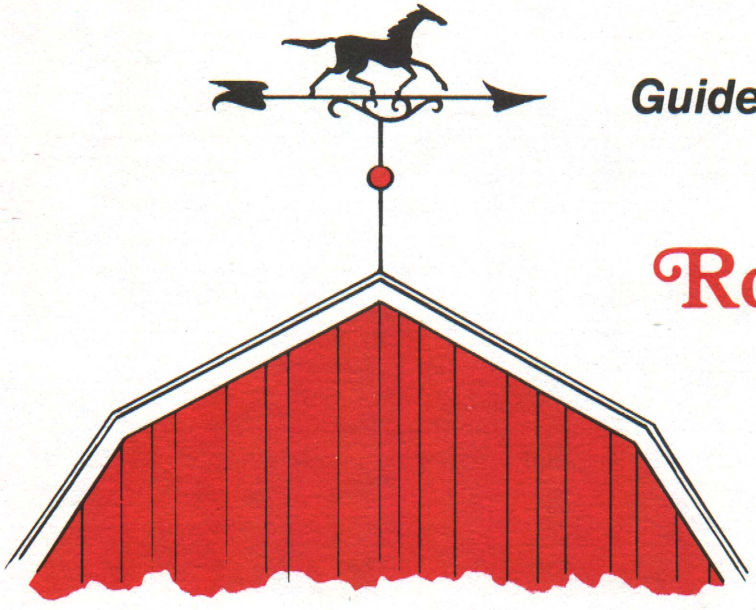

FARMING KNOW-HOW
Guidelines to Better Family Farming

Row Crop Planters

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Approximately 3.5 million acres of row crops (corn, soybeans, dry beans) are planted annually in Michigan. Their market value is well over $600 million.

The accuracy with which the seed for these crops is metered and placed in the soil and the uniformity of covering and compacting the soil around the seed are of great importance. These factors can significantly affect germination, plant population and crop yield.

The successful operation of a row crop planter depends upon the correct functioning of the total machine. This involves the correct metering and placement of fertilizers, insecticides and/or herbicides in addition to the seed. The major emphasis of this publication, however, will be on the metering and placement of the seed.

Historically, the conventional seed plate assembly has been the standard method of metering the seed for most row crops, particularly corn. In more recent years, however, several new and innovative seed metering systems have come onto the market in an attempt to overcome some of the limitations of the conventional seed plate system. Each of these new systems is successful, but each has certain limitations and shortcomings of its own, which must be understood and respected by the operator in order to obtain optimum results.

Checking the Planter for Wear, Damage

Check the row crop planter for worn or broken parts or other damage well in advance of the planting season, and put it into top operating condition before taking it into the field. Some of the more important points to check are:

1. *Planter Frame*

The frames of most row crop planters are rather light and flexible, and may be sprung or damaged by turning at field ends or by striking a field obstruction such as a tree or a stone. Damage from turning is most commonly caused by starting the turn before the planting units are raised completely clear of the ground, or by the end of the planter striking a fence or tree. If a sprung planter frame is suspected, the easiest way to check it out is to hitch the tractor to the planter and connect the hydraulic system. Be sure that all tires are inflated to the proper pressure and that the planting depth adjustment are set identically for all rows. Then place the entire unit on a level area (preferably on a concrete floor) and lower the planting units until they *almost* touch the floor. Preferably, all planting units should clear the floor by the same amount, but variations of up to ½ inch between units are usually not significant, and can be compensated for through the individual planting depth adjustments on each row unit. Greater variations may indicate some mechanical damage to the planter frame or individual planting units. This should be checked out thoroughly, possibly even by consulting with the dealer or his service representative.

2. *Runner Alignment*

Planter runners may be forced out of alignment by turning at field ends when the planting units are not raised completely clear of the ground. When this occurs, the runners tend to "lead" the planter to the right or left, making it difficult to maintain the desired width of "guess row" between the various trips across the field. If runner alignment appears to be a problem, check each planting unit mounting bracket for damage, and refer to the operator's manual for possible adjustment.

