



Cross Slot[®]

NO-TILLAGE SYSTEMS

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MAXIMIZING SEEDLING EMERGENCE AND CROP YIELD POTENTIAL



“YOU CAN USE CROSS SLOT OR NO-TILL IT, KNOW THE DIFFERENCE”

www.CrossSlot.com

DVD
ENCLOSED

**CROSS SLOT
YOUR ONE-STOP
NO-TILL SEEDING TECHNOLOGY**

◆ *Wheat harvest of Cross Slot seeding
Wolf Farm
Washington State*



◆ *“With such low disturbance, the micro-organisms and worms have taken over this ground and brought it back to life”
Dan & Ben Wolf
Washington State Farmers*



30' (9m) Cross Slot drill, Alberta, Canada



FIELD BENEFITS OF CROSS SLOT SEEDING

ONE-PASS NO-TILL CROP ESTABLISHMENT

CROPS AND ROTATIONS

- ◆ Cross Slot drills seed all common agricultural crops and combinations.
- ◆ Yields—Extensive research and field experience has shown equal and improved yields compared with minimum and conventional tillage seeding.

NO-TILL SOILS

- ◆ Cross Slot drills seed precisely into almost all agricultural soils.
- ◆ Cross Slot drills readily adjust to variable moisture, density and friability.

SEEDING DEPTH SENSOR

- ◆ Each seeding opener down force is hydraulically controlled and independent of vertical travel.
- ◆ Required down-force for variable soil conditions is continuously monitored and automatically adjusted by an electronic sensor.

BANDED FERTILIZERS WITH SEEDING

- ◆ Fertilizer is banded adjacent to the seed through the same opener with no emergence reduction.
- ◆ All forms and combinations of fertilizer are possible: dry, liquid, anhydrous.

RESIDUE MANAGEMENT

- ◆ Heavy residue is no problem, either standing or down.
- ◆ No pre-seeding residue management is needed.
- ◆ Residue is returned over seed row with no ‘tucking/hairpinning’ problems in seed furrow.

VARIABLE SEED AND FERTILIZER

- ◆ Seed and fertilizer rates are variable by drill sections and field zones.



Dry land canola, WA, USA



ECONOMIC BENEFITS OF CROSS SLOT SEEDING

COMPARED WITH TILLAGE AND MINIMUM-TILLAGE

DECREASED COSTS

- ◆ Seed rate is reduced by high germination and emergence.
- ◆ Fuel costs, labor and tractor time – save up to 60%.
- ◆ Capital costs are similar to tillage – operating costs are much less.
- ◆ Machinery replacement and maintenance are less frequent.

DECREASED SOIL DEGRADATION

- ◆ No compaction – minimal tillage, flotation tires.
- ◆ Low-disturbance drilling reduces moisture loss – otherwise every tillage pass can lose 0.5 in (12 mm).
- ◆ Reduced irrigation frequency from conserved moisture.
- ◆ Stones are progressively buried – not brought to the surface.

DECREASED ENVIRONMENTAL IMPACTS

- ◆ Less erosion-wind and water – minimum dust and runoff.
- ◆ Less CO₂ emissions.

INCREASED YIELDS

- ◆ Equal or better than tillage seeding.
- ◆ Excellent emergence and establishment.
- ◆ Banded fertilizer efficiency.
- ◆ Flexible cover-crops established and re-cropped.

INCREASED SOIL HEALTH

- ◆ Organic matter – readily builds in first few years.
- ◆ Water infiltration – better porosity – less runoff.
- ◆ Biological variety and numbers improve.
- ◆ Soil trafficability – improved for machinery and livestock.

INCREASED SEEDING EFFICIENCY

- ◆ Routine seeding speed is 6–9 mile/hr (10–14 km/hr).
- ◆ More acres (hectares) farmed with the same resources – more profit.
- ◆ More time available for management and choices.



