AUGUST 1943 BULLETIN 475

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

M. F. MILLER, *Director*

Corn Tillage Studies on Rolling Putnam Silt Loam

MACK M. JONES AND ROBERT P. BEASLEY

COLUMBIA, MISSOURI

GENERAL DISCUSSION

Although exhaustive trials of substitutes for plowing were not made on this soil (Putnam silt loam), bedding (ridging) and using field cultivators and subsurface cultivators instead of plowing did not give encouraging results. The soil is frequently too wet in the spring, or trash and crop residues too bulky, to handle satisfactorily by methods other than plowing.

Early spring plowing was superior to either fall plowing or late spring plowing. Disking ahead of plowing failed to give higher yields, and of course increased the power and labor required. Disking may be necessary under some conditions, however, to cut up trash and crop residues adequately or to enable a wet soil to aerate and dry more rapidly, and thus enable earlier plowing.

For tillage work after plowing and before planting, harrowing with a spike-tooth harrow, provided the soil is in very good working condition, appears to give as good results as tandem disking and harrowing. Therefore, when soil conditions are favorable, particularly when there is a shortage of labor, or when the season is late, some power and labor may be saved by omitting the disking.

The field cultivator may be used instead of the disk harrow for secondary seedbed preparation following plowing where only a light amount of trash has been plowed under. The field cultivator has less tendency toward over-pulverization, and consequently there is less danger of this soil packing and running together in the event of excessive rains.

The spike-tooth harrow, the rotary hoe, or the spring-tooth weeder can be used quite satisfactorily and economically for the first cultivation of corn, if rainy weather does not delay the first cultivation too long. These implements are capable of fast and cheap operation and do good work if the ground is not crusted too hard or packed and if only small weeds are present. Cultivators equipped with sweeps or surface blades which give shallow cultivation, yet control weeds, appear to be better than cultivators equipped with shovels which operate more deeply. If the cultivation is too deep, apparently too many corn roots are cut or disturbed.

Corn Tillage Studies on Rolling Putnam Silt Loam

MACK M. JONES AND ROBERT P. BEASLEY

Experiments were begun in 1934 to determine the most economical use of power, labor and machinery in the production of corn on Putnam silt loam. Various implements and methods were used in preparing the seedbed and in cultivating corn in an attempt to discover the methods which would give the best yields with the least work and expense. The cropping system was a two-year rotation of corn and oats with lespedeza. The experiments consisted of two main series, one on seedbed preparation methods and one on cultivation methods. There were two to four replications of each experiment. The plots were $\frac{1}{25}$ acre in size.

Seasonal variations in weather naturally affect results, particularly crop yields, from experiments of this type. Since this report represents a rather short period of time and since some of the observed differences are small, the results should be considered in general as indicating trends rather than conclusive proof of the effects of different methods of tillage.

It should be kept in mind that these experiments were made on a rolling phase of Putnam silt loam and apply only to this soil type. This soil has a very tight subsoil and is therefore rather difficult to handle.

The rotation used in these experiments is not a common one, but was used to secure results more rapidly. The results secured from tillage experiments are of course affected by the preceding crop and the crop residues that may be left. Results with corn following bluegrass, or even red clover or sweet clover, would be expected to be somewhat different from those obtained when corn follows lespedeza.

Certain crop rotations require less frequent plowing of the soil. For example, land in a three- or four-year rotation of corn, small grain and sweet clover, would require plowing only once or twice in three or four years. These rotations are better not only from the standpoint of maintaining soil fertility, but also from the standpoint of lower power and labor requirements. Also, one-year rotations of small grain with lespedeza, which are becoming quite popular, have been carried on for as long as four or five years without plowing.

PRIMARY SEEDBED PREPARATION

Various methods of primary seedbed preparation were tried, including fall plowing, early spring plowing, late spring plowing, using a field cultivator (equipped with sweeps and also equipped with spear-pointed shovels), using a sub-surface cultivator, tandem disking two and three times, and bedding (ridging) with disk hillers on a tractor cultivator. The seedbed preparation plots were given one cultivation with sweeps and rotary hoe attachments over the rows, and two subsequent cultivations with sweeps.