3. *Worn Planter Runners*

With continued use, planter runners wear, and eventually will no longer provide an adequate furrow in

which to place the seed. This will result in uneven or erratic depth of planting and lack of uniformity in seed coverage. When worn runners are replaced, they should be replaced for all rows. Be sure that new runners are properly aligned at right angles to the planter frame.

4. Worn Seed Metering Parts

A wide variety of seed metering devices are currently in use with row crop planters. Wear is inevitable, and sooner or later it becomes necessary to replace some or all of the parts involved. With plate-type planters, worn or sticking knockers, worn cut-off plates or weak cut-off springs are vulnerable spots. Also, worn seed plates, floor plates or false rings can cause trouble. Check the operator's manual thoroughly on these points.

Preparing the Planter

Prior to the start of the planting season, the best advice for both the inexperienced and experienced operator is: STUDY YOUR OPERATOR'S MANUAL. This manual will give better and more detailed information about the operation and performance of your planter than any other source. *Do not* trust your memory from one year to the next. It can be costly!

Check the machine for worn or damaged parts, and repair or replace as necessary. Lubricate the machine thoroughly, following lubrication specifications given in the operator's manual. Then, be sure that all moving parts are free and can operate smoothly.

Next, determine the planting population desired and the necessary seed spacing in the row to achieve this population. Again, referring to the operator's manual, select the necessary chain, sprocket and/or gear combinations and seed plate (or other seed metering unit) that will give the desired seed spacing. Set up the planter accordingly, and double-check against the operator's manual to see that there are no errors. Check the cell size in the seed plates or seed discs to be sure that the cell size and shape are compatible with the seed to be used. Then check out the planter on a road or driveway to be sure it is metering seed at, or near, the desired seed spacing. Most commercial seed companies provide information on the seed bag tag indicating the planter plate number for the various manufacturers that, in their opinion, will do the best job of accurately metering the seed.

Many planters, particularly those using conventional seed plates, require a "graded" seed for accurate planting. With seed corn, it is a relatively simple process to screen or grade seed with a high degree of accuracy for kernel width and thickness. It is much more difficult, however, to grade corn accurately for kernel length. Unfortunately, for most seed plates, kernel length is the more critical seed dimension for accurate metering. Thus, if the seed cell is long enough to accommodate the longest kernel in the bag, some "doubles" will be dropped when two short kernels approach the seed cut-off gate together. If the seed cell is short enough to eliminate all doubles, a number of "misses" will occur when large kernels approach the cut-off gate. The ideal solution is to attempt to select a seed plate that will allow one or two doubles per 100 seed cells and an equal number of misses per 100 seed cells. Thus, very nearly 100 kernels per 100 seed cells will be dropped, but not necessarily all of them one at a time.

Most planters which *do not* use the conventional seed plate as the seed metering device are less sensitive to seed size. Some will handle ungraded seed with complete satisfaction. Check your operator's manual on this point, or check with your dealer.

Relationship of Seeds Per Acre And Seed Spacing in the Row

Operator's manuals for row crop planters usually designate planting rates either in terms of "plants per acre" or "plant spacing in the row." In those instances where rates are referred to as "plants per acre," this *actually* means "seeds or kernels planted per acre," and not the plant population expected after emergence or at harvest time. Most crops and soils recommendations are for harvest-time populations, and not for planting or emergence rates. Therefore, it is usually necessary to over-plant the desired harvest-time population by 15 to 20 percent to allow for poor germination, insect and rodent damage, cultivating losses, etc. As a rough rule of thumb, over-plant by 20 percent for early-season or cool-weather planting and by 15 percent for late-season, warm-weather planting.

Most operators will know the harvest-time population they desire or the plant spacing within the row. It is not always easy, however, to convert plant spacing in the row to plants per acre or to convert plants per acre to plant spacing in the row.