Spring wheat emergence, Victoria, Australia



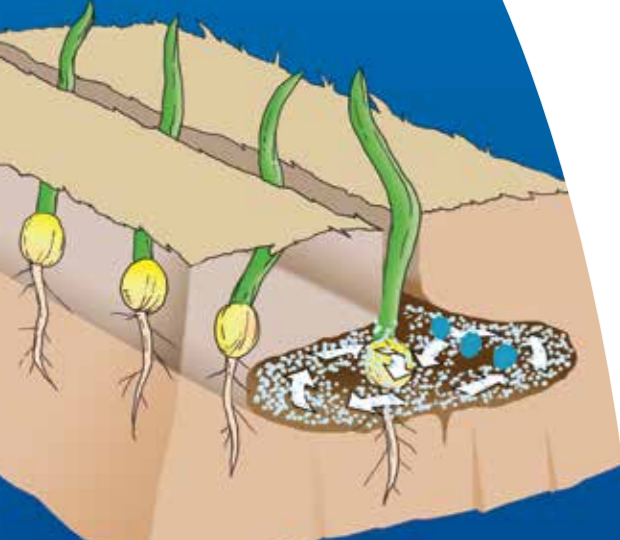
Wheat crops, ND, USA

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Field Benefits of Cross Slot Seeding	
Economic Benefits of Cross Slot Seeding	1
Seed & Fertilizer Placement	2
Fertilizer Banding	3
Seeding Depth Control	4
Residue Management	5
Crop Emergence	6
Crop Stands	7
Cross Slot Drills Assure Crop Success	8–9
Cross Slot Special Applications	10–12
Small & Medium Field Drills	13
Large Toolbar Components	14
Large Field Drills & Toolbars	15
Further Reading & Information, Media Sites	16
About Cross Slot, Contacts, DVD	

INSIDE FRONT COVER

INSIDE BACK COVER



Readily sows a wide range of crops: grasses, alfalfa, camelina, canola, millet, barley, wheat, oats, rye, corn, peas, soy beans, garbanzos, lentils, sunflowers.



SEED & FERTILIZER PLACEMENT

CROSS SLOT – UNIQUE SEED SLOT

- Creates unique horizontal seed slots at precise, selected depths, whereas all other openers make vertical slots.
- Seed on one side, fertilizer placed simultaneously on opposite side, up to annual crop requirements.
- Residue folded back over the slots reduces moisture loss, provides seedling protection.
- Opener wheels maintain seed depth and firm closure.
- Self-closing of both slots ensures positive soil contact.
- Ultra-low soil disturbance conserves seed zone soil moisture.
- Positive closure of seed slot traps soil moisture vapor, ensuring rapid germination.



Cross Slot sod furrow: seed & fertilizer 2



Cross Slot opener



40' (12m) wing-up Cross Slot drill

FERTILIZER BANDING

SIMULTANEOUS WITH SEEDING



Banding gives even emergence and increased, high quality yields
Steve Berger at a Larson Farm field day

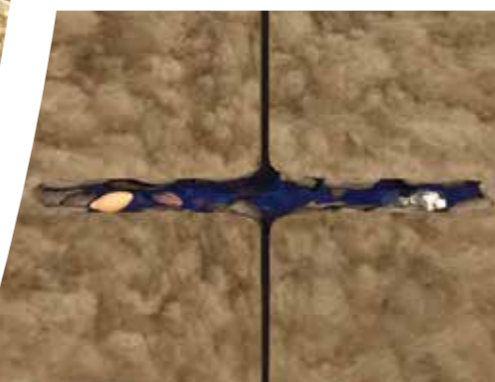
- Fertilizer banded with the same disc opener that sows the seeds (true one-pass).
- Dry, liquid, gaseous or combination fertilizer banded simultaneously with seeding.
- Fertilizer banded at seed depth or deeper.
- Separated from seed 0.5–2 in (1.5–5 cm).
- Fertilizer banding is unaffected by soil moisture, form, residues, or speed.
- One pass fertilization, lb/ac (kg/ac) rate up to annual crop requirements with no emergence effect.
- Field tested up to 300 lb/ac (330 kg/ha) urea dry fertilizer.
- Soil disturbance minimal and confined to sub-surface (non-inversion).
- True, one pass, low-disturbance, no tillage seeding.



Unbanded fertilizer Banded fertilizer



Cross Slot seed and fertilizer placement



Seed & fertilizer placement...



