Farm Mechanization
FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture and Food

Order No.. 224.650-1
Agdex: 730
June 1991

# CONSERVATION TILLAGE / SEEDING EQUIPMENT

## SCOPE OF ARTICLE

This factsheet gives a general introduction into the types of tillage/seeding equipment, farmers have used in their attempts at conservation farming and their relative merits and shortcomings in small grains and oilseed production. It covers equipment performing minimum to zero tillage ranging from 10 foot disk drills to 60 foot wide air seeders. Although the Peace River area has some limitations in the types of conservation equipment readily available, most types are represented in some form.

The factsheet is divided into eight main sections as follows:

1. requirements of ideal equipment
2. geometry of equipment
3. types of equipment
4. general specification comparisons
5. buying considerations
6. summary
7. credits
8. drawings of the various opener designs

## REQUIREMENTS OF IDEAL EQUIPMENT

If the ideal equipment existed it would possess all the following features:

(Information on items in *italics* is contained in graphs 1 to 6 on following pages).

- *Accurate and uniform seed placement*
- *Accurate metering of seed and fertilizer*
- Combined seed and fertilizer placement
- Handle a wide range of seed sizes and crops
- *Large capacity for seed and fertilizer*
- Provide good soil/seed contact (packing)
- Good trash clearance, front to back and top to bottom
- Minimal soil disturbance and stubble knockdown
- Ability to work in varying soil types
- Ability to work in wet and dry soil conditions
- *Low draft requirements*
- Mechanically simple and reliable
- Low maintenance requirement
- *Easily transportable*
- Cost- effective

## GEOMETRY OF EQUIPMENT

It has been suggested that most problems experienced in tillage in high residue situations would be solved if the machines possessed the following basic functional and design features:

- adequate vertical spacing – min. 18” – 20” undercarriage
- adequate horizontal spacing between standards - min. 24”
- effective coulters – min. 18” – 20” diameter
- proper tillage point design (shovels) –$60^0$ to $70^0$ V angles with $37^0$ pitch on subsurface
- correct speed of operation – 4 to 5 mph for most machines
- adequate depth of adjustment by hydraulics and gauge wheels
- adequate disk angle adjustment
- flexible implement frames and widths – 5’ to 8’ sections desirable for use on uneven land

## TYPES OF EQUIPMENT

Advancements and modifications to equipment are continually occurring but most equipment fits into one of the following categories.

### DISKER ( See Figure 1 )

Diskers consist of a series of independent disk gangs normally spaced 7” apart. Disk penetration and depth are controlled by hydraulic cylinders on each section and compression or torsion springs on each gang. Seed and fertilizer are gravity metered by fluted feed cups or augers and delivered through common drop tubes to

each disk. The disks invert the soil to cover the seed or fertilizer.

**Advantage:**
- can seed into heavy trash conditions
- can place high rates of fertilizer
- seeds and controls weeds in one pass
- works well in wet conditions
- doesn't require pre-tillage (moisture conservation)
- multi-purpose use (seed/tillage)

**Disadvantages:**
- poor depth control
- requires additional packing
- small seed/fertilizer capacity
- leaves field surface rough
- inefficient phosphate placement
- slow to transport
- does not work well on hilly land
- requires skilled operator for adjustment

## DOUBLE DISK PRESS DRILL ( See Figure 2 )

The equipment consists of two vertical flat disks that run at a slight angle to each other, touching at the front to open the seed furrow. These openers are normally spaced 6" apart on two rows. Seed depth is controlled by an adjustable compression spring on each disk unit and a hydraulic cylinder equipped with an adjustable stop. Grain and fertilizer are metered by externally cogged feed cups or traction wheels which are controlled by ground driven variable speed or variable displacement meters. It is then delivered by gravity through hoses to each separate opener. Steel press wheels pack the soil behind each opener. This equipment has been most effective in drier areas in low trash situations.