The ROW-INCHES PER ACRE method offers a quick and easy way to determine plant spacing in the row when the desired planting population and row width are both known, or to determine the planting population when the plant spacing in the row and row width are both known.

The term ROW-INCHES PER ACRE means the length of row, in inches, necessary to be equivalent to one acre of land for any specified row width. This can be calculated from the following equation:

$$\frac{\text{sq. ft./acre} \times \text{sq.in./sq. ft.}}{\text{row width (in.)}} = \text{row-in./acre}$$

Example: Assuming 30-inch row width:

$$\frac{43{,}560 \times 144}{30} = 209{,}088 \text{ row-in./acre.}$$

Where the desired seed spacing in the row is known, the planting population (seeds per acre) can be obtained by dividing the row-inches per acre by the seed spacing (in inches) in the row.

Example (corn): Assuming that a 9.0-inch kernel spacing in the row is desired, with a 30-inch row width:

$$\frac{\text{row-in./acre}}{\text{kernel spacing in the row (in.)}} = \frac{209{,}088}{9.0} = 23{,}232 \text{ kernels/acre planting rate for 30-in. rows.}$$

Where the desired harvest-time population is known, the kernel spacing in the row may also be calculated by dividing the row-inches per acre by the planting rate.

Example (corn): Assuming a desired harvest-time population of 20,000 plants per acre, with 30-inch row width. Over-planting 15 percent would require a planting rate of 23,000 kernels per acre:

$$\frac{\text{row-in./acre}}{\text{kernels/acre planting rate}} = \frac{209{,}088}{23{,}000} = 9.1\text{-in. kernel spacing in the row for 30-in. rows.}$$

While all examples given here have dealt with corn, this procedure is equally applicable for all row crops, including soybeans and field beans. The row-inches per acre for more common row widths are given in Table 1.

TABLE 1. Row-inches per acre for selected row spacings.

Row width, inches	*Row-inches per acre*	*Row width, inches*	*Row-inches per acre*
6	1,045,440	28	224,023
7	896,091	30	209,088
8	784,080	32	196,020
10	627,264	34	184,489
12	522,720	36	174,240
14	448,046	38	165,069
16	392,040	40	156,816
18	348,480	42	149,349
20	313,632	44	142,560
22	285,120	46	136,362
24	261,360	48	130,680
26	241,255	50	125,453

Maximum Recommended Planting Speed

For many years, the standard recommended speed for planting corn and other row crops was a maximum ground speed of 3.0 to 3.5 miles per hour. While this was a valid recommendation when planting high populations in wide rows with the older 8-, 12- or 16-cell seed plates, it is no longer necessarily valid when planting in narrower rows using seed plates with 20, 24 or more seed cells, or when planting with some of the newer planters that do not utilize conventional seed plates as the seed metering device.

Ground speed, in itself, is *not necessarily* an important factor in planter operation. It must not, however, exceed other considerations such as roughness of the soil surface, stones or other factors which might cause mechanical damage to the planter or vibrate seed hoppers to the extent that the seed metering devices could not function uniformly.

Research and test data indicate that the one factor most important in affecting the accuracy of seed metering is the speed in revolutions per minute at which the metering device turns. This assumes a seed plate with the correct seed cell size or the correct seed metering unit for the newer non-seed-plate type planters has been selected. With plate-type planters, the number of seed cells per minute passing under the knocker is of relatively less importance in seed metering accuracy. Accuracy and uniformity of seed placement in the soil, however, *is* affected by ground speed and by the smoothness of the soil on which the planter is operating.