...in one-pass



Sunflower crop 3



Each opener is hydraulically controlled

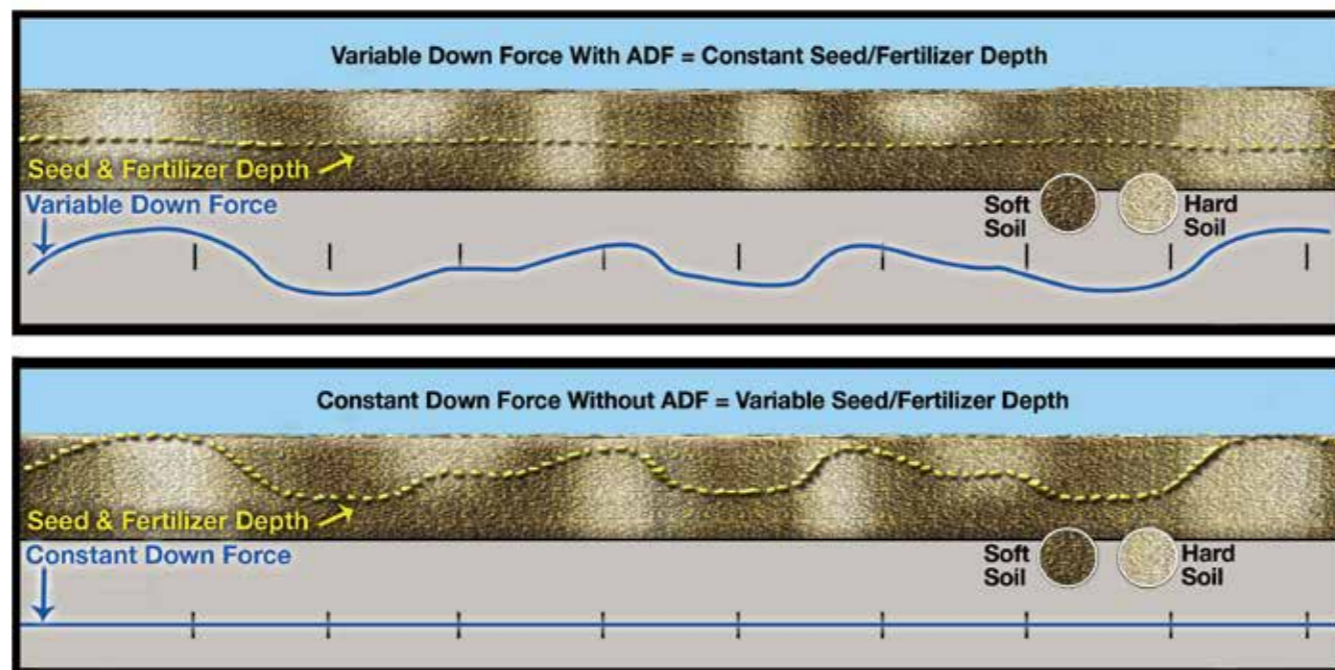


SEEDING DEPTH CONTROL

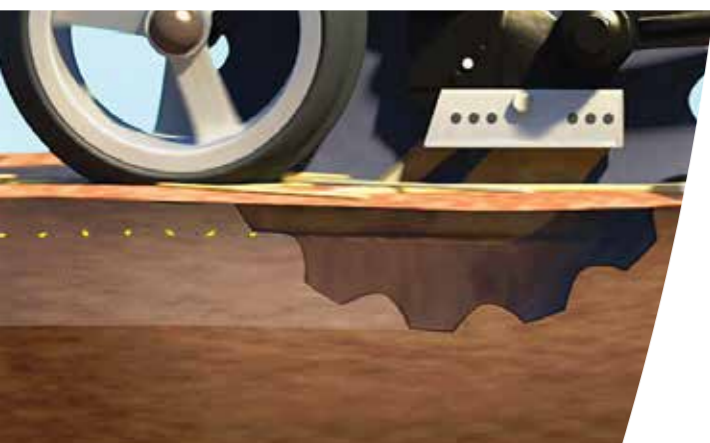
THE MOST IMPORTANT PERFORMANCE REQUIREMENT

- ◆ Uniform, correct seeding depth is of utmost importance to crop stands and yields.
- ◆ Achieving uniform seeding depth in no-till fields is difficult because of variable surfaces and soil densities.
- ◆ Cross Slot drill engineers have superbly mastered this uniform depth requirement.
- ◆ Each opener is hydraulically controlled to provide the required down-force, up to 1000 lb (454 kg) down-force per opener.
- ◆ Down-force is independent of vertical adjustments for soil surface variations.
- ◆ Depth control and minimal soil disturbance provides near maximum seed emergence.
- ◆ Seeding rates can be reduced due to improved emergence.
- ◆ Electronic sensors continuously monitor and re-adjust the down force required to maintain the set seed depth.
- ◆ Automatic down force (ADF) samples 10 times per second and adjusts 3 times per second.

Depth Control by Automatic Down Force (ADF)



Automatic down force control unit in tractor cab



Each opener individually controls seed depth



Seeding into 100 bu/ac (6.7t/ha) wheat residue



Constant seed depth = consistent results



Seeding into 100 bu/ac (6.2t/ha) corn residue



RESIDUE MANAGEMENT

CROSS SLOT SEEDS IT ALL

- ◆ Pre-seeding plant residue management is usually not required.
- ◆ Manages any form, type or quantity of residues with only a depth adjustment.
- ◆ Residues are replaced over the horizontal shelves by the depth wheels.
- ◆ No residue enters the seed zone which avoids 'hairpinning' – a common problem with other openers.
- ◆ Existing field residues are retained without redistribution.
- ◆ Residue reduces rainfall impact and runoff (erosion), reduces evaporation (more soil water) and provides organic matter.
- ◆ Residues attract earthworms to the slot zone.
- ◆ Grain crops produce 3–4 tons of residue per acre worth \$75–100 in nutrients, moisture and yield gains.
- ◆ Don't waste it – use Cross Slot!