**Advantages:**
- has reliable design
- has lower draft requirements
- provides good packing
- places phosphorous fertilizer more efficiently
- good depth control
- relatively low cost

**Disadvantages:**
- will not penetrate heavy trash (hairpinning) or hard soils
- requires pre-seeding tillage
- small seed/fertilizer capacity
- slow to transport
- single use only
- no weed control while seeding

## HOE PRESS DRILL ( See Figure 3 )

Hoe press drills are similar to disk-type drills but use a hoe or shovel opener to place the seed. Spacing of 7' to 10" on three rows are common. Press wheels are mounted behind each opener.

**Advantages:**
- positive depth control
- even penetration in hard soils
- good seed/soil contact
- clears chaff and straw
- rugged construction with few wear points

**Disadvantages:**
- seeding rate affected by speed
- small seed/fertilizer capacity
- higher draft than disk drills
- no weed control at seeding – slow to transport

## ZERO TILL DISK DRILL ( See Figure 4 )

The ability to place fertilizer with the seed or deep band it at the time of seeding is the main feature that distinguishes this equipment from conventional disk-type drills.

**Advantages:**
- good seed placement
- built heavy – good penetration
- minimum soil disturbance
- accurate depth control (gauge wheels)
- capable of banding fertilizer
- good packing
- can seed conventionally

**Disadvantages:**
- will not cut heavy straw
- hairpinning in wet conditions reduces germination
- higher repair costs
- small seed/fertilizer capacity
- higher draft requirements
- no weed control at seeding
- expensive

## ZERO TILL HOE DRILLS ( See Figure 5 )

The ability to place fertilizer with the seed or deep band it at the time of seeding is the main feature that distinguishes this equipment from conventional hoe drills.

**Advantages:**
- good trash clearance
- good packing

- can seed conventionally
- side band fertilizer needs
- allow higher rates of fertilizer (one pass seeding)

**Disadvantages:**
- high draft requirements
- side banding may disturb seed bed
- wide opener leaves field rough
- reduced seeding efficiency
- expensive to own and maintain

**SEED RITE** ( See Figure 6 and 7 )

The seed rite is similar to the hoe drill except it has openers on 8" spacing in four rows and replaces packing wheels with a rod weeder.

**Advantages:**
- good penetration
- good seed placement
- weed control at seeding
- ground rod packs soil

**Disadvantage:**
- higher draft than press drills
- deep seeding in loose soil
- difficult to seed shallow
- may plug in heavy damp trash
- tends to roll stones to surface

**CROSS-SLOT DRILL** ( See Figure 8 )

This is a new development which was introduced to our area in 1990 that uses a unique opener design on an end wheel drill ;to place seed and fertilizer. A series of single disk openers with a small horizontal wing projecting from either side of the disk produce

an inverted T-shaped slot. Seed and fertilizer are placed on either side of this slot. Opener spacing is variable down to 8" apart and are followed by two rubber depth gauge and packing wheels to close the slot.

**Advantages:**
- minimal soil disturbance
- good penetration of trash and hard soil
- good seed placement
- not subject to hairpinning
- less reliant on drill weight for opener penetration

**Disadvantage:**
- expensive
- small fertilizer and seed capacity
- present poor availability of commercial drills

**AIRSEEDER** ( See Figure 9 )

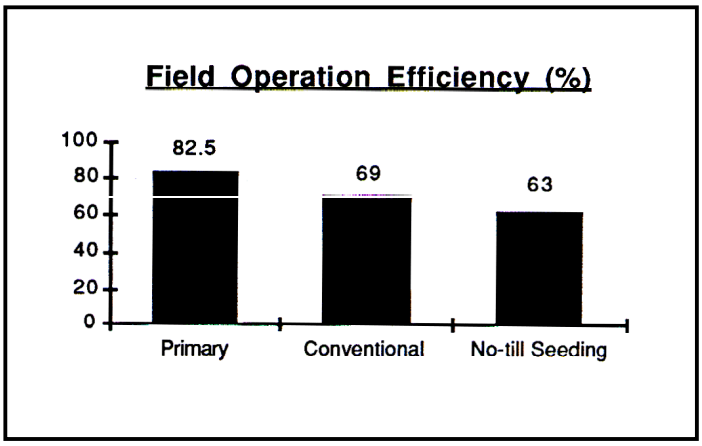
As the name goes, this seeding system uses airflow to distribute seed and fertilizer to the openers. Centrally located hoppers are connected by a series of air delivery hoses to the rear of individual cultivator shanks. A variety of system combinations exist from those using a simple cultivator frame, to more modern flexible, floating frames to air drills. Air drills support the opener frame between caster wheels on the front and a packing assembly on the rear.

