Probability of
WET OR DRY DAYS
In North Dakota

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Depending upon what activity is planned, a "dry" day is not necessarily defined as one without precipitation. For some farming operations precipitation totaling 0.10 might not be critical; but more than 0.10 inch of rain would, in effect, create a "wet" day for these operations.

Thus, various levels of precipitation can be established and a day when these levels are not exceeded can be termed "dry." By the same reasoning, a "wet" day occurs only when certain precipitation levels are reached.

It is now possible to assess the probability of dry or wet weather continuing for any number of successive days. This has been made possible by examining and summarizing some of the long-term climatic records of North Dakota.

In 1965 more than 50 years of Weather Bureau precipitation records were summarized in NCR Research Publication 161, Probabilities of Sequences of Wet and Dry Days in North Dakota.[1] The study based on weather observations made by volunteer Environmental Science Services Administration (ESSA) — U.S. Weather Bureau cooperative weather observers at 10 North Dakota locations (Figure 1), provides wet and dry day probabilities under four "wet and dry day" definitions.

In the referenced publication and in this summarization, the critical levels selected to define a "wet" day are totals of at least 0.01, 0.10, 0.20 and 0.50 inches of rain in 24 hours.

The probability of "wet" or "dry" days for specified periods is given in the NCR publication cited. Rainfall probabilitiy can be applied to any day during the period. Table 1 is an example of those in the NCR publication. It contains a similar table for each of the 4 threshold values (0.01, 0.10, 0.20, 0.50) for each of the 10 locations shown in Figure 1.

[1]Preparation of the data in Probabilities of Sequences of Wet and Dry Days in North Dakota, NCR Research Publication 161, was supervised by Guy E. Wilkinson, former associate professor Department of Soils, N. D. State University. The publication is available from the Agricultural Information Department, NDSU, Fargo. Similar rainfall probability studies have been completed for other states in the North Central Region and Alaska, and are available through the agricultural colleges of the various states.

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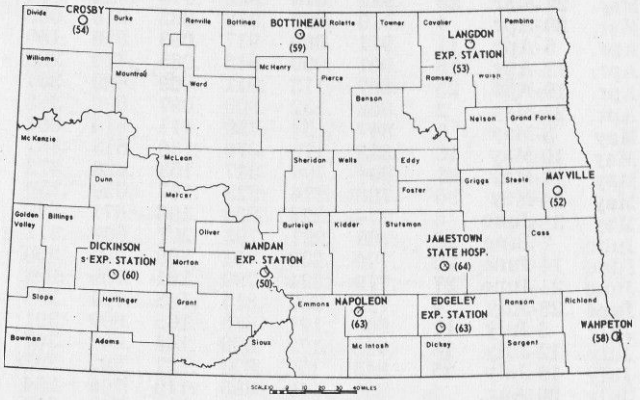

Figure 1. Location of stations in North Dakota (number indicates years of record used in determining probabilities).

The tables furnish the basic information for calculating the probability of any specified combination of "wet" and "dry" days that may be required in making long term management decisions. The most appropriate table can be selected for specific applications. For example, concrete finishing may be affected by as little as 0.01 inch of rain whereas decisions relative to hay drying may be influenced if as much as 0.10 inch occurs on any of the 3 days normally required for mowing, curing, baling or chopping.

To demonstrate the use of the probabilities, consider a haymaking operational example. The "initial" probability for a dry day on the day the hay is cut is 1.000, or 100 per cent. It is assumed the hay will not be cut unless the day is dry. In Table 1, which gives probabilities for "wet" days of at least 0.10 inch at Dickinson, only probabilities under the general heading "transition" are used. So the probability of a "dry" day immediately following the "dry" day when the hay was cut is obtained from the dry/dry column.

The chance of a "dry" day following a "dry" day in the week of June 14-20 is .791 or 79.1 per cent — about 8 times in 10. If the second day is "dry," then the chance for a third "dry" day is the same as for the second day (79.1 per cent).

