

# Planting, Mechanical Thinning and Weeding

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Except for a few minor changes, the manufacturers of the standard types of beet drills have made no major improvement for precision planting of beet seed in the past thirty-five years.

In our area there has been one notable exception—the development of the Milton drill. Its vertical rotor with a double row of seed cups on the rim discharges seed evenly an inch above the bottom of the seed furrow. Observations in the field of plantings made by this drill the past two years in our area indicate that there are fewer and shorter gaps without seedlings, and less bunching of seed than for any of the other drills used. This is important where mechanical thinning is followed.

In 1950 we disposed of all but two John Deere 4-row drills in our northern district, and purchased at least one 6-row trail-type double rotor Milton drill for each factory district as demonstrators and rental drills. Fourteen Milton drills planted 3,439 acres of beets in 1951. The 6-row drills planted an average of 253 acres each. One drill planted 547 acres, or almost eight percent of the planted acres at that factory.

The moulded rubber V-shaped press wheel insert improved the germination stands when used on the standard makes of press wheel.

Coincident with the development of mechanical thinning, it is imperative that beet drill improvement be speeded up to provide for more precise planting of the various sizes and types of seed found to be most suitable for each area.

## Mechanical Thinning

Early in 1949 D. J. Roach, executive *vice* president of our company, assigned to several members of our agricultural staff the job of developing a machine which would work in wet or dry soils, in thick or thin beet stands, in clean or weedy fields, in small or large beets, and do a satisfactory job of removing excess beets and weeds, while at the same time leaving a good stand of single beets or small bunches requiring no hand or finger thinning. This was a big order because for twenty-five years beet growers, implement manufacturers and sugar company experts had been trying to develop a machine, a tool, or a system for mechanical thinning which would eventually meet these qualifications and be acceptable to growers and laborers.

A measure of the success of this endeavor is evidenced by the fact that in 1950 the first 335 company-owned Great Western 4-row beet thinners and 80 grower-owned machines thinned 29,554 acres mechanically. This past year 52,745 acres, or 30 percent, were thinned by 414 company-owned GW thinners and 54 grower-owned machines in our four state area. Grower and labor acceptance from the first assured a mechanical solution to the problem of hand thinning. It seems to me it is no longer a question of "can it be done?" but rather one of "how soon can it be made universal?"

In the development of the GW beet thinner in 1949 every known tool or machine developed up to that time was tried out on our farm at Windsor,

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Colorado, under soil conditions which varied from dry to extremely wet. Beets were mechanically thinned from the two true leaf stage to those whose foliage almost covered the ground and were mixed with weeds 18" high.

None of the machines, systems or combinations tried out during 1949 did the work under all conditions as well as the Great Western 4-row thinner developed at Windsor.

This system of GW mechanical thinning differs from cross blocking in that the power-driven rotating knives always leave three small blocks with the 8-bladed head and six blocks with the 16-bladed head in each foot of row, whereas the usual cross blocker left only one block of greater width in each foot of row. These smaller blocks contained largely single plants requiring no finger thinning from the labor. When the 16-tooth cutter head equipped with  $\frac{5}{8}$ "  $\frac{3}{4}$ " or 1" knives is used, six small blocks of approximately 1" in width are left per foot of row, and the stand is reduced 35, 50 and 57 percent, respectively, from that of the original.

The GW thinner is a rugged 4 or 6-row machine which travels down the row. It has a simply designed adjustment in the hub of the wheel for quick changing to span four or six rows of 20", 22" or 24" row widths. In a matter of minutes it can be adjusted for wide and narrow row combinations by sliding the individual thinner units to the proper location on the drive axle. The 8-bladed cutter heads revolving at right angles to the direction of the rows leave a block of beets every  $8\frac{1}{2}$ ". They are easily and quickly removed for exchange to a different set of longer or shorter knives to leave the kind of stand desired. Since the cutter heads rotate across the rows, it will thin properly when the thinner is off to one side of the row as much as 2" to 3". It is mounted on rubber and powered by its own traction, permitting it to be pulled behind any row-crop tractor by simply hooking it to the draw bar. It has a one-lever control for all rows, but each row is able by the use of compression springs to work independently and thereby insure that the cutting knives will operate at the desired depth in the soil at all times.

Each machine to be adaptable to most all types of stands should be equipped with at least three sets of cutting heads, viz.,  $1\frac{1}{2}$ " and  $1\frac{3}{4}$ " for the 8-blade heads, and the third set of, preferably,  $\frac{5}{8}$ " knives on 16-blade heads. The latter type is generally used the second time to complete the mechanical thinning process known as the Windsor or "Twice-Over System."

#### The "Once-Over System"

Most of the acreage thinned so far by the GW thinners has been by the "Once-Over system," which is quite simple. It consists of selecting the proper cutting head to leave approximately twice the number of plants desired for a final harvested stand. When the germination stands are reduced to this point, beet labor has a better opportunity for selecting the single plant, weed-free hills, thus speeding up and improving the quality of its work—in the heavier germination stands, the 8-blade head with  $1\frac{3}{4}$ " knives will remove 50 percent of the stand, and for stands as light as 20 percent, the smaller knives will do a good safe job. Experience soon demonstrated to growers that poor germination stands could be worked with the machine

without reducing the plant population below that desired. At the same time it will remove some weeds within the row, while mulching the soil with an in-the-row cultivation.