**Advantages:**
- greater efficiency
  - greater capacity, filling time reduced
  - rapid transport
- good trash clearance
- weed control at seeding
- multi-use: seed, band, tillage
- moisture efficient
- rugged construction
- may be capable of side banding while seeding

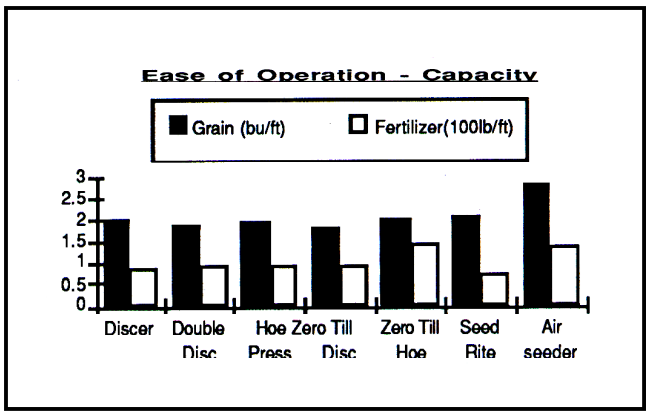
**Disadvantages:**
- cultivator - depth control
  - leveling
- packing system required
- seed damage possible
- requires skilled operator
- power source for air system
- expensive to purchase
- doesn't seed place fertilizer when deflector boots are used
- tends to roll stones to surface

## General Specification

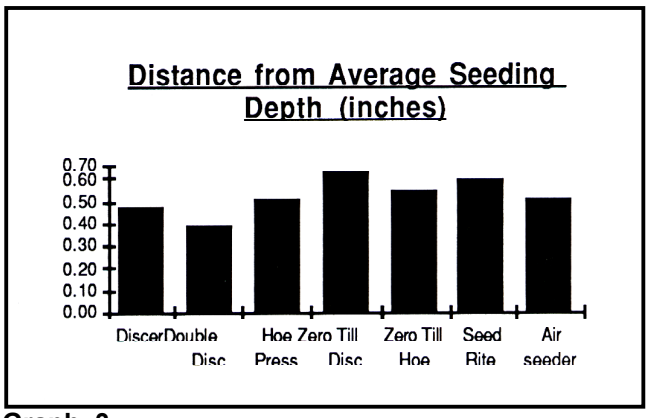
The following graphs have been produced from product and test summaries and show trends occurring among tillage/seeding equipment options. Individual product information and results from accredited testing agencies like PAMI should be referred to for further details.



