



WEATHER and PROFITABLE MACHINERY SIZE

The ability of the farmer to perform the various operations from spring to fall in a timely fashion is a function of several interrelated factors. The factors are:

1. Time available
2. Size of farm.
3. Type or nature of farm.
4. Size of the labor force.
5. The size of machinery available.
6. The quantity of machinery available.
7. Soil type.

The absolute amount of time available for performing any given production process is greatly influenced by weather conditions. However, the amount of work that can be performed within the available time period can be modified by the seven factors listed above.

The purposes of this circular are: (1) To estimate the time available for planting and harvesting in the nine crop reporting regions of North Dakota, (2) to estimate the probabilities of planting and harvesting periods of a given length occurring in these regions, and (3) to assist farmers in determining optimum machinery requirements. Such information is of great value to farmers planning to either enlarge the present farm size or those that are planning to acquire new machinery.

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COOPERATIVE EXTENSION SERVICE
NORTH DAKOTA STATE UNIVERSITY
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This circular will give time available for field work. Using the machinery cost and capacity information given in Extension Circular A-524 or Experiment Station Bulletin No. 479, the farm manager can determine the optimum or least cost machinery combinations for his particular situation.

Figure 1 shows the nine regions of North Dakota for which the time data of this study are compiled. The weather reporting stations are also shown in the figure.

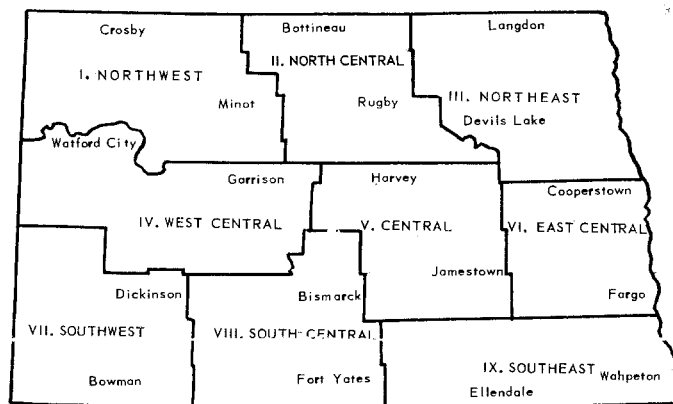


FIGURE 1. NORTH DAKOTA CROP AND LIVESTOCK REPORTING DISTRICTS, WEATHER REPORTING STATIONS INCLUDED

Table 1 gives the normal time period in which planting occurs for each of the nine regions. Also given is the "actual planting" or "expected planting" period or the days field work could be done.

TABLE 1. OPTIMUM AND ACTUAL PLANTING PERIODS IN NORTH DAKOTA (BY DISTRICTS)

District	Optimum planting period	Actual planting period ^a
Northwest	April 1 - May 30: 60 days	34 days
North-Central	April 1 - May 30: 60 days	34 days
Northeast	April 1 - June 5: 65 days	34 days
West-Central	April 1 - May 30: 60 days	36 days
Central	April 1 - May 30: 60 days	34 days
East-Central	April 1 - May 30: 60 days	34 days
Southwest	April 1 - May 25: 55 days	32 days
South-Central	April 1 - May 25: 55 days	32 days
Southeast	April 1 - May 25: 55 days	32 days

Average = 34 days

^aThe actual planting period was determined by omitting the unfavorable days from the optimum planting period. In the spring, the unfavorable days were those during which it snowed, rained, or the temperature was too low to allow field work. It was assumed that .10 of an inch or more of precipitation would prevent field work for one day. Precipitation of over .75 of an inch would prevent field work for two days. More precipitation caused a still longer delay.

SOURCE: *North Dakota Weather-Crop Bulletin, 1950-1963*, Agricultural Statistics No. 14, Department of Agricultural Economics, North Dakota State University, Fargo, North Dakota, November, 1965.

U.S. Weather Bureau, Fargo, North Dakota.

1/ For additional information see N.D. Experiment Station Bulletin No. 479, "Determining Least Cost Machinery Combinations," and Extension Circular No. A-524, "Small Grain Plowing and Tillage Costs."

Table 2 gives the normal time period in which harvest of small grains occurs for the nine regions of North Dakota. It also indicates the expected number of days that harvesting can be done.