Research data indicate that with plate-type planters, a seed plate speed of 33 revolutions per minute is about the maximum at which the seed plate should rotate. At faster speeds, turbulence may be created in the seed hopper, which, in turn, results in poor and irregular seed cell fill. Some of the newer planters, which do not utilize the conventional seed plate as a metering device, may operate their seed metering mechanisms faster, but all are subject to some upper limit, above which planting accuracy will be adversely affected. The maximum recommended speed for the fingerwheel mechanisms of the John Deere Plateless Planter, for example, is 62 revolutions per minute, while the maximum recommended seed drum speed for the International Harvester Cyclo Planter is 35 revolutions per minute. For the Allis-Chalmers Air Champ Planter, the maximum recommended seed disc speed is 30 revolutions per minute, and for the White Plant/Aire Planter, it is 35 revolutions per minute. This information, however, is difficult to relate to ground speed, particularly where a wide variety of row widths and a wide range of planting populations are involved.

Since seed spacing in the row and ground speed are both linear, it is possible to calculate a "multiplier factor" to multiply against the seed spacing in the row, and thereby arrive at the maximum ground speed in miles per hour that *will not* exceed the maximum recommended revolutions per minute for the seed metering mechanism. Multiplier factors for the more common seed metering devices are given in Table 2.

These multiplier factors may be used for all types of row-crop planting where seeds are metered one at a time. With some crops, such as soybeans, each cell in some seed plates may meter two or more seeds per cell. Under these circumstances, multiply the appropriate multiplier factor for the number of cells in the plate by the number of seeds metered per cell.

To use the multiplier factor, the following steps are recommended:

1. With planters using seed plates or seed discs, *be sure* that the seed plate or seed disc contains the proper cell size and conformation for the seed being used.
2. Using data given in Table 1, calculate the seed spacing in the row (in inches) for the row width and planting rate desired.
3. Determine the number of seed cells in the seed plate, seed disc, etc. being used.
4. From Table 2, determine the correct multiplier factor for the seed metering device being used.
5. Multiply the seed spacing in the row (inches), as calculated in Step 2, by the multiplier factor obtained in Step 4. This will give the maximum ground speed in miles per hour that should be used for this specific situation. CAUTION: *Do not* use a ground speed higher than the maximum recommended by the planter manufacturer. See your operator's manual and Table 2 of this publication.

TABLE 2. Multiplier factors for determining the maximum allowable ground speed for row crop planters, without exceeding the maximum recommended revolutions per minute for the seed metering mechanism (based on metering *one* seed per cell).

CONVENTIONAL PLATE-TYPE PLANTERS

Maximum recommended seed plate speed, 33 R.P.M. Maximum recommended ground speed, 7 m.p.h.

No. of cells in seed plate*	Multiplier factor
8	.250
12	.375
16	.500
20	.625
24	.750
28	.875
29	.906
32	1.000
34	1.062
38	1.187

** For seed plates not listed, calculate the multiplier by dividing the number of cells in the seed plate by 32.*

WHITE PLANT/AIRE PLANTERS

Maximum recommended seed disc speed, 35 R.P.M. Maximum recommended ground speed, 8 m.p.h.

No. of cells in seed disc	Multiplier factor
30	1.000
50	1.667
60	2.000
80	2.667
120	4.000

ALLIS-CHALMERS AIR CHAMP PLANTERS

Maximum recommended seed disc speed, 30 R.P. M. Maximum recommended ground speed, 8 m.p.h.

No. of cells in seed disc	Multiplier factor
45	1.250
90	2.500
144	4.000

JOHN DEERE PLATELESS PLANTERS

Maximum recommended fingerwheel speed, 62 R.P.M. Maximum recommended ground speed, 8 m.p.h.

No. of fingers on fingerwheel	Multiplier factor
12	.700

INTERNATIONAL HARVESTER CYCLO PLANTERS

Maximum recommended seed drum speed, 35 R.P.M. Maximum recommended ground speed, 7 m.p.h.

No. of cells in seed drum	Multiplier factor
24	.800
72	2.400
144	4.800

EXAMPLE 1 (corn):

1. Desired harvest-time population = 20,000 plants/acre
2. Planting rate (15% over-plant) = 23,000 kernels/acre
3. Row width = 30 inches
4. Kernel spacing in the row (use Table 1) = 9.1 inches
5. Number of cells in seed plate = 20 cells
6. Multiplier factor (from Table 2) = .625

kernel spacing in row (in.) × multiplier factor = maximum recommended planting speed (mph)

9.1 (in.) × .625 (multiplier) = 5.7 mph max.