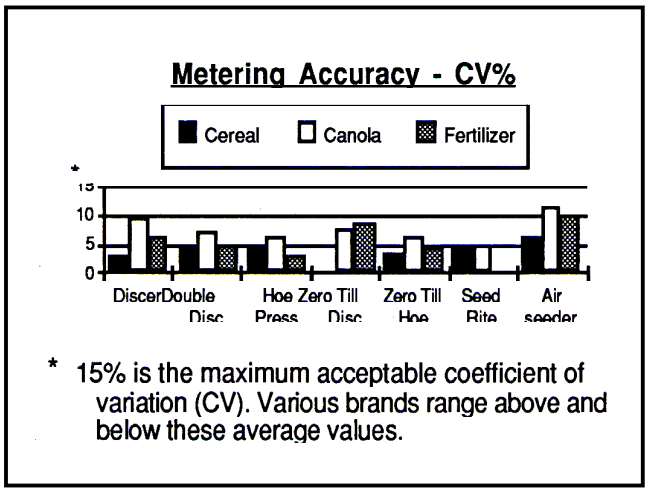

**Graph 1**



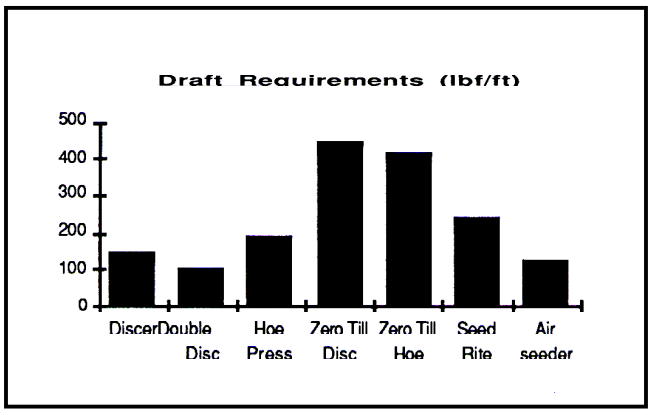

**Graph 2**



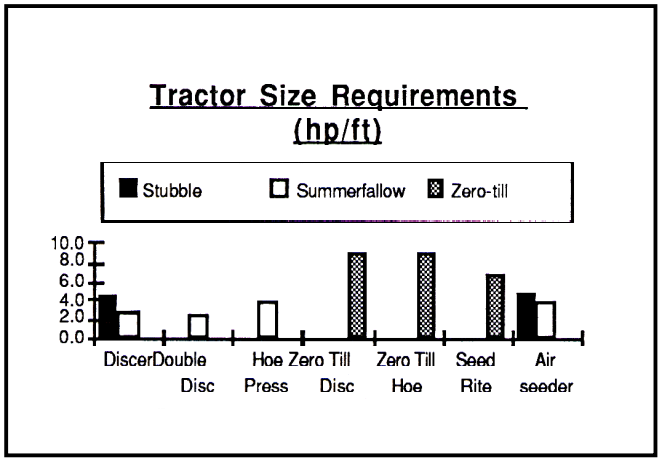

**Graph 3**




**Graph 4**




**Graph 5**




**Graph 6**

## BUYING CONSIDERATIONS:

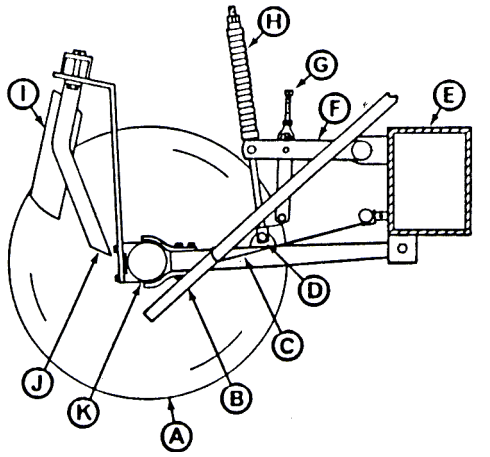
If a change to your conservation farming approach is warranted your next purchase of tillage/seeding equipment should take into account a number of variables:

- the sensitivity of your land to wind and water erosion
- the amount of stubble in your rotation
- your residue management system
- your farm size
- your available manpower
- the costs and benefits of the change
- future fuel prices
- your crop rotation