Seeding peas into heavy grass residue



Peas emerging through heavy residue



Extensive early root growth & earthworm activity



Excellent crop stand



Uniform crop emergence



CROP EMERGENCE PRODUCTION DEPENDS ON HIGH STAND ESTABLISHMENT

- ◆ Top Left Photo: One pass crop seeding by Cross Slot.
- ◆ Left Centre Photo: Winter canola seeded side by side on the same day, Cross Slot drill on the left side and a common hoe drill on the right side.

Seeding rate for both drills was 3 lb/ac (3kg/ha), no fertilizer was applied to either at the time of seeding in a dry-land area of 8–10 in (20–25 cm) annual rainfall.

Left Center & Lower: Photo taken approximately four weeks after seeding.

- ◆ Right Centre Photo: Cross Slot provides the capability to seed on the previous crop row to capture higher organic matter, fertility and moisture.

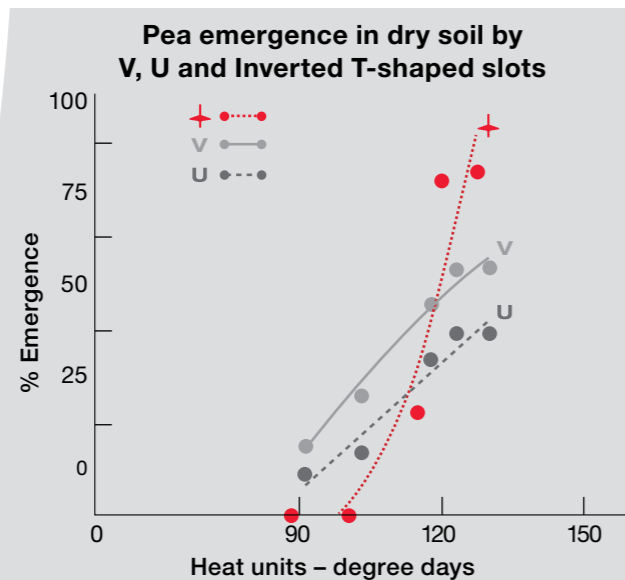


Cross Slot drill

Hoe drill



Uniform crop emergence matters



Emergence comparison graph



Cross Slot seeded winter wheat root growth



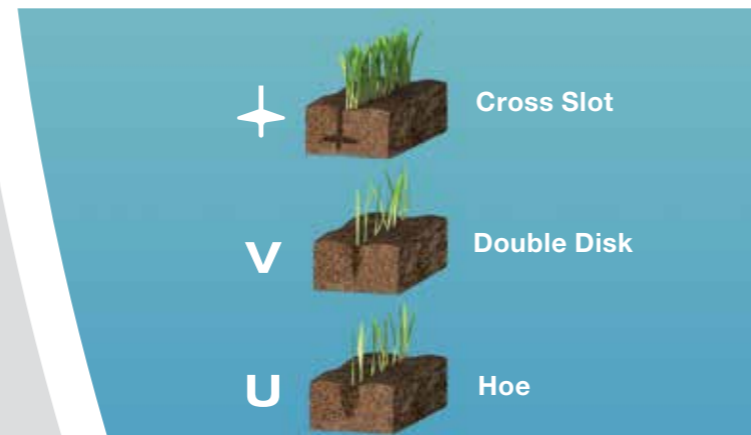
July seeding into 3' (1m) yellow clover soon after spraying



Seeding on the previous crop row



Emergence after 3 weeks



Seedling emergence comparison in the dry



Cover crops well established after 7 weeks



CROP STANDS CROSS SLOT DRILLS PROVIDE AMAZING FIELD RESULTS

PHOTOS ON LEFT

- ◆ Cross Slot demonstrates its flexibility and ability to seed directly into heavy residue. Spraying was the only preparation required before seeding. The ground was seeded with a cover crop mix of millet, peas, wheat and clover and this was available for cattle grazing going into winter.

PHOTOS ON RIGHT & BELOW

- ◆ A variety of crops seeded by Cross Slot drills.
- ◆ Cross Slot drills can seed cover crops directly after harvest which provides maximum benefits.