Fall Plowing versus Spring Plowing.—Spring plowing gave better results than fall plowing. It appears that winter rains settle and pack this particular soil (Putnam silt loam) so much that by spring the fall-plowed ground is practically in the same condition as the ground which has not been plowed. Table 1 gives a comparison of yields on fall-plowed and spring-plowed plots. The yields for 1934 and 1936 are given in pounds of fodder, because no grain was produced in those years on account of drouth. It will be noted that in each of the four years, spring plowing gave higher yields.

TABLE 1 - FALL PLOWING VERSUS SPRING PLOWING

	Year and Yield			
Method	1934 Lbs. Fodder per Acre	1935 Bus. per Acre	1936 Lbs. Fodder per Acre	1937 Bus. per Acre
Spring Plow, Tandem Disk and Harrow	570	26.0	1800	35.2
Fall Plow, Tandem Disk and Harrow	510	22.7	1760	31.5

There was considerably more erosion on the fall-plowed plots than on those left unplowed until spring. Apparently the cover afforded by the lespedeza stubble was effective in retarding soil washing.

The power and labor requirements, although varying somewhat from year to year, were not appreciably different for fall or spring plowing.

Early Spring Plowing versus Late Spring Plowing.—During two years of the experiments, comparisons were made between early and late spring plowing. Early plowing proved to be better these two years, as is shown on Table 2. It appears that early spring-plowed ground mellows and forms a better seedbed than the late-plowed ground.

TABLE 2
LATE SPRING PLOWING VERSUS EARLY SPRING PLOWING

Method	Year and Yield 1940 Bus. per Acre	1941 Bus. per Acre
Early Plow,		
	Apr. 1, 2*	March 22*
Tandem Disk and Harrow	38.8	58.3
Late Plow,		
	May 7*	May 14*
Tandem Disk and Harrow	34.5	48.5

* Date of Plowing.

TABLE 3 - SUBSTITUTES FOR PLOWING

Method		Man Hrs. per Acre	Horsepower Hrs. per Acre	Year and Yield 1937 Bus. per Acre	1938 Bus. per Acre	1939 Bus. per Acre	1940 Bus. per Acre	1941 Bus. per Acre
Plow,	Seedbed	1.43	16.3					
	Planting	0.41	0.8	35.2	34.2	40.8	38.8	58.3
Tandem Disk and Harrow	Cultivation	1.30	7.4					
	Total	3.14	24.5					
Tandem Disk,	Seedbed	1.20	9.2					
Bed,	Planting				34.0	35.8	33.3	
Level and Plant	Cultivation	1.30	7.4					
	Total	2.50	16.6					
Bed,	Seedbed	0.89	6.4					
	Planting					31.5		
Level and Plant	Cultivation	1.30	7.4					
	Total	2.19	13.8					
Tandem Disk	Seedbed	1.05	10.3					
Subsurface Tiller,	Planting	0.41	0.8				26.4	
Harrow	Cultivation	1.30	7.4					
	Total	2.76	18.5					
Subsurface Tiller,	Seedbed	0.74	7.5				14.5	
	Planting	0.41	0.8					
Harrow	Cultivation	1.30	7.4					
	Total	2.45	15.7					
Tandem Disk	Seedbed	0.62	6.5					
	Planting	0.41	0.8		32.0	32.8		
Tandem Disk and Harrow	Cultivation	1.30	7.4					
	Total	2.33	14.7					
Tandem Disk,	Seedbed	0.93	9.3					
Tandem Disk,	Planting	0.41	0.8		33.9			
Tandem Disk and Harrow	Cultivation	1.30	7.4					
	Total	2.64	17.5					
Field Cultivator (sweeps)	Seedbed	0.88	10.8					
	Planting	0.41	0.8					31.0
Tandem Disk and Harrow	Cultivation	1.30	7.4					
	Total	2.59	19.0					
Field Cultivator (shovels)	Seedbed	0.88	10.6					
	Planting	0.41	0.8					29.9
Tandem Disk and Harrow	Cultivation	1.30	7.4					
	Total	2.59	18.8					
Tandem Disk,								
Cultivator (sweeps)	Seedbed	1.03	9.7					
Cultivator (sweeps) and	Planting	0.41	0.8	32.2				
Harrow	Cultivation	1.30	7.4					
	Total	2.74	17.9					

Substitutes for Plowing.—Since plowing requires more power and labor than other tillage operations, certain substitutes for plowing were tried, to see if some less expensive operation could be used. Table 3 compares various methods with the standard of plowing, tandem disking, and harrowing. No method gave quite as high yields as the standard, although the yields for some of the methods, which require less work, fell only a little short. Under some price conditions, some of the cheaper methods might give greater returns per unit of work spent.