## SUMMARY

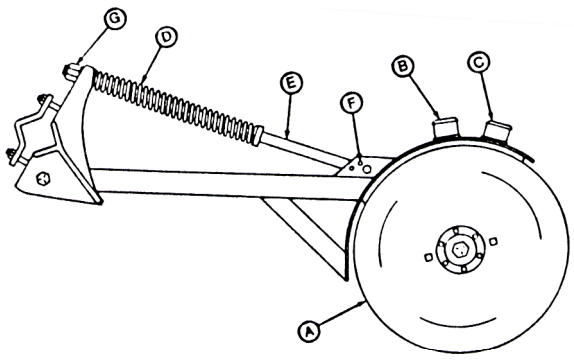
Much of the equipment designed for conservation tillage is in its second or third generation. Most newer drills do a good job of fulfilling the basic requirements of seed and fertilizer placement in increased residue conditions. It is expected and hoped that the trend will now be to improve the efficiency, cost effectiveness and ease of adjustment and maintenance of this equipment.

It is obvious that major changes in equipment systems will require changes in their management. Involvement in a local soil conservation group can be a great asset in making these equipment decisions. Participating in demonstration trails and sharing experience with others is a great way to minimize the risk during such as changeover in equipment and management systems.



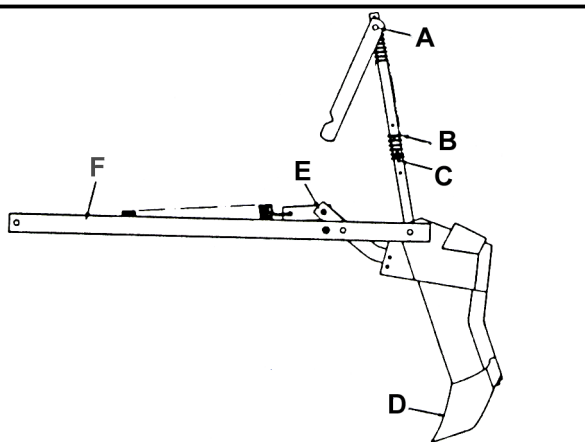

Disk Gang: (A) Disk, (B) Seed and Fertilizer, (C) Drop Tube Holder, (D) Spring Force Adjustment Bolt, (E) Main Frame (F) Lift Arm, (G) Front Disk Gang Levelling Screw, (H) Tension Spring, (I) Scraper, (J) Rock Deflector and Trash Bar, (K) Gang Bearing.

**Figure 1 Typical Disk Gang Assembly on a Disker Seeder**



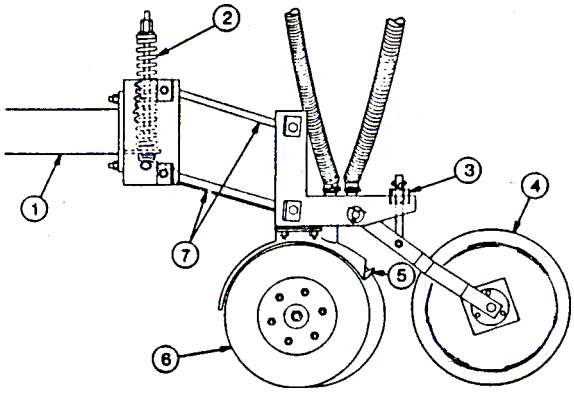

Double Disk Opener: (A),Disks, (B) Fertilizer Tube, (C) Grain Tube , (D) Spring, (E) Pressure Rod, (F) Depth Adjustment Holes,

**Figure 2 Typical Double Disk Opener Assembly**



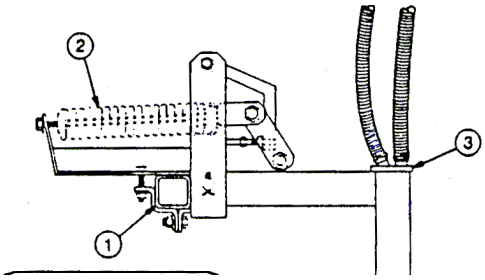

Hoe Assembly: (A) Depth Adjusting Clip, (B) Pressure Spring, (C) Pressure Adjusting Clip, (D) Hoe Opener, (E) Spring Trip, (F) Drag Bar.