Since the first day is assumed to be dry or no cutting would be done, the probability of 3 consecutive "dry" days with rainfall of less than 0.10

Table 1. Probability that a given day at Dickinson, N. Dak. will be wet or dry. (Wet day = at least .10 inches)

Period of			Initial		Transition			
			Dry	Wet	Dry/Dry	Wet/Dry	Dry/Wet	Wet/Wet
Mar.	1-Mar.	7	.933	.067	.944	.056	.780	.220
Mar.	8-Mar.	14	.928	.072	.936	.064	.825	.175
Mar.	15-Mar.	21	.925	.075	.928	.072	.888	.112
Mar.	22-Mar.	28	.922	.078	.922	.078	.922	.078
Mar.	29-Apr.	4	.918	.082	.918	.082	.918	.082
Apr.	5-Apr.	11	.911	.089	.917	.083	.850	.150
Apr.	12-Apr.	18	.901	.099	.915	.085	.774	.226
Apr.	19-Apr.	25	.887	.113	.911	.089	.699	.301
Apr.	26-May	2	.868	.132	.903	.097	.638	.362
May	3-May	9	.847	.153	.889	.111	.614	.386
May	10-May	16	.825	.175	.870	.130	.613	.387
May	17-May	23	.804	.196	.847	.153	.628	.372
May	24-May	30	.786	.214	.823	.177	.650	.350
May	31-June	6	.774	.226	.804	.196	.671	.329
June	7-June	13	.769	.231	.793	.207	.689	.311
June	14-June	20	.770	.230	.791	.209	.700	.300
June	21-June	27	.779	.221	.799	.201	.709	.291
June	28-July	4	.792	.208	.815	.185	.704	.296
July	5-July	11	.809	.191	.835	.165	.699	.301
July	12-July	18	.828	.172	.856	.144	.693	.307
July	19-July	25	.845	.155	.873	.127	.692	.308
July	26-Aug.	1	.860	.140	.885	.115	.706	.294
Aug.	2-Aug	8	.872	.128	.891	.109	.743	.257
Aug.	9-Aug.	15	.879	.121	.893	.107	.777	.223
Aug	16-Aug.	22	.883	.117	.893	.107	.808	.192
Aug.	23-Aug.	29	.885	.115	.894	.106	.816	.184
Aug.	30-Sep.	5	.887	.113	.897	.103	.809	.191
Sep.	6-Sep.	12	.889	.111	.903	.097	.777	.223
Sep.	13-Sep.	19	.892	.108	.911	.089	.735	.265
Sep.	20-Sep.	26	.898	.102	.920	.080	.704	.296
Sep.	27-Oct.	3	.906	.094	.929	.071	.684	.316
Oct.	4-Oct.	10	.914	.086	.935	.065	.691	.309
Oct.	11-Oct.	17	.924	.076	.939	.061	.742	.258
Oct.	18Oct.	24	.933	.067	.940	.060	.836	.164
Oct.	25-Oct.	31	.940	.060	.941	.059	.924	.076
Nov.	1-Nov.	7	.945	.055	.945	.055	.945	.055
Nov.	8-Nov.	14	.948	.052	.948	.052	.948	.052
Nov.	15-Nov.	21	.949	.051	.951	.049	.912	.088
Nov.	22-Nov.	28	.950	.050	.957	.043	.817	.183
Nov.	29-Dec.	5	.951	.049	.963	.037	.718	.282
Dec.	6-Dec.	12	.952	.048	.968	.032	.635	.365
Dec.	13-Dec.	19	.954	.046	.970	.030	.622	.378
Dec.	20-Dec.	26	.956	.044	.969	.031	.674	.326
Dec.	27-Jan.	2	.959	.041	.966	.034	.795	.205
Jan.	3-Jan.	9	.961	.039	.962	.038	.936	.064
Jan.	10-Jan	16	.963	.037	.963	.037	.963	.037
Jan.	17-Jan.	23	.962	.038	.962	.038	.962	.038
Jan.	24-Jan.	30	.960	.040	.960	.040	.960	.040
Jan.	31-Feb.	6	.955	.045	.958	.042	.891	.109
Feb.	7-Feb.	13	.950	.050	.958	.042	.798	.202
Feb.	14-Feb.	20	.944	.056	.957	.043	.725	.275
Feb.	21-Feb.	27	.938	.062	.952	.048	.726	.274

inch per day is 1.00 x .791 x .791 = .626 or 62.6 per cent. Thus in southwestern North Dakota a farmer cutting hay on a "dry" day in mid-June can expect no interference from rain in about 3 of 5 years.