EXAMPLE 2 (corn):

1. Desired harvest-time population = 14,000 plants/acre
2. Planting rate (15% over-plant) = 16,100 kernels/acre
3. Row width = 30 inches
4. Kernel spacing in the row (use Table 1) = 13.0 inches
5. Number of cells in seed plate = 24 cells
6. Multiplier factor (from Table 2) = .750

kernel spacing in row (in.) × multiplier factor = maximum recommended planting speed (mph)

13.0 (in.) × .750 (multiplier) = 9.7 mph

However, 9.7 miles per hour *exceeds* the maximum recommended planting speed for all planters. Since the example is based on a plate-type planter, a planting speed of approximately 7.0 miles per hour is the maximum that should be used. (See Table 2 or your operator's manual.)

Most seed metering devices have the greatest accuracy when operating from one-half to full maximum recommended R.P.M. Slower speeds result in more doubles being dropped and, therefore, a higher planting rate than actually desired. Higher speeds will result in more skips and misses and a lower plant population. Higher speeds also tend to promote irregular seed placement in the row and uneven seed coverage.

General

Before taking a planter to the field, check the machine over thoroughly and lubricate to be sure that it is ready to go and properly set up for the job at hand. Much of the check-out procedure should be carried out well in advance of the planting season, preferably during the winter months. A final check-out is desirable, however, just prior to taking the planter to the field.

The following steps are recommended:

1. READ and STUDY the operator's manual for the make and model of planter being used. If the original manual has been lost, the machinery dealer will be glad to provide a new one.

2. Check the planter for sprung or damaged frame and for furrow opener alignment. Repair or replace damaged parts as necessary.

3. Lubricate all moving parts according to recommendations given in the operator's manual.

4. Be sure that all shafts and moving parts are free and can turn or move smoothly. Look particularly at the following parts:

a. seed metering devices in all seed hoppers;
b. fertilizer augers, fingerwheels and other fertilizer metering and conveying devices; and
c. insecticide and/or herbicide metering or flow regulating devices for adjusting or regulating the metering rate.

If any of these parts are "frozen" or do not move freely, work cautiously to loosen them. Do not apply undue force. Check the operator's manual.

5. Be sure that planter furrow openers and other soil-engaging parts are polished and will scour.

6. Determine the harvest-time population desired, and calculate from Table 1 the kernels or seeds per acre and the seed spacing in the row (inches) required to reasonably guarantee that harvest-time population.

7. Refer again to the operator's manual for the chain, sprocket and/or gear combinations that will come closest to the desired planting rate in seeds per acre or the desired seed spacing in the row.

8. Select the correct seed plate, seed disc or seed drum that appears to be the most appropriate for the seed to be used *and* the planting rate desired. Refer to the operator's manual *and* the information given on the seed bag tag. It may be possible to use two or more seed plates (with the same cell size, but different numbers of cells), particularly with plate-type planters. In general, use the plate that has the greatest number of cells.

9. Make a quick check of kernel length in comparison to the length of the seed cell in the planter plate when planting corn with a conventional seed plate-type planter. To do this, take *one* handful of seed directly from the bag. Spread this seed sample on a table and select what appear to be the 10 longest kernels of the sample. Fit each seed, one at a time, into a cell in the plate selected. If more than *one* of the 10 kernels touches both ends of the seed cell, the cell is slightly shorter than should be used and will most likely result in some cells not filling, thus under-planting. If *all* of the 10 kernels fit loosely in the seed cell, it is too long and will result in planting too many doubles. Substitute another plate with either a slightly longer or shorter seed cell.

10. On the road or lane, try out the planter and check seed spacing for each row to be sure that each planting unit is metering seed at, or near, the desired planting rate.