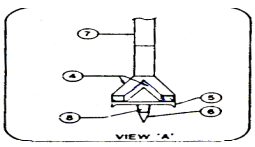
**Figure 3 Typical Hoe Drill Opener Assembly**

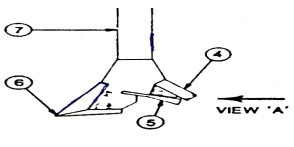



Offset Double Disk Opener: (1) Drill Frame, (2) Pressure Spring, (3) Depth Adjustment Spacers, (4) Gauge-Press Wheel, (5) Mud Scraper, (6) Seed Disks, (7) Parallel Linkage.

**Figure 4 Typical Zero Till Disk-Type Opener**

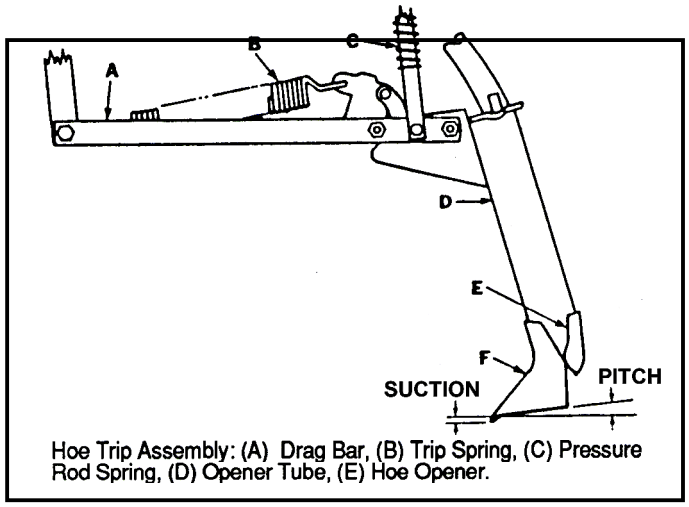


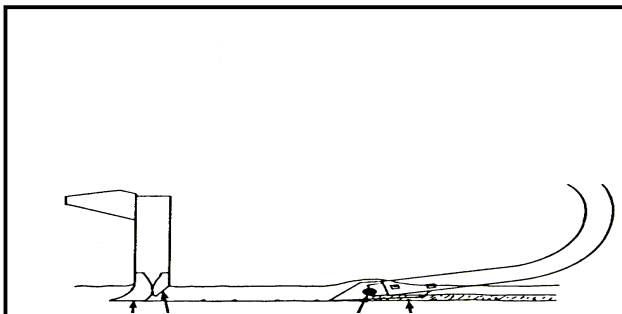

Hoe Opener: (1) Drill Frame, (2) Rock-Trip Spring, (3) Shank Inlet Tube, (4) Shank Outlet Tubes, (5) Sealer Plate, (6) Hoe Point, (7) Shank, (8) Deep Banding Outlet.

**Figure 5 Typical Zero Till Hoe Drill Opener Assembly**




Hoe Trip Assembly: (A) Drag Bar, (B) Trip Spring, (C) Pressure Rod Spring, (D) Opener Tube, (E) Hoe Opener.

**Figure 6 Seed Rite Hoe Trip Assembly**



Seed Placement and Soil Compaction: (A) Hoe Opener, (B) Deflector, (C) Ground Rod, (D) Seeds.