Wheat ready for harvest



Sunflower seeded into wheat residue



Cover crop of durum wheat, turnips and tillage radishes



Cross Slot renovated sod pasture

CROSS SLOT DRILLS ASSURE CROP SUCCESS



Cross Slot Wheat



8

Cross Slot Canola



Cross Slot Sunflowers



9

Cross Slot Forage



Early May seeding barley



Unseeded CRP



September pre-harvest



CROSS SLOT SPECIAL APPLICATIONS

UNIQUE CAPABILITIES

CONSERVATION RESERVE PROGRAM (CRP) TAKE-OUT

- ◆ Conservation reserve acreages (CRP) and grass seed production fields require the Cross Slot no-till capabilities of reseeding with very minimal soil and surface disturbance. Rotating grass fields into no-till cropping with minimal organic matter loss becomes a profitable change without soil tillage and fallow periods.
- ◆ CRP ground seeded by Cross Slot needs no preparation (mowing, grazing, burning, discing, etc), other than spraying.
- ◆ CRP conversion crops seeded by Cross Slot have included winter wheat, spring wheat, peas, canola, barley, corn, triticale, oats and lentils.

PICTURES ON THE LEFT

- ◆ CRP ground (25 years) sprayed and directly seeded with Cross Slot.
- ◆ No other preparation was required.
- ◆ Normal annual rainfall for this dry land area is 12–14 in (30–35 cm).
- ◆ Seeding rate was 90 lbs/ac (100 kg/ha) barley and 95 lbs/ac (106 kg/ha) of N banded at the time of seeding.
- ◆ This crop yielded 80 bu/ac (4.32 T/ha) of barley.

PICTURES ON THE RIGHT

- ◆ This 25 year CRP ground was sprayed in May.
- ◆ Winter wheat was directly seeded in early September.
- ◆ Normal annual rainfall for this area is 8–10 in (20–25 cm).
- ◆ The seeded ground was sporadically covered in low Sagebrush and Rabbitbush.
- ◆ Excellent emergence occurred in two weeks in late September.
- ◆ A good stand was established prior to winter.



CRP seeded with winter wheat early September



Good emergence in late September



Late November before winter



July cover crop: durum, radishes, turnips, vetch



Well established in September



Successful outcome late October, ND, USA



CROSS SLOT SPECIAL APPLICATIONS

UNIQUE CAPABILITIES

COVER CROPS, FORAGES, SOD/PASTURE

COVER CROPS

- ◆ Cover crops are a useful management tool.
- ◆ Cross Slot drills have seeded cover crops for many years.
- ◆ It is important to get them seeded as early as possible.
- ◆ Early seeded cover crops can be grazed.
- ◆ Grazing winter canola recently provided an estimated benefit of \$85–95/ac (\$200–230/ha).

FORAGES

- ◆ Forages (brassicas, specialty grasses) are readily seeded by Cross Slot.
- ◆ Forages provide the ability to increase available dry matter for animal feed.
- ◆ Seasonal forages can be used for summer feed when other grasses have died off.

SOD/PASTURE

- ◆ Sod/pasture renovation is a unique application for the ultra-low soil disturbance Cross Slot opener. Leaving the field surface undisturbed following seeding provides the option to maintain current species while others emerge and grow for enhanced grazing.
- ◆ Sod can be treated similarly to CRP. It can be sprayed and directly seeded.
- ◆ The ability to apply 1000 lbs (450 kg) down force per opener allows sod ground to be renovated or cropped earlier than other openers.



Early July seeding into sprayed sod, ND, USA



Minimum disturbance at seeding



Successful emergence in late July



Excellent contour following



CROSS SLOT SPECIAL APPLICATIONS

UNIQUE CAPABILITIES

UNEVEN SURFACES

- ◆ Each opener independently maintains its set seed depth over dips and ridges.
- ◆ Uniform seeding depth is required for even emergence.
- ◆ Cross Slot hydraulic down force and parallel linkages provide a full 18 in (45 cm) of vertical motion without losing full surface contact.
- ◆ Common openers with spring-loaded down force have uneven seed depth and emergence – shallow in dips and deeper on ridges – resulting in less yield than with Cross Slot openers.