11. In the field, check planting depth to be sure that the seed is being placed at the desired depth and is properly covered.

12. With the planter in the ground, check to see that all planting units are approximately level from front to rear (parallel to the soil surface). Planting units that are not approximately level will cause erratic seed placement and lack of uniformity in seed coverage. Check your operator's manual for appropriate adjustments.

13. Again using the operator's manual, follow the general procedure outlined above for the application of fertilizer, insecticides and/or herbicides.

Tips on Planter Operation

Each make and model of row crop planter has its own characteristics and limitations which must be recognized and understood by the operator to obtain maximum results from the machine. These details must be gotten from the operator's manual. There are some general operating procedures, however, that are applicable to most, if not all, row crop planters.

1. Limit ground speed to a point where the seed metering device will not turn faster than the manufacturer's maximum recommended speed. Also, try to avoid situations where the seed metering device will turn at less than **half** the manufacturer's maximum recommended speed. (See Table 2 for guidelines, and refer to your operator's manual.)

2. Never operate a planter at speeds greater than 7 to 8 miles per hour. (Again, refer to Table 2 and your operator's manual for specific recommendations.) Ground speeds greater than 5 miles per hour are advisable only when operating on a relatively smooth and obstruction-free planting surface.

3. Placing one or two teaspoons of powdered graphite on top of the seed with each refill of each seed hopper will tend to reduce gumming on moving parts caused by fungicides used in treating the seeds. The graphite also tends to lubricate moving parts, greatly reducing wear.

4. With planters requiring graded seed, it is advisable to remove the last 2 or 3 inches of seed from the seed hoppers with every third or fourth refill. Save this seed and use it later with a slightly larger plate. Seed metering devices requiring graded seed tend to meter out the medium-sized and smaller seeds first, causing an eventual accumulation of larger seeds in the bottom of the hopper. This will eventually cause erratic planting and under-planting unless a larger plate is used.

5. Leave a headland at each end of the field that is sufficiently wide for turning the planter without too much lost time. In general, a minimum headland width is twice the width of the planter. (For example, use 8-row headlands for a 4-row planter.)

6. Never back up with a planter when the planting units are in the ground. Always try to have some forward motion when raising or lowering the planters.

7. Visually examine all hoppers for all rows frequently to be sure that the seed, fertilizer, etc., level for all rows is going down uniformly.

8. Seed monitoring equipment is available for most row crop planters and is sold as an integral part of many late-model planters. This equipment is particularly desirable for the larger multi-row planters, as it gives the operator a continuous signal as to the performance of the seed metering device for each row unit.

Storing the Planter

Preparing the planter for storage at the end of the season is just as important as preparing it for operation at the start of the season. The following steps in preparation for storage may be used as guidelines.

1. Remove all seed, fertilizer, chemicals, etc., from all hoppers. Use an air hose to blow out all chaff, dust, etc., from seed and fertilizer hoppers.

2. Remove all seed plates or seed discs, clean thoroughly and store separately.

3. With dry fertilizer, remove all fertilizer metering parts, clean thoroughly and store separately.

4. With liquid fertilizer, flush the entire system with clean water. Drain the system completely to avoid freezing damage. See your operator's manual for specific cleaning instructions. Never leave liquid fertilizer in tanks when the temperature may drop below 40 °F. Some types tend to crystalize at this temperature.

5. If liquid herbicides are used, drain and flush the entire system thoroughly with clean water. Disassemble nozzle tips and clean all parts thoroughly. Store these parts separately. Be sure that the entire system is drained to avoid freezing damage.

6. Clean planter runner, furrow opener discs and other polished parts and coat with a rust-preventative material.

7. Lock planter into transport position so that planting units cannot accidentally drop to the floor during storage.

8. Check the planter over thoroughly and make a list of repairs that need to be made prior to the next planting season.

9. Store the planter in a building where it will be protected from rain and snow.

10. Refer to your operator's manual for specific details on winterizing and storing your planter.