Determining the germination stand is the first step before mechanical thinning. This is done by placing a 100-inch tape along the row to be counted, and counting the inches which contain beets. The number of beet-containing inches becomes the percent germination stand. These may be singles, doubles or multiple plants in each inch. At least ten counts at random, made diagonally across the field, will give a fair estimate of the germination stand. Using Table 1, look down the lefthand column to the figure closest to the stand resulting from your counts; then select the blade indicated which will give the kind of thinned stand desired.

Table 1.—Number of Beet Hills Remaining Per 100 Foot of Row After Using the Cutter Heads Shown Below.

Germination Stand <sup>1</sup>	Once Over System						Twice Over System <sup>2</sup>		
	5/8" 16 Blade	1 1/2" 8 Blade	7/8" 16 Blade	1 3/4" 8 Blade	1" 16 Blade	2" 8 Blade	1 3/4" 8 Blade plus 3/8" 16 Blade	1 3/4" 8 Blade plus 1/2" 16 Blade	1 3/4" 8 Blade plus 1" 16 Blade
16	132								
18	144	120							
20	156	132	120	120					
22	168	156	132	132		120			
24	180	168	144	144	120	132			
26	204	180	156	156	132	132	96		
28	216	192	168	168	144	144	108		
30	228	204	180	180	156	156	120		
32	252	216	192	192	168	168	120	96	
34		228	204	204	180	180	132	108	
36		252	216	216	192	192	132	120	
38			228	228	192	192	144	120	96
40			240	240	204	204	156	132	108
42			252	252	216	216	156	152	108
44					228	228	168	144	120
46					240	240	180	144	120
48					252	252	180	156	132
50							192	168	132

<sup>1</sup> Beet-containing inches in 100 inches of row.

<sup>2</sup> The 8-bladed head followed in 4 days with the 16 bladed head shown.

Once Over	5/8" 16-Blade Head will cut out.....	36%	of Beets
	1 1/2" 8-Blade Head will cut out.....	43%	of Beets
	7/8" 16-Blade Head will cut out.....	50%	of Beets
	1 3/4" 8-Blade Head will cut out.....	50%	of Beets
	1" 16-Blade Head will cut out.....	57%	of Beets
	2" 16-Blade Head will cut out.....	57%	of Beets
Twice Over	1 3/4" 8-Blade Head plus 3/8" 16-Blade Head will cut out.....	68%	of Beets
	1 3/4" 8-Blade Head plus 1/2" 16-Blade Head will cut out.....	73%	of Beets
	1 3/4" 8-Blade Head plus 1" 16-Blade Head will cut out.....	79%	of Beets

For example, with the 8-blade heads there are three choices with knives 1 1/2" and 1 3/4" and 2" in length, and three choices with the 16-blade heads with the 5/8", 7/8" or 1" knives. Assume we have a 26 percent germination stand, by using the 5/8" 16-blade head (1st column) the GW thinner would leave 204 hills per 100 feet, or by using a 1 1/2" 8-blade head (2nd column) it would leave 180 hills in each 100 feet. This stand is approximately double the number of plants required for an average of one beet per foot at harvest time, and is recommended as the kind of stand to leave for hand labor to

finish. Examination of the figures below the chart will disclose that either the  $\frac{7}{8}$ " 16-blade head or the  $1\frac{3}{4}$ " 8-blade head will remove 50 percent of the stand. Also, the 1" 16-blade head or the 2" 8-blade head will reduce the germination stand 57 percent.

Ordinarily the 8-blade heads are preferred for the "Once-Over" thinning method; however, the 16-blade heads leave twice as many bunches only one-half the width of those left by the 8-blade head. Conditions must be more favorable for its use as it has a greater tendency to cover small beets and is rougher on the tops of large plants.

It is recommended for growers not acquainted with the use of the machine to start out with the "Once-Over Method" and leave plenty of stand. This is not too serious where hand labor is following to complete the mechanical thinning operation.

If the beets are small and are apt to be severely damaged by dashing rains, hail or wind storms, it is best to use the type of thinner head which will leave double the number of beets desired until they are larger, when the stand can be reduced a second time over with the thinner.

#### **Complete Mechanical Thining—"Twice-Over Method"**

This system requires the use of the 8-blade head first, followed by a 16-blade head for the second operation four to eight days after the first time over. If, for illustration, the grower used a  $1\frac{3}{4}$ " 8-blade head on a 30 percent germination stand followed in four to eight days by a  $\frac{5}{8}$ " 16-blade head, he would have 120 beet-containing hills per 100 feet of row, with approximately 15 to 25 as doubles or multiples.

Since the small knives pass through the row of beets at a slight angle, it is important that the two operations go in opposite directions. This makes a criss-cross pattern which cuts out most of the weeds in the row. The blocks left are small squares in the center of the beet row containing a large proportion of singles with fewer weeds than if the second operation had followed the same direction as the first. Going over the field twice gives two in-the-row cultivations which are better for the crop than two ordinary cultivations.