ROCKY SOILS

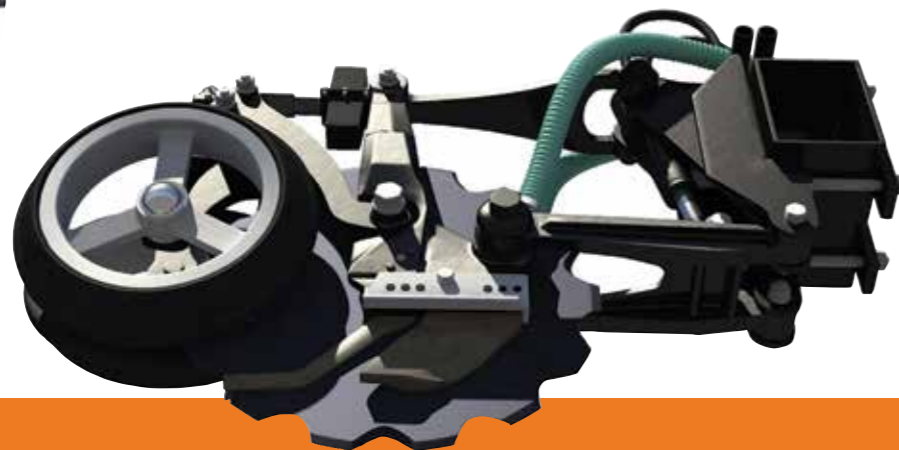
- ◆ Soils with rocks always provide a drilling challenge for ruggedness and seeding.
- ◆ Seeding into rocky ground requires very durable machinery.
- ◆ The Cross Slot single disc opener provides a mechanism to safely lift each opener up and over the rocks without damage, and immediately returns to seeding.
- ◆ Unlike hoe and shank drills, Cross Slot does not pull rocks out of the ground.
- ◆ After several seedings, it forces the rocks below the surface to leave a clean, workable surface.



Seeding uneven, muddy ground



Opener action – rise & fall 18" (45cm)



Seeding forage crop into rocky ground



Successfully seeded into rocky ground



Rocky soil results for feeding cattle



5 row, self-contained demo unit, Australia



9 row, specialty research drill, Germany



10' (3m) 19 row drill, Germany



SMALL & MEDIUM FIELD DRILLS

CROSS SLOT OPENERS ARE READILY ADAPTED TO SMALL MACHINES

RESEARCH DRILLS

- ◆ Researchers have found the reliable and uniform seeding of Cross Slot openers very useful to their multiple plot experiments.
- ◆ Cross Slot openers readily adapt to variable residue, soil and seed depths for specific experimental trials, such as crop and variety testing, fertilizer rates, etc.
- ◆ Small field owners have adapted smaller versions of drills to accommodate their acreage and gate sizes.

SMALL AND MEDIUM DRILLS

- ◆ The capability to seed into wide ranging residue and soil conditions offers ready opportunities without pre-treatments.
- ◆ Custom designed Cross Slot drills in widths of 8–25 ft (2.5–7.5 m) for smaller acreages are available with either fixed or folding frames.
- ◆ Small size drills contain the same openers and control units as full size drills, adapted to appropriate seed and fertilizer tanks and meters.
- ◆ These range from single Cross Slot opener units through multiple row units.
- ◆ Cross Slot openers can be adapted to a wide range of machines suitable for all scales of agriculture.



24' (7m) 29 row unit, Kansas, USA



20' (6m) rigid unit on 10" (25cm) spacing AK, USA



24' (7m) folding unit on 10" (25cm) spacing MT, USA



25' (7.5m) folding unit on 10" (25cm) spacing WA, USA



WA, USA
25' (7.5m) toolbar, 12" (30cm) spacing



WA, USA
30' (9m) folding drill, 10" (25cm) spacing



AB, Canada
40' (12m) toolbar, 10" (25cm) spacing

LARGE TOOLBAR COMPONENTS

EXAMPLE STANDARD TOOLBARS

Toolbars for large scale Cross Slot drills can be designed to fit customer needs. Tanks, meters and monitors are fitted accordingly. The following briefly describes common components of an example machine.

TOOLBAR/DRILL

- ◆ Standard openers.
- ◆ Operating width: 30'–60' (9–18 m).
- ◆ Transport widths (wings up): 12'–21' (3.5–6.5 m).
- ◆ Row spacing: 10"–12" (25–30 cm) is common (infinitely variable from 6" (15 cm)).
- ◆ Auto-down-force system for opener depth control.
- ◆ Hydraulic Memory Valve and hydraulic accumulators.
- ◆ Hydraulic drawbar tilt.
- ◆ Flotation tires.
- ◆ Seed hopper 3–5 section meter – size optional.
- ◆ Fertilizer hopper 3–5 section meter – size optional.
- ◆ Pneumatic seed distribution system.
- ◆ Pneumatic fertilizer distribution system.
- ◆ Hydraulic fan and product delivery.
- ◆ Camera system (2 or 4).

OPENERS – STANDARD

- ◆ 22 in (55 cm) notched discs (24 in (60 cm) option).
- ◆ 3 in (7.5 cm) or 4 in (10 cm) ribbed press wheels.
- ◆ Triple-lipped sealed bearings.
- ◆ Screw depth adjustment.
- ◆ Individual hydraulic cylinder.
- ◆ Parallel linkage arms.
- ◆ Seed and banded fertilizer.
- ◆ Vertical travel 18 in (45 cm).

