

Influence of rainfall amount, rainfall timing, organic matter, and soil pH on sulfentrazone dry pea injury and yield (2004)

At Minot, sulfentrazone was applied at 3 oz/A immediately after direct seeding dry peas into a sandy loam soil. Select was applied to minimize competition from grassy weeds. Herbicide treatments were applied with a tractor-mounted sprayer.

Water was applied to simulate various rainfall amounts and timing. Water was sprayed over 1-square meter plots with a tractor sprayer to simulate 0.25, 0.5, and 1.0 inch rainfall. The desired precipitation amount was achieved by repeated passes with a boom equipped with XR8015 nozzles. The simulated rain was applied on three separate dates: 1 d after seeding, early emergence (cracking), and postemergence (1- to 2-inch peas). Treatments were arranged in a randomized complete block design with four replications. Each treatment was evaluated visually for crop tolerance in July. Yield was determined by hand-harvesting the entire square meter plot.

This study was conducted on a sandy loam soil. Soil characteristics varied widely from plot to plot, especially soil pH. Dry pea injury appeared to be distinctly correlated to soil pH and somewhat less correlated to soil organic matter (OM). There was little correlation with rainfall amount or timing. If rainfall had an effect on injury, it was likely masked by the effects of soil pH and OM. We evaluated dry pea injury in three ways: 1) Injury based on the degree to which plants exhibited sulfentrazone injury symptoms, 2) Growth reduction, and 3) Stand reduction. We evaluated this way since plants in some plots were mostly healthy, but still had some stand reduction or growth reduction. Other plots had plants that showed severe injury symptoms that are characteristic of sulfentrazone injury in addition to growth reduction and stand reduction.

Correlation analysis showed an r factor of 0.89 when comparing soil pH and sulfentrazone injury symptoms (Table 1). As soil pH increased, crop injury also increased. An r factor of 1.0 would indicate perfect correlation; that is, as one factor increases, the other factor also increases. As expected, OM was negatively correlated with sulfentrazone injury symptoms ($r=-0.57$). As OM decreases, we expect more crop injury. Stand reduction was slightly correlated with soil pH ($r=0.34$) and OM (-0.21). Table 2 shows the layout for the entire research plot with the soil pH and corresponding sulfentrazone injury rating. Yield was negatively correlated with soil pH and positively correlated with OM.

Table 1. Correlation analysis (r) for soil factors and dry pea injury.

	Sulfentrazone injury ^a	Growth reduction	Stand reduction	Yield
Soil pH	0.89	0.75	0.34	-0.55
Organic matter	-0.57	-0.63	-0.21	0.62

^a Peas evaluated based on degree to which plants exhibited sulfentrazone injury symptoms.

Plot number

401	402	403	404	405	406	407	408	409	410	
301		302	303	304	305	306	307	308	309	310
201	202	203	204	205	206	207	208	209	210	
101		102	103	104	105	106	107	108	109	110

Soil pH in each plot

8.1	8	.08	.08	.08.1	8	.0	6.4	5.8	5.4	5.6
4.9	5.6	5.8	7.5	8	.07.9	7.2	6.1	5.8	5.2	
5	.05.1	4.8	5.2	7.7	7.3	5	.04.7	4.7	4.8	
5	.05.3	4.8	4.7	4.8	4.7	4.7	4.7	4.9	4.8	

Dry pea injury rating (based on degree to which plants showed sulfentrazone injury symptoms)

8.5	6	.0	9	.08	.07	.0	8	.02.5	3.5	1.5	1	.0
1	.03	.04	.09	.0	6.5	8	.07.5	3	.00	.0	0.5	
1.5	3	.03	.02.5	5	.03.5	1	.02	.02	.01.5			
0	.01.5	2	.01.5	1.5	1	.0	1.5	1.5	1.5	1	.0	

Table 3 shows data from all four replications since treatment means are essentially meaningless due to wide soil variability from plot to plot. These data agree with previous studies that have shown that crop injury may be higher in high pH and low organic matter soils. This study also showed that crop injury may not always occur in low organic matter soils. Dry pea injury tended to be lower when soil pH was low (4.7-6.1) even though there was low organic matter (<2.0).