**Figure 7 Seed Rite Ground Rod Assembly**

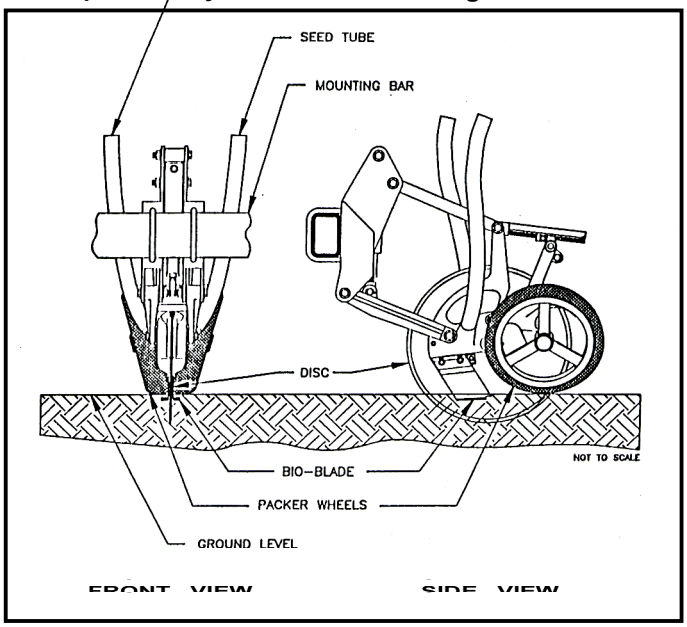
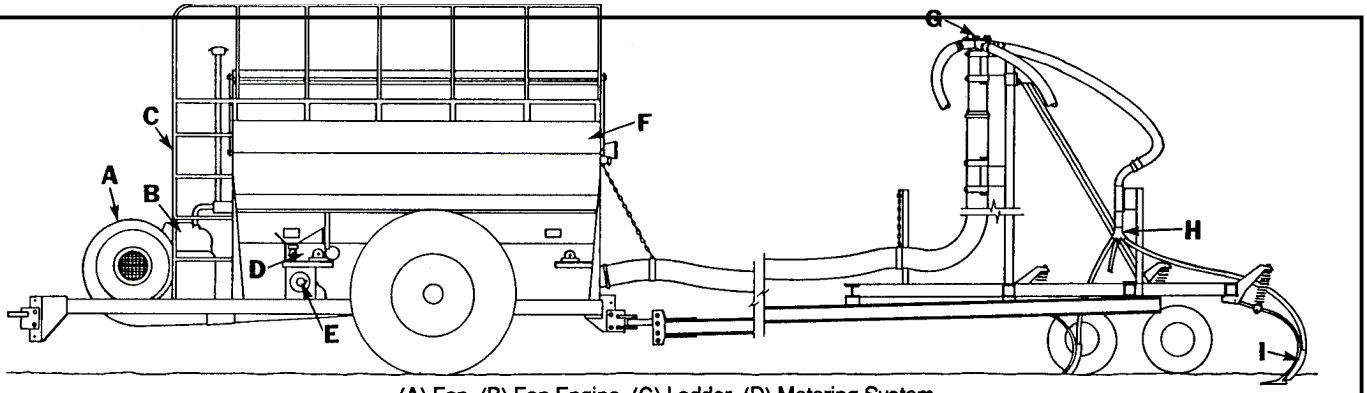



**Figure 8 Cross-Slot Opener**




(A) Fan, (B) Fan Engine, (C) Ladder, (D) Metering System, (E) Air Lock, (F) Tanks, (G) Primary Header, (H) Secondary Heacer,(I) Seed Boot

**Figure 9 Typical Air Seeder Equipment**

**Compiled and Edited by Murray Tenove, Resource Management Branch, Ministry of Agriculture and Food from:**

1. Seeding Equipment for Conservation Tillage; (Gorgon Hultgreen, Saskatchewan Wheat Pool, Agriculture Canada/ Saskatchewan Agriculture)
2. Zero Tillage Production Manual; (Manitoba/ North Dakota Zero Tiller's Farmers Assoc.)
3. Proceeding of Air Seeding '90 Conference; (D. Struthers, M. Jorgensen, Wood ruff, et al.)
4. Conservation Tillage for Montana Farmers

Prepared for the Conservation Tillage Handbook; Chapter 6 / Equipment, No. 1, Pages 1 to 6, Peace River Soil Conservation Assoc., Mar. 1991
Funded by A.R.D.S.A. (Agriculture Canada/BC Ministry of Agriculture and Food).

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