TABLE 2. OPTIMUM AND ACTUAL HARVESTING PERIODS IN NORTH DAKOTA (BY DISTRICT)

District	Optimum harvesting period	Actual harvesting period ^a
Northwest	August 1 - September 25: 55 days	43 days
North-Central	August 1 - September 25: 55 days	43 days
Northeast	August 1 - September 25: 55 days	42 days
West-Central	July 25 - September 10: 45 days	36 days
Central	July 25 - September 10: 45 days	36 days
East-Central	July 25 - September 10: 45 days	35 days
Southwest	July 25 - September 5: 40 days	33 days
South-Central	July 25 - September 5: 40 days	32 days
Southeast	July 25 - September 5: 40 days	32 days

Average = 37 days

^aThe actual harvesting period was determined by omitting the unfavorable days from the optimum harvesting period. In the fall, the unfavorable days are those during which rainfall prevents field work. It was assumed that precipitation of .10 of an inch would prevent combining and swathing for one day. Precipitation of .50 of an inch would prevent combining and swathing for two days. More precipitation caused a still longer delay.

SOURCE: *North Dakota Weather-Crop Bulletin, 1950-1965, Agricultural Statistics No. 14, Department of Agricultural Economics, North Dakota State University, Fargo, North Dakota, November, 1965.*

U.S. Weather Bureau, Fargo, North Dakota.

The data included in Tables 1 and 2 regarding actual time available are averages. If one organizes his machinery-labor-acreage combination based upon the average time available, 50 per cent of the time he will not be able to complete the operation in such a manner to assure himself maximum timeliness of operation and may have yield reduction and loss of profits.

TABLE 3. PROBABILITY OF THE SPECIFIED MINIMUM PLANTING PERIOD OCCURRING (BY DISTRICTS)

District	Less Than				
	15 days	20 days	25 days	30 days	35 days
	(per cent)				
Northwest	0	5	10	15	55
North-Central	0	5	10	15	55
Northeast	0	5	10	20	60
West-Central	0	5	15	20	40
Central	0	5	15	20	35
East-Central	0	5	20	30	40
Southwest	5	10	25	40	50
South-Central	5	5	10	25	60
Southeast	0	5	20	35	50

Source: U.S. Weather Bureau, Fargo, North Dakota.

TABLE 4. PROBABILITY OF THE SPECIFIED MINIMUM HARVESTING PERIOD OCCURRING (BY DISTRICTS)

District	Less Than				
	15 days	20 days	25 days	30 days	35 days
	(per cent)				
Northwest	0	0	0	0	10
North-Central	0	0	0	0	10
Northeast	0	0	0	0	10
West-Central	0	0	0	5	25
Central	0	0	0	5	30
East-Central	0	0	0	10	35
Southwest	0	0	0	15	60
South-Central	0	0	5	25	70
Southeast	0	0	5	20	80

Source: U.S. Weather Bureau, Fargo, North Dakota.

Tables 3 and 4 give the probabilities of actual planting and harvesting periods occurring.

The figures given in the tables are the percentage probabilities of planting (Table 3) or harvesting (Table 4) days available from 15 to 35 days occurring. For example if you are located in the East-Central Region, the probability that the planting period will be 25 days or less is 20. This tells you that two years out of 10 you have 25 days or less in which to perform spring tillage and planting operations.

The use of this information is illustrated in the following example. A farmer in central North Dakota wishes to determine the size of tractor and associated tillage and planting equipment needed to get his crop in on time at minimum cost. From Table 1 he notes that his average planting period is 34 days. However, he wishes to be at least 95 per cent certain that he will be able to get all his crop planted by the end of May. Turning to Table 3 he notes that there is only a 5 per cent probability that less than 20 days will be available during the planting season.

Our farmer next determines the number of hours he is willing and able to do field work per day during this period. Taking account of meals and care of livestock he figures 10 hours per day times the 20 days, for a total 200 hours available.

To find the field capacity needed, he divides the number of acres to be planted by the hours available as follows:

$$\frac{\text{Acres to be planted}}{\text{Hours available}} = \text{Field capacity needed}$$

$$\frac{640}{200} = 3.2 \text{ acres per hour} \\ \text{or } 1 \div 3.2 = .3125 \text{ hours/acre}$$

From Bulletin 479 the time requirements for various sized machines for the tillage and planting operations are calculated to be as follows:*

HOURS PER ACRE FOR SPRING PLANTING OPERATIONS

Tractor Size	Field Cultivator		Drag Harrow		Press Drill		Total
	size	hrs/acre	size	hrs/acre	size	hrs/acre	
4 plow	15½'	.13	35'	.05	12'	.25	.43
5 plow	16'	.12	35'	.05	14'	.21	.38
6 plow	18½'	.10	35'	.05	16'	.18	.33
7 plow	21'	.09	45'	.04	24'	.12	.25
8 plow	24'	.08	45'	.04	28'	.11	.23

Based upon this information, a 6-plow tractor and associated equipment would be the minimum size to accomplish the work in the time available.

*A rule of thumb for calculating field capacity for machinery is width (ft) x speed (MPH) /10 = acres/hour. Divide acres per hour into 1 to get hours per acre.