From a planning standpoint, a farmer looking at the week of June 14-20 for haymaking would be interested in at least 3 and probably 4 consecutive "dry" days (less than 0.10 inch per day). The probability of 3 such days is 62.6 per cent, while for 4 days it would be 1.00 x .791 x.791 x .791 = .495 or 49.5 per cent. With this kind of probability a farmer might decide to use hay conditioning equipment to reduce haying time, or some management practice such as fertilizing to hasten grass growth so haying could be done earlier.

Similar probabilities were derived for other North Dakota locations for the period of June 14-20 (Figures 2, 3, 4 and 5). As shown in Figure 3, the probabilities of "favorable haying weather" for this week are highest in northwestern North Dakota and lowest in southeastern North Dakota.

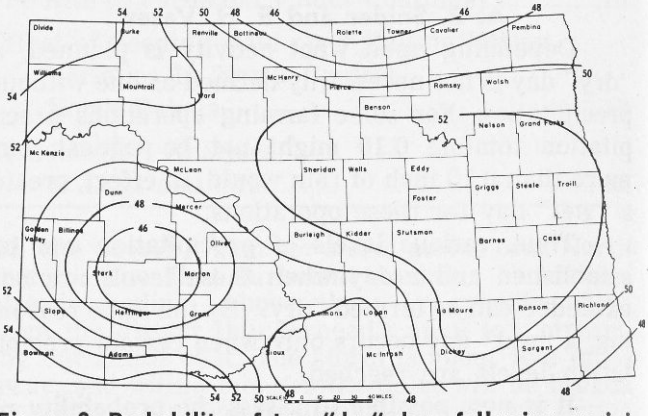

Figure 2. Probability of two "dry" days following an initial "dry" day (precipitation less than 0.01 inch) during week of June 14-20.

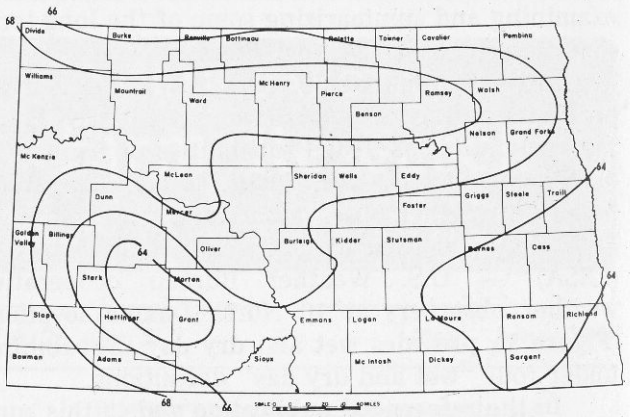

Figure 3. Probability of two "dry" days following an initial "dry" day (precipitation less than 0.10 inch) during week of June 14-20.

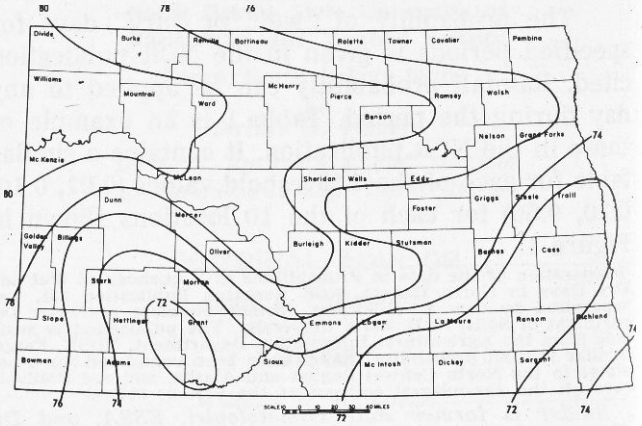

Figure 4. Probability of two "dry" days following an initial "dry" day (precipitation less than 0.20 inch) during week of June 14-20.

