FREQUENCY, MAGNITUDE AND TIMING OF LARGE STORM EVENTS ON SEDIMENT AND NUTRIENT LOSS

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Numerous climatic studies have shown that weather patterns are changing in Wisconsin and other Midwestern States. Precipitation events are becoming more extreme in both volume and intensity and are occurring with larger variation on a state and regional basis. The timing and magnitude of these more extreme events plays a vital role in the potential for sediment and nutrient loss from agricultural land.

To assess the magnitude of a precipitation event, Depth-Duration-Frequency (DDF) charts are commonly used to evaluate rainfall depths (inches of rain) for different durations (e.g., 30 min, 1 h, 24 h). These values are then compared to statistical frequency of similar sized events to determine a ranking of a storm. A common example is the 25-year/24-hour event that is used as a design criteria in technical standards for sizing best management practices to be effective to a given storm size. An example in northeast Wisconsin is the value of 5.29 inches of precipitation received in a 24 hour period. This is the 25-year/24-hour storm event that should statistically occur once every 25 years.

Edge-of-field runoff data was collected on five Discovery Farms throughout Wisconsin and compared to the local DDF values for each precipitation event that occurred during the non-frozen ground period. On the five Discovery Farms locations, 59 site-years of data were evaluated that comprised a variety of farming systems and practices in different regions of the state. The magnitude of each non-frozen ground precipitation event was calculated and was assessed to determine if an edge-of-field runoff event occurred. Of the 2,400 total non-frozen rain events that occurred on the five farms, only 246 (or 10%) of the rain events resulted in edge-of-field runoff. Individual farm values ranged between 8 and 14%. During the 7-year evaluation period, with some farms only collecting data during a portion of this period, four 10-year events, two 25-year events, and one 100-year events were observed.

Table 1. Non-frozen ground precipitation and runoff from five Wisconsin farms and median depth and duration of precipitation events resulting in runoff.

				Median storm producing runoff	
	Farm years	Rain events	Runoff events	Depth (in)	Duration (hr)
Farm 1	**5.5**	471	44	0.61	4.16
Farm 2	**4.3**	399	40	0.75	4.67
Farm 3	**3.3**	308	27	1.03	3.86
Farm 4	**6.3**	639	52	1.07	2.94
Farm 5	**7.5**	583	83	0.90	2.90
% runoff			**10%**		

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In addition to observing that the largest precipitation events typically did not result in the largest runoff events, it was also observed that the largest runoff events often did not correspond with the largest sediment or nutrient loss. Taking into account both frozen and non-frozen ground runoff events, a single runoff event was observed to account for the majority of sediment or nutrient loss for the year. Many of the high sediment loss events occurred during the spring of the year, once the ground was thawed; whereas high phosphorus and nitrogen loss events occurred on both frozen ground and spring runoff events.

Table 2. Occurrence of non-frozen ground precipitation events of a given magnitude based on regional Depth-Duration-Frequency values on five Wisconsin farms.

	Farm Years	**<1 yr**	**1 yr**	**2 yr**	**5 yr**	**10 yr**	**25 yr**	**100 yr**
Farm 1	**5.5**	36	1	4	1	1	0	1
Farm 2	**4.3**	37	1	0	1	1	0	0
Farm 3	**3.3**	22	3	2	0	0	0	0
Farm 4	**6.3**	39	9	2	0	1	1	0
Farm 5	**7.5**	71	6	2	2	1	1	0
Total	**27**	205	20	10	4	4	2	1

References

Hershfield, D.M. 1961. Rainfall Frequency Atlas of the United States. U.S. Department of Commerce, Weather Bureau Technical Paper 40, 115 p.

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