and a Moore 'Uni-drill®' from Northern Ireland and loaned by Geraldton farmer, Peter Martin.

Sixteen soil types between Geraldton and Jerramungup were sown using the five-metre-wide tined seeder in 1989, and 13 soil types were sown in 1990. Eight soil types were cropped in both 1989 and 1990. Each year, three soils were sown using the seed-only Uni-drill, with superphosphate top-dressed. Nine soils in 1990 only were sown with the No-Till Drill.

Wheat, barley, oats, lupins or field peas were sown at recommended seed and fertiliser rates. Herbicide treatments were applied by landholders, at times and rates representative of satisfactory direct-drilling practice.

**Crop establishment**

Crop establishment six weeks after sowing, using the narrow-winged points, was generally comparable to or better than sowing using conventional or deep-front-bladed narrow-winged points. Wheat plant numbers were inferior only on a sandy loam near Geraldton in 1990.

The lucerne points, without wings, achieved comparable plant numbers on the two loamy sand soils tested. However, they left some seed uncovered in the only sandy loam soil tested.

The use of traditional combine seed drills with cultivating tines, or separate prior tillage, generally resulted in better crop establishment in the initial years of direct drilling loamy soils. When tillage delayed time of sowing, crop establishment tended to be inferior to that achieved from early sowing using the narrow-winged points.

The use of press wheels tended to increase plant numbers by about 10 to 20 per cent in 1989, and increase only seedling vigour in 1990. Plant numbers increased significantly using press wheels in both years only on a sandy clay Moort soil near Jerramungup, but not on the seven other soils sown in both years. The increase in plant numbers averaged 41 per cent for the narrow-winged points, and 88 per cent for the deep-bladed narrow-winged points.

Use of the John Deere No-Till Drill increased crop plant numbers relative to the narrow-winged points in a medium clay soil at Mingenew, but decreased plant numbers on loamy sand soils at Chapman and Darkan. The No-Till Drill seeded satisfactorily into dry sandy clay and loamy sand soils at Jerramungup, both of which were too hard for tined seeders.

Wheat, lupin and field pea establishment from seeding with the Moore Uni-drill® were comparable to that from the narrow-winged points, except when seed was sown less than 25 mm deep in loamy sand and medium clay during the relatively dry 1990 seeding season.
The John Deere 752 No-Till Drill has two ranks of individually spring-mounted 450 mm-diameter discs, with close-coupled depth wheels set at 7° to the direction of travel. A press wheel then presses the seed into hard soil on the bottom of the furrow, and a closing wheel covers the seed. Row spacings are 190 mm (7.5 inch).

The Moore Uni-drill® has a 300 mm-diameter disc at a slight angle to the direction of travel, with a rigidly-mounted sowing boot jutting out about 20 mm, and forming a furrow over the seed zone. A single-ribbed metal press wheel follows. Each assembly is mounted in pairs at 166 mm (i.e. 6.5 inch) row spacings.

Harvest yields
Grain yields and total dry matter production after sowing using narrow-winged points were generally comparable to yields and dry matter production from all other points, with or without prior tillage. The use of press wheels did not increase crop yields, though there appeared to be a trend towards increased yields in two well-structured loamy soils.

Wheat yield and total dry matter production after sowing using the No-Till Drill tended to be lower than that for all tined treatments. Pressing the seed into the bottom of the furrow before covering may cause unsatisfactory crop yields in hard soils.

Drawbar power
The drawbar power needed to pull the 30-tine seeder at about 8 km/hour was about 10 per cent less with narrow-winged points, than with either deep-front-bladed or conventional points.

Replacement costs of narrow-winged points
Various hard-faced and tungsten-tipped narrow points were fitted to cooperating farmers' seeders at Morawa, Narrogin, Darkan and Esperance. Wear appeared to be least when an 8 mm-wide strip of tungsten carbide was silver-soldered from the tip of the point 30 mm up the leading vertical edge. Narrower tungsten tips up to the soil surface help prolong point life.

Fabcast® tungsten-tipped, narrow-winged and lucerne points similar to those used in this study are sold by Primary Sales Australia. Their replacement costs after sowing 200 ha of gravelly loamy sands near Darkan in 1990 were estimated to be comparable with those of scarifier points.

Stubble retention
Direct-drilling minimises stubble retention problems, because only a single pass is made through the stubble.

The tined seeder could not seed satisfactorily through 400 mm-long stubble from a 3 t/ha wheat crop, even though the tines were spaced 1,080 mm-apart laterally, in six ranks at 450 mm intervals. The long straw, which was flattened by grazing sheep, tended to catch around individual tines, blocking part of the seeder after it had travelled about 80 m. Straw became packed to the frame on which the John Deere 700-Series tines were mounted. Even when dislodged before blocking, clumps of straw were left unevenly on the soil surface.

Vertical 400 mm-diameter disc coulters mounted in front of each tine to cut the soil to the depth of sowing did not appear to improve stubble handling greatly. Dry stubble appeared to be more easily cut than moist stubble. Straw was cut better in dry soil than when soil was wet and soft.

Both the Moore Uni-drill® and John Deere No-Till Drill readily sowed through long heavy stubble. Some straw was pushed into the soil uncut, leaving the ends sticking out like hair.
pins. There have been overseas reports of toxic effects of stubble breakdown products from such 'hair pinned' stubble on germinating seedlings.

**Runoff and soil loss**

No-tillage seeders avoid loosening the entire soil surface. Surface runoff stripped topsoil to the depth of cultivation from a three-metre-length of a contour-sown plot which had been direct-drilled using conventional points at Darkan. There was no rill erosion on adjacent plots sown without tillage, using narrow-winged, deep-front-bladed, lucerne points and the No-Till Drill.

Surface runoff and suspended sediment loss were similar for all direct drill treatments under simulated heavy rainfall in the first two years. Infiltration was similar in the first two years under natural rainfall. Infiltration increased from 80 per cent to 96 per cent in the third year as organic matter increased under no-tillage sowing.

Suspended sediment loss doubled after the traditional three tillage operations. The amount of runoff doubled under permanent pasture and suspended sediment loss was only half that after direct drilling using narrow or conventional points.

However, runoff was less turbid from the first season using the minimal disturbance, triple disc drill. Turbidity of runoff was comparable with that from tilled soils in this trial. It was attributed to fresh soil splayed over the entire soil surface by the narrow points, and to shearing of surface soil by the depth wheel beside each disc of the No-Till Drill as it 'crabbed' along at an angle of 7° to the direction of travel.

**Conclusions**

- Direct-drilling using 55 mm-wide narrow-winged points, without cultivating tines, achieved crop establishment and yields comparable to those from using 50 mm-deep-front-bladed or conventional points in loamy soils in medium (greater than 350 mm) rainfall areas.
- The use of press wheels tended to increase crop establishment, but not yields. The additional cost of press wheels suggests that increasing seeding rates may be a more economical way of improving crop establishment on most soils.
- The disced John Deere No-Till Drill and Moore Unidrill® readily seeded into heavy stubble and hard soils, though crop establishment and yields were inferior to other seeding methods in most soils tested.
- Straw must be short if tined seeders are to sow through stubble with little clumping. Straw length and ease of stubble handling, therefore, should start from the harvest of the previous crop.
- Direct-drilling crops using narrow points reduces rill erosion. Sowing crops with minimal soil disturbance reduced surface runoff and suspended sediment loss after three seasons.