Potential Field Work Days During Planting and Harvesting

A-1008, March 1991
Reviewed and reprinted February 1995

John W. Enz, Climatologist
James L. Helm, Extension Agronomist
P. Chris Brenk, Research Specialist

Profitable farming operations require strict control of production costs. One approach to production cost control is purchasing enough to complete the required work in the time available. Owning excess machinery capacity is an added expense, but pla also be costly. Cost conscious farmers will choose the size of their farm machinery based on the number of acres to be cover to do the required work. Unfortunately there are large fluctuations in the number of suitable field work days from year to year.

Estimates of the number of suitable field work days for planting and harvesting operations in North Dakota are presented in th temperature criteria were used to calculate the number of suitable planting and harvesting days using climatic data from 18 N Service stations. The years 1948 through 1988 were used in the analysis. The probability of occurrence of suitable planting a from these estimates. These data, in conjunction with machinery cost and capacity data, may be used to determine the optim for a North Dakota producer or they may be used to plan for possible future expansion.

Planting and Harvesting Periods

Planting before the end of May results in a yield advantage for the major crops grown in North Dakota. A 50-day spring planti desirable planting times was chosen for each crop district based on typical climatic conditions. It consists of the period April 1 northeast (Table 1). Spring climatic conditions often delay planting in the northeast so April 11-May 30 was chosen for this re

A 45-day harvest period was chosen (Table 1), but starting dates are more variable than those for planting. The periods vary a in the various districts. Planting and harvesting periods were modified from those used in a 1969 circular (Olson et. al., 1969) conditions."

Table 1. Planting and harvesting windows for various North Dakota climatic divisions.

State Climatic Division	Planting Period (50 days)	Harvest Period (45 days)
Northwest	Apr 01-May 20	Jul 25-Sep 07
North-central	Apr 01-May 20	Jul 25-Sep 07
Northeast	Apr 11-May 30	Jul 30-Sep 12
West-central	Apr 01-May 20	Jul 25-Sep 07
Central	Apr 01-May 20	Jul 25-Sep 07
East-central	Apr 01-May 20	Jul 20-Sep 02
Southwest	Apr 01-May 20	Jul 20-Sep 02
South-central	Apr 01-May 20	Jul 20-Sep 02
Southeast	Apr 01-May 20	Jul 20-Sep 02

First Spring Work Day

The first spring work day was predicted to occur after 100 thawing degree days (TDD) had accumulated following the disappe degree days are a measure of the energy available for warming the soil and evaporating surplus water. Daily TDD values are degrees Fahrenheit from the mean daily air temperature, but only positive daily values were used to calculate the total TDD a temperature was below 32 F no thawing degree days were subtracted from the accumulated total.

However, several other criteria were necessary to predict the first work day (Table 2). If snowfall resulted in depths of 1 inch o accumulating or after 100 had already accumulated, the accumulation process started over at zero following snowmelt. Late s all locations, resulting in a loss of five to seven days during the last half of April and four to five days during the first half of Ma immediately, TDD accumulation was not affected. "

Table 2. Criteria used to estimate the first spring work day each year.

Snow Depth	TDD accumulation	Resultant Action	
> 0	and = 0	No TDD accumulated;	
= 0	and <100	Positive TDD accumulated;> 0 and > 100	TDD total reset to 0 and start over
> 0	and <100	TDD total reset to 0 and start over="0" and> 100	TDD accumulation stops; First or
		subsequent work day(s)	

Unfortunately, snow depth information is missing in the climatic records at many stations. To compensate for the missing sno was begun on several selected April dates. This model, ignoring snow depth, was run using Fargo and Williston climatic data obtained for the same stations based on snow depth and TDD criteria listed in Table 2. Results indicated that the use of snov day more accurately in most years, so stations were chosen for analysis on the basis of available snow depth data.

Based on data analysis, the average starting date for spring field work is near mid-April everywhere but northeastern North Da These dates agree quite well with data from the North Dakota Agricultural Statistics Service, which show a statewide average years 1976-1990.

Rainfall Criteria

Once the first spring work day for each year was established, rainfall criteria listed in Table 3 were used to identify subsequer planting season. Rainfall criteria were also established to identify unsuitable harvesting days (Table 3).

Table 3. Rainfall criteria used to determine unsuitable work days.

Planting		Harvest	
Daily Rainfall (inch)	Number planting days lost	Daily Rainfall (inch)	Number harvest days lost
0.00 - 0.10	0	0.00 - 0.05	0
0.10 - 0.49	1	0.06 - 0.19	1
0.50 - 0.99	2	0.20 - 0.49	2
> 1.00	3	0.50 - 0.99	3
		> 1.00	4

Climatic Data

A model using rainfall and snowdepth criteria from Tables 2 and 3 was developed to determine the number of planting and h data. The model was run using data from 1948-1988 for National Weather Service stations listed in Table 4. This period was c year snow depth data are generally available on computerized data sets. To test the adequacy of this 41-year period the mod beginning in 1900. Results from this 89-year period were nearly identical to those from the 41-year record. The years 1948-19 represent the entire period of record for these stations.

Table 4. Climatic stations used in the analysis.