OPTIONS – COMMON

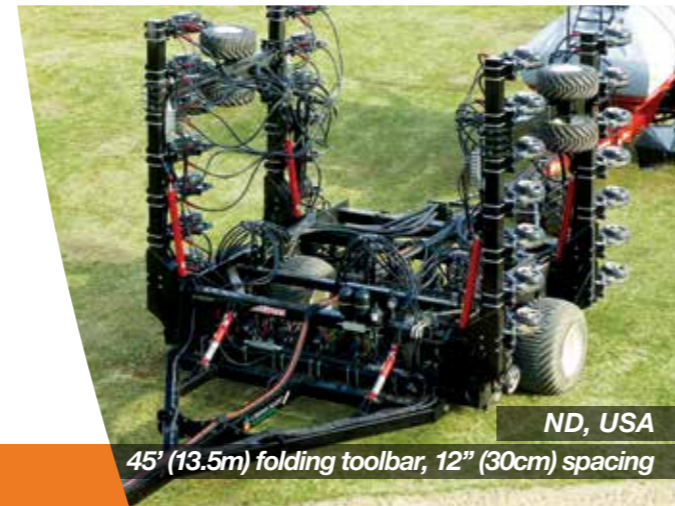
- ◆ Product metering: Hydraulic, electric or mechanical.
- ◆ Fertilizer forms: dry, liquid, gas or combination.
- ◆ Lights, walkways, safety options.
- ◆ Floating wings with controllable wing pressure.
- ◆ Delivery tube blockage sensors.



WA, USA
37' (11m) folding drill, 12" (30cm) spacing



SK, Canada
51' (15.5m) folding toolbar, 12" (30cm) spacing



ND, USA
45' (13.5m) folding toolbar, 12" (30cm) spacing



AB, Canada
30' (9m) toolbar, 10" (25cm) spacing



KS, USA
24' (7m) folding drill, 10" (25cm) spacing



ND, USA
45' (13.5m) folding toolbar, 12" (30cm) spacing

LARGE FIELD DRILLS & TOOLBARS

CROSS SLOT OPENERS HAVE PROVEN THEIR RUGGED SUCCESS ON LARGE ACREAGES

60 FOOT TOOLBARS HAVE ACHIEVED 1000 ACRES/DAY

FIELD PROVEN TOOLBARS

- ◆ Cross Slot openers have been thoroughly tested around the world for their capability and durability to successfully no-till seed many crop and soil options and challenges.
- ◆ The seedings ranged from pasture/sod, cover crops to cereals and legumes in all ranges of soils from sands to clays, and all climatic ranges from droughts to floods.
- ◆ These applications were all with one opener style, Cross Slot, fitted to a multitude of custom frames and metering bins.

SPEED & HORSEPOWER

- ◆ Each Cross Slot unit requires approximately 8–10 HP per opener.
- ◆ Additional 1–2 HP will be required, depending on the seed cart, fertilizer tanks or bins and topography.
- ◆ Seeding speeds of 6–8 mile/hr (9.5–12.5 km/hr) are common.
- ◆ A 45' (13.5 m) Cross Slot drill at 7 mile/hr (11 km/hr) will seed a daily acreage equal to a 60' (18 m) unit at 5 m/hr (8 km/hr).

FLEXIBLE APPLICATIONS

- ◆ This versatile opener has been adapted to a wide range of drill and toolbar designs with options appropriate to customer needs.
- ◆ Drills are commonly 18–36 ft (5.5–11 m) wide with supply boxes and meters mounted on the frame, while toolbars are usually 40 ft (12 m) to 60 ft (18 m) wide with product tanks and meters on towed carts.
- ◆ Row spacings on both drills and toolbars can be adjusted to accommodate wide to narrow row widths, for example:
 - A 15 in (38 cm) (soybeans) spaced single rank drill/planter can be set up to seed 30 in (75 cm) (corn) or similar combinations.
 - A 10 in (25 cm) spaced toolbar can readily be set up to seed 20 in (50 cm) or 30 in (75 cm) spaced crops.
 - One Cross Slot toolbar can be used to seed both cereals on 10 in (25 cm) and corn on 30 in (75 cm) spacing.
 - A 12 in (30 cm) spaced toolbar can be set up to seed 24 in (60 cm) or 36 in (90 cm) spaced crops.