Table 3. Influence of rainfall amount, rainfall timing, organic matter, and soil pH on sulfentrazone injury to dry pea.

Rainfall treatment^a

Plot	Stand reduction		Growth reduction		Injury ^b	Organic matter		Soil pH	Pea yield	
				%	%	0-10	%		lb/A	
0.25-inch rainfall	101	0	0	0.0	1.4	5.0	3440			
1-day after planting	205		20		42	5.0	1.6	7.7	2520	
	308		20		35	3.0	1.5	6.1	2780	
	405		30		65	7.0	1.2	8.1	1350	
Mean =			18	36	3.8	1.4	6.7		2520	
0.5-inch rainfall	102	15	15	1.5	1.5	5.3	2690			
1-day after planting	206	20	30	3.5	1.6	7.3	2740			
	309	0	0		0.0	1.6	5.8	4090		
	406	25		75	8.0	1.2	8.0	1660		
Mean =					15	30	3.3	1.5	6.6	2790
1.0-inch rainfall 1900	103	15		22		2.0		1.5	4.8	
1-day after planting	207	15	3	1.0	1.7	5.0	2890			
	310		10	10	0.5	1.7	5.2	3430		
	407		30	40	2.5	1.3	6.4	1870		
Mean =			18	19	1.5	1.5	5.4	2520		
0.25-inch rainfall 2340		104		55		15	1.5	1.7	4.7	
Early emergence	208	20	38	2.0	1.5	4.7	1950			
	301	25	40	1.0	1.4	4.9	2270			
	408	25	68	3.5	1.4	5.8	1850			
Mean =			31	40	2.0	1.5	5.0	2100		

0.5-inch rainfall		105	50	45		1.5	1.7	4.8	1750		
Early emergence	209		15	30	2.0	1.7		4.7	2780		
		302	20	45	3.0	1.4	5.6		2050		
		409	20	25	1.5	1.5	5.4		3420		
			Mean =	26	36	2.0	1.6	5.1	2500		
1.0-inch rainfall		106		25		20	1.0	1.8	4.7	2290	
Cracking to 1"	210	20	20	1.5	1.8	4.8			2940		
		303		60	50	4.0	1.4	5.8		1470	
		410	20		15	1.0	1.7	5.6	3440		
					Mean =	31	26	1.9	1.7	5.2	2530
0.25-inch rainfall		107		20		30	1.5	1.7	4.7		2380
1-2" peas	201	20	25	1.5	1.4	5.0			2160		
		304		35		85	9.0	1.4	7.5	1240	
		402	30	60	6.0	1.6	8.0		1910		
					Mean =		26	50	4.5		1.5
6.3	1920										
0.5-inch rainfall	108	15	25		1.5	1.7	4.7		2610		
1-2" peas	202	25	50	3.0	1.3	5.1			1510		
		305	35	75	6.5	1.4	8.0		1210		
		403	40	90	9.0	1.4	8.0		530		
			Mean =	29	60	5.0	1.4	6.5	1470		
1.0-inch rainfall		109	30	15	1.5	1.8	4.9		3160		
1-2" peas	203	20	65	3.0	1.4	4.8			1430		
		306	35	80	8.0	1.4	7.9		1200		
		404	30	80	8.0	1.3	8.0		730		
			Mean =	29	60	5.1	1.5	6.4	1630		

No rainfall 110	18	18		1.0	1.6	4.8	2940
	204	38	35	2.5	1.5	5.2	1820
	307	40	85	7.5	1.4	7.2	1490
	401	55	85	8.5	1.4	8.1	910
Mean =	38	56	4.9	1.5	6.3	1790	

^a Sulfentrazone was applied preemergence at 3 oz/A the same day as planting

^b Peas evaluated based on degree of sulfentrazone injury symptoms (0=no injury, 10=dead).