If a farmer reduces his haying to a 2 day period by using hay conditioning equipment (crimper or crusher) or a hay dryer, the probability of 2 "dry" days 0.10 inch or less per day) would be 1.00 x .791 = .791 or 79 per cent. Thus the chance of getting rain on hay is reduced to about 1 year in 5 if the haying period is 2 days. If the 0.01 inch definition is used to identify haying weather, the probability of 2 "dry" days following a "dry" cutting day drops to 46 per cent in southwestern North Dakota during June 14-20. Thus, about 1 out of every 2 years a farmer can expect to have at least 0.01 inch of rain fall on his cut hay.

This same method of calculating the probability of receiving 0.01, 0.10, 0.20 or 0.50 inch of rainfall in 24 hours can also be done for one or more than one day periods during tillage, seedbed preparation, seeding, spraying or harvest operations.

Figure 6 shows an example of such a calculation for Dickinson. We see that mid-June is one of the wettest periods of the year at this location. It indicates that the probability for 3 consecutive "dry" days (less than 0.10 inch per day) increases from mid-June until it reaches a maximum in December. The same type of calculation could be made for other locations and be used by farmers to assist in planning operations such as those mentioned.

It is not necessary to know that the first day is dry. One can determine from the publication the "initial" day probability for any period. Someone at Dickinson, planning dates for a rodeo, could determine that the "initial" day probability in the week of June 14-20 is 77 per cent versus 79.2 per cent for June 28-July 4 by looking at the "dry" column under "initial" in the table dealing with 0.10 inch of precipitation. The probability of 3 consecutive "dry" days (less than 0.10 inch rain per day) during these periods could also be worked out. For June 14-20 it is 77 per cent (initial) x 79.1 per cent (dry/dry) x 79.1 per cent (dry/dry) equals 48.2 per cent. For June 28-July 4 the probability of 3 consecutive "dry" days is 52.6 per cent.

A grower of sugar beets and potatoes at Mayville could make use of the wet/wet column to check on the probability of 2 "wet" days (at least 0.10 inch of rain per day) stopping his potato digging or sugar beet lifting operations. This column shows the probability of two such "wet" days increasing from about 16 per cent in early September to about 32 per cent in late October. Probabilities of this type certainly indicate the grower faces a higher possibility of precipitation the later he performs these operations at Mayville. Freezing temperatures could also combine with the precipitation, which is more likely to occur in late October and further add to his harvesting problems.

Slowly, but surely, the old adage that everyone talks about the weather but no one does anything about it is being changed as we gain more knowledge about our climate and soil moisture relationships.

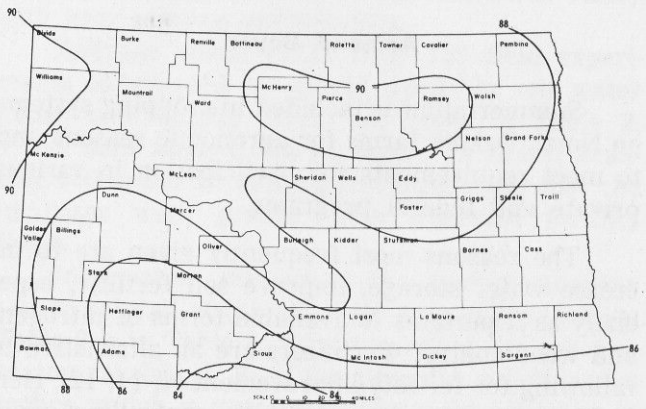

Figure 5. Probability of two "dry" days following an initial "dry" day (precipitation less than 0.50 inch) during week of June 14-20.