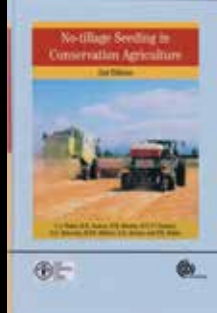
ND, USA
45' (13.5m) folding toolbar, 12" (30cm) spacing



Australia
60' (18m) bi-folding toolbar, 12" (30cm) spacing



Australia
35' (10.5m) folding single rank toolbar



FURTHER READING

No-Tillage Seeding in Conservation Agriculture – 2nd edition

Authors: C.J Baker, KE Saxton, WR Ritchie, WCT Chamen, DC Reicosky, MFS Ribero, SE Justice and PR Hobbs

Published by: CAB International and Food And Agriculture Organisation of the United Nations (Rome, Italy) 2006

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FURTHER READING

Successful No-Tillage in Crop and Pasture Establishment

Authors: Bill Ritchie, John Baker, Mark Hamilton-Manns

Produced by: Monsanto New Zealand Limited 2000

ISBN 0-473-06685-8

OTHER INFORMATION

Check us out on-line at www.CrossSlot.com. You will find a comprehensive summary of the science behind Cross Slot together with photos, videos and user comments from around the world.

FOLLOW US!

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CROSS SLOT NO-TILL TECHNOLOGY SELECTED AS BEST IN THE WORLD

Our company designs the world's most sophisticated no-tillage system.

Our factories build them, we market them and support our Cross Slot users in the field.

The science and design that originated at Massey University, New Zealand, is embodied in all our Cross Slot machines and is internationally recognized.

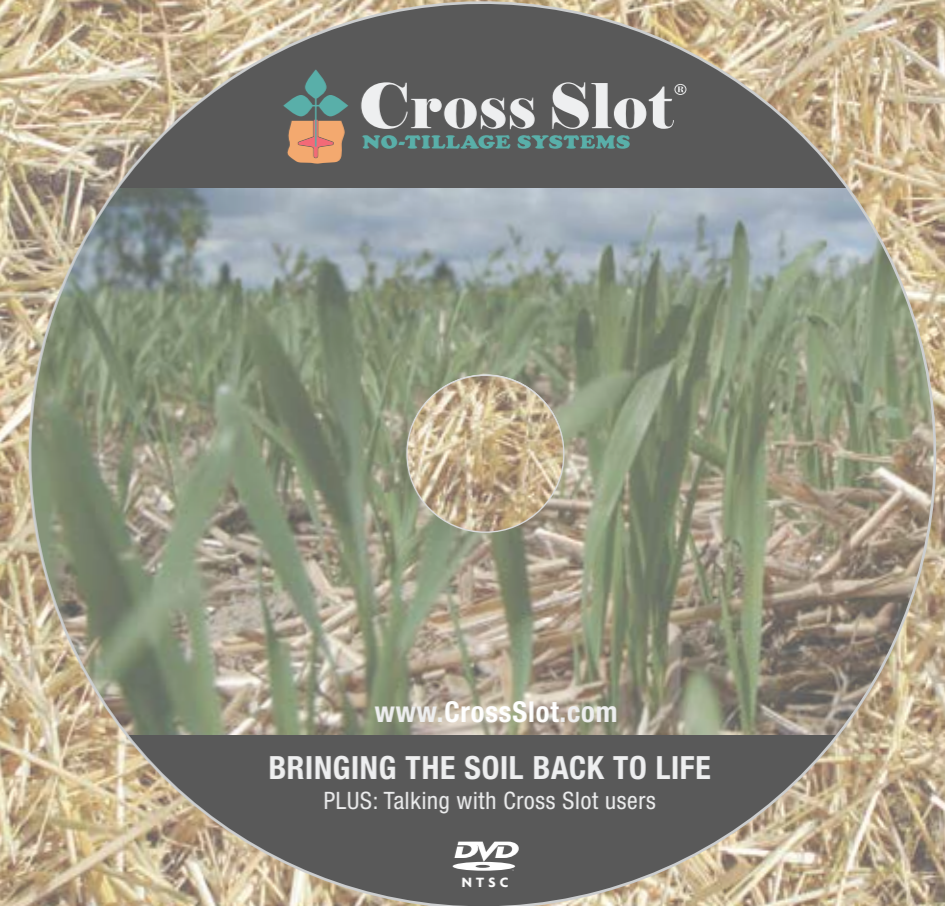
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FOR CONTACTS IN YOUR AREA



16 45' folding toolbar, 12" spacing, ND, USA

"You can use Cross Slot or No-Till it. Know the Difference"

Cross Slot openers have seeded into this residue – spot the rows...

MANUFACTURING AND DISTRIBUTING GLOBALLY

CROSS SLOT SYSTEMS DELIVER