It will be noted that bedding (ridging) with disks (disk hillers) on the tractor cultivator did not give good results. This work was rather heavy for the cultivator and it was difficult or impossible to obtain adequate penetration. By using a stronger implement for bedding and obtaining more thorough working of the soil, better results might have been obtained.

Neither the subsurface cultivator nor the field cultivator gave good results when used instead of the plow for preparing seedbeds. Apparently there was inadequate breaking and pulverization of the soil.

Disking Ahead of Plowing.—Disking ahead of plowing might be thought to produce a better seedbed. These tests fail to give higher yields, however, as shown in Table 4. In fact, slight decreases in yields were obtained from the plots which were disked before plowing. The disking apparently pulverized the soil too finely, allowing it to settle and pack down too much. The extra preliminary disking also increased the labor and power requirements somewhat.

TABLE 4 - VALUE OF DISKING PRIOR TO PLOWING

Method		Man Hrs. per Acre	Horsepower Hrs. per Acre	Year and Yield 1934 Lbs. Fodder per Acre	1936 Lbs. Fodder per Acre	1937 Bus. per Acre	1939 Bus. per Acre	1941 Bus. per Acre
	Seedbed	1.43	16.3					
Plow,	Planting	0.41	0.8					
	Cultivation	1.30	7.4	570	1800	35.2	40.8	58.3
Tandem Disk and Harrow	Total	3.14	24.5					
	Seedbed	1.74	19.1					
Tandem Disk,	Planting	0.41	0.8					
Plow,	Cultivation	1.30	7.4	505	1740	35.1	40.4	56.0
Tandem Disk and Harrow	Total	3.45	27.3					

It should be remembered that these trials were conducted on ground that was in oats with lespedeza the preceding year. The crop residues and debris were therefore light. Had there been corn stalks or other heavy crop residues to be turned under, it is possible that the results would have been different.

SECONDARY SEEDBED PREPARATION

Various methods of "ordering" or working the ground subsequent to plowing were tried, with the results indicated in Table 5. It will be noted that harrowing only between plowing and planting gave reasonably good, although not consistent, results. When soil conditions are just right, harrowing alone seems to be adequate. The saving in power and labor resulting from the omission of disking from the standard practice of plowing, disking, and harrowing, is rather small. In general, therefore, it appears that such omission would not be justified.

TABLE 5 - COMPARISON OF SECONDARY SEEDBED PREPARATION METHODS

Method		Man Hrs. per Acre	Horsepower Hrs. per Acre	Year and Yield 1937 Bus. per Acre	1938 Bus. per Acre	1939 Bus. per Acre	1940 Bus. per Acre	1941 Bus. per Acre
	Seedbed	1.43	16.3					
Plow	Planting	0.41	0.8					
	Cultivation	1.30	7.4	35.2	34.2	40.8	38.8	58.3
Tandem Disk and Harrow	Total	3.14	24.5					
	Seedbed	1.24	13.1					
Plow	Planting	0.41	0.8					
	Cultivation	1.30	7.4	35.1	35.3	37.0	36.1	51.1
Harrow	Total	2.95	21.3					
	Seedbed	1.48	16.1					
Plow	Planting	0.41	0.8	35.8	35.2	36.5		
Cultivator (sweeps)	Cultivation	1.30	7.4					
Harrow	Total	3.19	24.3					
Plow	Seedbed	1.96	18.5					
Bed	Planting			40.3	35.7			
Level and Plant	Cultivation	1.30	7.4					
	Total	3.26	25.9					

Cultivating with a tractor cultivator equipped with sweeps, and then harrowing gave practically as good results as tandem disking and harrowing. In 1939, however, working with the tractor cultivator (practically the same as using the field cultivator) gave yields somewhat lower than the check plots. Using the tractor cultivator or the field cultivator instead of the disk harrow may be quite acceptable for ground that is not trashy, but would probably not be satisfactory where corn stalks or other bulky material had recently been plowed under.