Ashley	Fargo	New England
Bismarck	Grand Forks	Oakes

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Bottineau       Hettinger       Stanley
Crosby          Jamestown       Wahpeton
Devils Lake     Langdon         Watford City
Dickinson       Minot           Williston
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See the "North Dakota Agricultural Weather Network" (NDAWN) for current and historic weather information.

Available Planting Days

The number of suitable planting days in North Dakota averages 25, but ranges from 19 to 29 across the state. However, it is e district and from year to year, ranging from as few as five to seven to as many as 45 days at various locations. Probabilities ar variable numbers more meaningful. For example, a 90 percent probability of occurrence means that, over a long period of tim occurrences will be equalled or exceeded in 90 percent of the years. Similarly, a 50 percent probability means that a specifiec exceeded in 50 percent of the years, but in the other 50 percent of the years it will be less than the specified number.

Numbers of planting days with a 50 percent probability increase from 20 in the northeast to 27 and 28 in the south and northv are two isolated areas, located in southwestern and southeastern North Dakota, with 24 or fewer available planting days out c

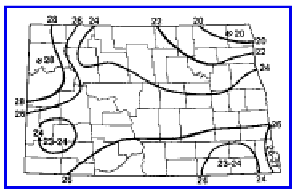

Figure 1. Number of planting days available in 50 percent of the years.

For long range planning 90 percent probability levels are recommended. The cost of additional or la worse case scenario is far greater than yield reductions associated with late planting. Since the wors five planting days it is probably impractical to be completely prepared. Data in Figure 2 give the num equalled or exceeded in 90 percent of the years across the state. Another interpretation of the 90 pe there will be at least the indicated number of field work days available in nine out of every 10 years.

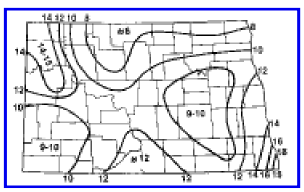

Figure 2. Number of planting days available in 90 percent of the years.

At least eight to 10 work days are available in 90 percent of the years over an area encompassing r northwest and southeast (Figure 2). In the northwest the number of days increases very rapidly fro from this area were used in the analysis to more accurately identify the rapid changes. Surprisingly similar to the northeast district with fewer than 10 planting days occurring in one out of 10 years. Th May snowfalls in the region. This anomaly disappears rapidly as the probability level is reduced to 5 of planting days increases rapidly from 12 to 18 in the southeast. This is due to consistently earlier spring snowmelt and grou generally comes earlier in this region and producers are able to get in the fields earlier.

Harvesting Days

Numbers of suitable harvesting days depend on rainfall amounts and associated weather conditions. Rainfall criteria used in results represented conditions during the recent wet harvests of 1985, 86, and 87. Reported research (Bauer and Black, 1983 rain will completely wet a typical small grain windrow. Thus, rainfall of 0.20 inches or more was assumed to cause a two-day c 0.05 inches was assumed to cause little loss of harvesting time, but this depends entirely on the associated weather conditior

The number of suitable harvesting days at the 50 percent probability level ranges from 28 to 32 over most of the state (Figure in the northwest indicating the generally drier conditions in that region during July and August.

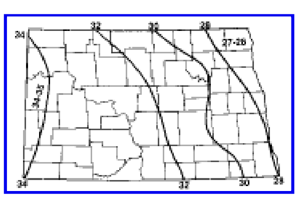

Figure 3. Number of harvesting days available in 50 percent of the years.

Ninety percent of the time there are at least 14 days available in the northeast, increasing to 24 in th northwest (Figure 4). This trend reflects decreasing rainfall amounts from east to west across the st are adequate harvesting days available in most years.

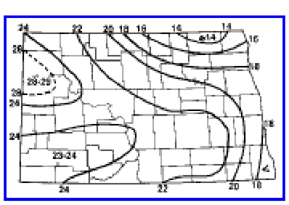

Figure 4. Number of harvesting days available in 90 percent of the yea

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Summary

Estimates of the number of suitable field work days available for planting a and 90 percent of the years are provided in Figures 1-4. This information, combined with the number of acres to be covered, t machinery capacity data, allows estimation of the size and number of pieces of equipment necessary to complete the requirec purchasing replacement equipment, adding equipment, or selling excess equipment will be aided with these calculations.

In addition, farmers who are planning to expand their operations either by purchasing or renting additional land may use thes and labor requirements for the new operation. This will enable them to anticipate the true costs related to expansion. Helmer 90 percent probability level total machinery cost per acre in Nebraska declines as farm size increases to 2000 acres. They als completion probabilities to 80 percent tends to increase the optimum farm size to about 3000 acres, but data were inconsister

Information on machinery capacity, operational costs, and performance will be provided in subsequent circulars. Examples of scenarios will be included.

References

Bauer, A. and A.L. Black. 1983. Rain-induced harvest losses in swathed and standing wheat. North Dakota Agricultural Exper September, 11 pp.

Helmer, G.A. and R. Monji. 1984. Weather risk and size economies of large machinery in wheat production. Nebraska Agricul Bulletin 306, Sept., 24 pp.

Olson, C.E., R.G. Johnson, B.B. Rice, and D.H. Eidsvig. 1969. Weather and profitable machinery size. North Dakota Coopera A-534, August, 2 pp.

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