In 1950 our company on its Windsor, Colorado, farm completely mechanically thinned (without any finger thinning) 294 acres of sugar beets at a savings of 56 percent of the summer work without loss in yield. The total hand labor bill for hoeing and weeding was \$10.35 per acre, a saving of \$12.15 from the regular contract price of \$22.50 per acre. This work was again repeated on 251.1 acres on the same farm in 1951. Mexican National labor used for the hoeing was paid 80 cents per hour for all but one field, which was at \$5.50 per acre. The average cost for hoeing was \$7.24 per acre. The hoeing was delayed until after June 20th when most workers had finished their thinning.

A number of beet growers throughout the Great Western territory this past season tried out the Windsor "Twice-Over Method" on their entire contract. Several attained yields as high as the highest in their communities at a great saving in labor and at reduced costs for hoeing and weeding.

### Company's Plan for Using the GW Thinner

Our company decided to loan the machines to the growers without cost, since only a few would purchase them until workers were convinced they could earn more money per day at reduced rates following machine work, and until beet growers recognized the system was successful.

As a further inducement, wherever the machine was used a credit of \$1.50 per acre was allowed up to an amount which would offset a labor charge of \$2.00 per acre on those farms where workers were shipped to the grower at company expense for transportation. Under this arrangement in 1950, the company machines thinned an average of 81 acres per machine, or approximately three times the average of 28 acres for the grower machines. In 1951, the company machines' average was increased to 121 acres, while that for the grower was 46 acres per machine, still approximately one-third that of the company machines.

The 79 additional 6-row machines introduced in 1951 proved so popular that 144 of the 4-row thinners were exchanged for a like number of 6-row machines for use in 1952. The maximum thinned last year by a 4-row thinner was 303 acres, as compared to 491 acres by a 6-row machine. Many of the 4-row machines thinned over 200 acres, and a large number of the 6-row machines thinned more than 300 acres for the season. One of our Lyman, Nebraska, growers thinned 42 acres in 7 1/2 hours with a 4-row machine. The present number of company thinners has a potential ability to thin mechanically 100,000 acres in 1952.

The control of the machines was the responsibility of the company fieldmen. The number of machines assigned to each fieldman was in proportion to the acreage of his district. All other field work was made secondary to the operation of the thinning machines. To assist the fieldmen during the thinning season the receiving station repair crews were used to help adjust the machines and stay with them until the work was going satisfactorily. This allowed the fieldmen more time to manage the placement of his machines.

Each grower was urged to visit his neighbor's field from whom he was to get the machine, to learn how to operate and adjust it and be ready to move it to his farm as soon as it finished. Growers were requested to tell the fieldmen in advance when they would finish with the machine, or when they would be ready for one. A daily report was made by each fieldman to his manager of the acreage covered by each machine.

Field demonstrations for growers on the earliest plantings and during the summer months on specially planted plots were found to be very helpful in showing the method and advantages of mechanical thinning. Some beets should be mechanically thinned with the machine at the demonstration plot three to four days before the day of the demonstration. This provides an effective comparison between the recovered beets and those being thinned.

The first demonstrations held should be for the company's agricultural staff to learn the technique and to become sold on the method.

In 1950 after the first extensive trial with the GW thinners, a survey was made of 483 growers who had used them. Nine out of ten of these

growers favored the use of the machine. An analysis of their replies gave the following observations:

No loss in tonnage resulted through use of the machine. Many indicated an increase in yield following mechanical thinning because of an increase in stands over hand thinning. The timely use of the thinner cuts out excess plants and weeds, conserves moisture and fertilizer, and prevents loss of tonnage from delayed thinning. It is not necessary to have thick germination stands, as the machine is easily adjusted to work thin stands of beets. It takes the place of regular cultivations, in addition to cultivating in between plants in the row. Large acreages can be thinned daily with the machines. It assists workers in making larger hourly earnings and increased seasonal earnings because they have a longer time in which to work. The "Twice Over Method" eliminates the need for finger thinning. The workers are needed for only the hoeing and weeding. Using the GW thinners balances mechanical harvesting.

A limited use of the spring tine heads on the GW thinner when used after thinning promises to eliminate small weeds and grass without injuring the beets. This operation following complete mechanical thinning shows promise of reducing most of the hoeing and weeding. Under present conditions, migrant laborers will not remain in beet-growing areas for late hoeing and weeding.

I am not so naive as to believe that the system or machine I have described is the final solution. I know that both will be improved with time and by experience. This is the way of progress. It is not an easy job. I invite and urge every one here to concentrate on improving the technique and expanding the method to include every beet grower in every area. The success or failure of the program is largely in the hands of our agricultural force.

In conclusion, I want to congratulate the entire Great Western agricultural staff for its tireless, resourceful and enthusiastic salesmanship responsible for introducing in so short a time, on such a large scale, a method which promises to restore the growing of sugar beets to its former place in the agricultural economy of the West.