For two years a rather unusual method of preparing the seedbed was tried. The ground was first spring-plowed, and then bedded or ridged with the disks (disk hillers) on the tractor cultivator. At planting time the beds or ridges were levelled down and the planting done in one operation. This was accomplished by using sweeps and disks on the front units of the tractor cultivator and pulling the corn planter behind the tractor. This method of seedbed preparation, for the two years tried, gave yields somewhat above the

standard method of plowing, tandem disking, and harrowing. This method, as well as the use of the cultivators or the field cultivator instead of the disk harrow, left the ground somewhat more cloddy than the disk harrow, thus suggesting that it may be possible to work and pulverize the soil too much. Leaving clods of medium size imbedded in finer material probably is better than reducing more of the clods to fine material by excessive tillage. When this soil is worked too much, it seems to pack and become harder than when left slightly cloddy.

Bedding or ridging with disks on the tractor cultivator exerts a rather severe strain on the cultivator, and, unless operated with care, may result in springing or doing other damage to the cultivator parts.

It will be noted from Table 3, that bedding with disk hillers on the tractor cultivator was tried as a substitute for plowing, but results were not encouraging.

Delayed Planting.—The practice of disking the ground at about the normal time of planting and then delaying the harrowing and planting for 15 to 20 days was tried. The object of the later planting was to allow a crop of weeds to germinate and be killed by harrowing before the corn is planted. The results are given in Table 6. This method appears to have merit in certain seasons and not in others. There is danger that a rainy season may delay planting too long. It will be noted from Table 6 that there is some saving in power and labor by delaying planting provided the season is such that two cultivations are adequate.

TABLE 6 - DELAYED PLANTING

Method		Man Hrs. per Acre	Horsepower Hrs. per Acre	Year and Yield 1937 Bus. per A	1940 Bus. per A	1941 Bus. per A
	Seedbed	1.43	16.3			
Plow,	Planting	0.41	0.8	May 15*	May 9*	May 14*
Tandem Disk and Harrow	Cultivation	1.30	7.4			
Plant	Total	3.14	24.5	35.2	38.8	58.3
	Seedbed	1.60	16.0			
Plow	Planting	0.41	0.8	May 31*	May 28*	May 31*
Tandem Disk	Cultivation**	0.89	4.9			
Delay	Total	2.90	21.7	38.2	37.5	53.7
Harrow and Plant						

*Planting date

**Only two cultivations were given the late-planted plots.

CULTIVATION

Although the corn was check planted in these trials, cultivating was done in one direction only. The results may be considered as applicable to either drilled or check-planted corn. On the cultivation study plots, the seedbed was prepared by the standard method of spring plowing, tandem disking, and harrowing.

Methods of Early Cultivation.—The spike-tooth harrow, the rotary hoe, the spring-tooth weeder, and the tractor cultivator equipped with sweeps and rotary hoe attachments over the rows, were tried for the first cultivation. The rotary hoe attachment for the tractor cultivator consisted of three rotary hoe wheels mounted to run over each corn row. These rotary hoe wheels served to give the row a light cultivation and also to prevent covering of the small corn plants with soil thrown from the sweeps. The results of the early cultivation trials are given in Table 7.

TABLE 7 - COMPARISON OF METHODS OF EARLY CULTIVATION

Method		Man Hrs. per Acre	Horsepower Hrs. per Acre	Year and Yield 1937 Bus. per Acre	1938 Bus. per Acre	1939 Bus. per Acre	1940 Bus. per Acre	1941 Bus. per Acre
Sweeps with Rotary Hoes*	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8	34.7	43.6	39.2	34.8	53.9
Sweeps	Cultivation	1.30	7.4					
	Total	3.14	24.5					
Harrow	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8	35.4	39.8	34.5	34.6	54.8
Sweeps	Cultivation	.98	5.8					
	Total	2.82	22.9					
Rotary Hoe	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8	35.9	33.9	37.4	34.4	56.9
Sweeps	Cultivation	0.98	5.9					
	Total	2.82	23.0					
Weeder	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8	33.5				
Sweeps	Cultivation	0.98	5.8					
	Total	2.82	22.9					

*Sweeps with rotary hoe wheels over the row.

It was found that whether or not the harrow, rotary hoe or spring-tooth weeder could be used satisfactorily for the first cultivation depended very largely upon the season. In seasons favorable for the use of these implements, the first cultivation could be made much more rapidly and cheaply than with the regular cultivator.

The rotary hoe can be used to best advantage when the ground is lightly crusted and small weeds are just coming through the surface. For heavily crusted soil, the rotary hoe does not penetrate deeply enough to be effective. In seasons when rain prevents field work until weeds have become well rooted, the rotary hoe cannot be used satisfactorily. It was found that the speed of operation greatly affected the quality of work done by the rotary hoe. Speeds of 4½ miles per hour were quite satisfactory, while speeds of 2½ miles were not.

The spring-tooth weeder was not given a thorough trial in these experiments. It was used only one year, and in that year it was not quite so effective as the rotary hoe or the spike-tooth harrow. The spring-tooth weeder can probably best be used in cross-cultivating corn the second time, particularly if the first cultivation tends to leave the ground somewhat ridged. Under such conditions, the spring-tooth weeder levels the ground and kills and covers many of the weeds in the row. Where it can be used to advantage, this form of cultivation is very fast and very cheap. Since the plot lay-out of these trials did not lend itself to cross-cultivation, the spring-tooth weeder was not given a thorough trial.

Comparison of Shovels, Sweeps, and Surface Cultivators.—The yields of plots cultivated with shovels, sweeps, and surface cultivators are shown in Table 8. It will be noted that there is no great difference in power and labor required, nor in yields. The sweeps appear to give slightly better results than shovels, and the surface cultivator, for the two years tried, to have given somewhat better yields than the sweeps. The surface cultivator blades were 24 inches long, and four blades were used for each row. The blades were angled out and forward at about a 25-degree angle with the row and with the trailing end nearer the row. The two blades on each side of the row were about one foot apart and were set to scrape about one inch deep.

From these trials, which were somewhat limited, it appears that shallow cultivations which kill the weeds are better than deeper

TABLE 8 - COMPARISON OF SHOVEL, SWEEP AND SURFACE BLADES

Method		Man Hrs. per Acre	Horsepower Hrs. per Acres	Year and Yield 1935 Bus. per Acre	1937 Bus. per Acre	1939 Bus. per Acre	1940 Bus. per Acre	1941 Bus. per Acre
Sweeps with Rotary Hoes*	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8			39.2	34.8	53.9
Sweeps	Cultivation	1.30	7.4					
	Total	3.14	24.5					
Sweeps with Rotary Hoes*	Seedbed	1.43	16.3					
Shovel	Planting	.41	0.8			37.6		
Shovel	Cultivation	1.30	7.4					
	Total	3.13	24.5					
Sweeps	Seedbed	1.43	16.3					
Sweeps	Planting	.41	0.8	27.5	34.3			
Sweeps	Cultivation	1.39	7.6					
	Total	3.23	24.7					
Shovel	Seedbed	1.43	16.3					
Shovel	Planting	.41	0.8	26.9	34.0			
Shovel	Cultivation	1.39	7.6					
	Total	3.23	24.7					
Surface Blades	Seedbed	1.43	16.3					
Surface Blades	Planting	.41	0.8				36.8	55.2
Surface Blades	Cultivation	1.39	7.0					
	Total	3.23	24.1					

*Sweeps with rotary hoe wheels over the row.

cultivation. It is likely that deeper cultivation, such as given with shovels, breaks and disturbs too many roots of the corn plants, causing a decrease in yield.

Amounts of Cultivation.—A limited number of trials were made in comparing two, three, and four cultivations. On the basis of these trials, it appears that two cultivations will hardly be adequate for most seasons, and that additional cultivations above three will return only very small if any increases in yield. Such increases as were obtained would not pay for the extra cultivation.

Weather conditions may in some years make an extra cultivation desirable while in other years the number might safely be reduced below the usual three.

Power and Labor Requirements.—Draft tests were made on all of the implements used in these trials except tractor-mounted cultivators. The draft of tractor cultivators was estimated from the measured draft of horse-drawn cultivators. It was hardly feasible to make draft tests every day on which work was done in the field, because of the time that would be required to make them. Enough tests were made, however, to give average values. From the rates of travel and the average draft of various implements, the tractor hours per acre, the horsepower-hours per acre, and the man hours per acre were calculated and are given in Table 9. In calculating the tractor hours, it was assumed that the effective work would be only 93 per cent of the time in the field, the time lost for stops and turns being figured at 7 per cent. Likewise, it was assumed that the machinery chore labor and the lost time for the operator would be 17½ per cent.

The figures given in Table 9 are general averages and of course apply to Putnam silt loam soil. The draft of the implements and the work required to use them are doubtless higher than they would be on lighter and more friable soils.

The man labor and the tractor work per acre is itemized for the various single operations. The totals required for various combinations of operations are therefore easily computed. For the most common combinations, the totals are given in preceding tables. The savings in labor or power that may be made by eliminating certain operations, are likewise easily determined. Whether a certain operation should be omitted or not, would probably be determined more from the probable value of the operation in that particular season and from the power and labor demands of other farm enterprises, however, than from just the power and labor costs of the operation.

TABLE 9 - POWER REQUIREMENTS OF TILLAGE OPERATIONS
(PUTNAM SILT LOAM, PREVIOUSLY IN OATS AND LESPEDEZA)

Implement	Size	Depth	Draft Lbs.	Speed Miles Per Hr.	Horse-power	Tractor* Hrs. per Acre	Horse-power Hrs. per Acre	Man** Hrs. per Acre
			(Seedbed Preparation)					
Plow	2-14"	6"	1190	4	12.7	0.95	12.1	1.07
Tandem Disk	8'	Deep Cut						
		Unplowed ground	940	4	10.0	0.28	2.8	0.31
		Plowed ground	1070	3 1/2	10.0	0.32	3.2	0.36
Spike-tooth Harrow	15'	Not Weighted	600	4	6.4	0.15	1.0	0.17
Tandem Disk and Spike-tooth Harrow	8' 10'	Deep Cut Plowed ground	1400	3 1/2	13.1	0.32	4.2	0.36
Tandem Disk and Spike-tooth Harrow	8' 10'	Deep Cut Unplowed ground	1250	4	13.3	0.28	3.7	0.31
Tractor Cultivator								
Bedding	2 row		1000	3	8.0	0.42	3.4	0.48
Levelling and planting	2 row		900	3 1/2	8.4	0.36	3.0	0.41
Sweeps	2 row		850	4	9.0	0.32	2.9	0.31
Sweeps and Spike-tooth Harrow	2 row 10'		1200	3 1/2	11.2	0.36	4.0	0.41
Field Cultivator								
Sweeps	5'	4"	1500	3 1/2	14.0	0.51	7.1	0.57
Shovels	5'	5"	1460	3 1/2	13.6	0.51	6.9	0.57
Sub Surface Tiller	5'	6"	1370	3 1/2	12.8	0.51	6.5	0.57
Planter	2 row		250	3 1/2	2.3	0.36	0.8	0.41
			(First Cultivation)					
Spike-tooth Harrow	15'		500	4 1/4	5.7	0.14	0.8	0.16
Rotary Hoe	15'		550	4 1/4	6.2	0.14	0.9	0.16
Weeder	15'		500	4 1/4	5.7	0.14	0.8	0.16
Tractor Cultivator								
Sweeps & R.H.***	2 row		700	3	5.6	0.42	2.4	0.48
Sweeps	2 row		750	2 1/2	5.0	0.51	2.6	0.57
Shovels	2 row		750	2 1/2	5.0	0.51	2.6	0.57
Surface Blades	2 row		700	2 1/2	4.7	0.51	2.4	0.57
			(Subsequent Cultivations)					
Tractor Cultivator								
Sweeps	2 row		750	3 1/2	7.0	0.36	2.5	0.41
Shovels	2 row		750	3 1/2	7.0	0.36	2.5	0.41
Surface Blades	2 row		700	3 1/2	6.5	0.36	2.3	0.41

*Tractors Hrs. per Acre = $\frac{43,560}{\text{mph} \times 5280 \times \text{width of cut (ft.)} \times .93}$ (Assumes 7% time lost in stops and turns.)

**Man Hrs. per Acre = $\frac{43,560}{\text{mph} \times 5280 \times \text{width of cut (ft.)} \times .825}$ (Assumes 17 1/2% time lost in stops and turns and machinery chore labor.)

***Sweeps with rotary hoe wheels over the rows.