CERRILLOS

Site Description and Monitoring Activities

The roadside location was identified and set-up in partnership with the New Mexico Department of Transportation (NMDOT). The DOT1 site is located near mile marker 33 on Highway 14, north of Cerrillos, NM. The DOT2 site is located approximately 1.5 miles north on Highway 14, near the junction with Highway 42. Composted wood mulch was installed along the Highway 14 in 2006 following a road construction project. The area surrounding the sites is piñon-juniper woodland but the disturbance of the sites due to the road construction and the seeding and mulching treatments make roadside locations unique.

Due to the increasing use of wood mulch for post-construction erosion mitigation and revegetation, information from the DOT locations has potentially far-reaching implications. Four soil moisture probes, four soil temperature probes, and a rain gauge were installed within the NMDOT right-of-way in May, 2007 in the pattern described previously (Figure 1). Equipment positions were finalized in July 2007. Vegetation was measured in early November, 2007 using a square meter quadrat placed randomly within untreated and mulched areas (Figure 2). Vegetation measurements included percent cover and frequency data.

Figure 1. DOT employee assisting with sensor installation

Figure 2. Vegetation quadrat

Monitoring Results

Graphical summaries of data from the DOT1 and DOT2 data loggers are presented in Figures 3-10.

Readings from the temperature sensors under mulch at DOT1 and DOT2 indicate that significant thermal insulation was provided by the mulch cover. During the fall and winter from October to early March, the temperature under the mulch was generally higher. Once temperatures warmed up around the end of March, the temperature under the mulch was consistently lower and less variable. In spring 2008 (Figure 6), the temperature differences between the mulch and the control sensors at DOT1 became more pronounced as the weather warmed. The temperature under the mulch was significantly cooler and less variable. As indicated in the data summary table for Figure 6, during that quarter the maximum temperature for the mulched sensor was 107.9^{o}F versus a maximum of 143°F measured by the control sensor.

The soil moisture sensors attached to the DOT2 data logger showed patterns that would be expected based on other monitoring sites and published literature. The soil moisture was consistently higher and more persistent under the mulch than the adjacent control sensor (Figure 7-10). The difference between the mulch and control sensors was somewhat moderated by the fact that the control sensors at that location received afternoon shade while the control sensors did not. In terms of revegetation, the control soil moisture was frequently below 5-10% which is within the range of the permanent wilting point for many soil texture classes. Because the soil texture was not evaluated at this site the permanent wilting point cannot be determined exactly but overall, the bare soil areas showed values that indicate a moisture-limited environment.

Soil moisture measurements at the DOT1 data logger did not show expected results. The soil moisture sensor under the mulch showed wide flucuations while the control sensor was more stable. There were some differences in microtopography but they do not explain the large flucuations. The mulch sensor was on a slight south aspect relative to the control sensor due to the areas of mulch application. The minimum and maximum soil moisture values do not correspond with expected periods during each day. The erratic pattern of the mulch sensor readings indicate that there may be a problem with the soil moisture sensor such as poor soil contact. One of the challenges of placing the sensors close to the soil surface at this site was due to the method of mulch application during the treatment. According to DOT protocol, the wood mulch was applied with pressure and mixed with the surface soil. As a result there is no distinct line between the soil and mulch interface. Care was taken to ensure that no wood remained in contact with the sensor but it is possible that soil contact may not be optimal. The sensor should be repositioned and evaluated.

Vegetation measurements were intended to determine whether 70% cover had been achieved in the treated areas. Percent cover between treated and adjacent untreated areas were almost equal, indicating exceedance of the 70% goal. The average cover within treated areas was 26% versus 27% in untreated, bare soil quadrats.

Overall, the precipitation data was helpful in assessing the localized weather conditions at the site. Particularly monsoonal storms can be very limited in geographic extent and weather data from nearby stations in Santa Fe may not adequately reflect weather patterns at the site. However, two periods of precipitation data should be disregarded. From March 29 to 31, 2008 and from April 16 to 27, 2008, there are large precipitation events recorded by the equipment that did not actually occur. These events were not recorded by other regional weather stations and were not reflected in soil moisture response. This unknown equipment malfunction should be kept in mind for future anomalous data.

Conclusions

A mulch depth of less than an inch at DOT2 significantly changed soil moisture and temperature patterns. Soil moisture was generally higher under the mulch and the mulch provided insulation from extreme temperatures. The effects of the 2 inch mulch depth at DOT1 are less clear due to possible sensor malfunctions.

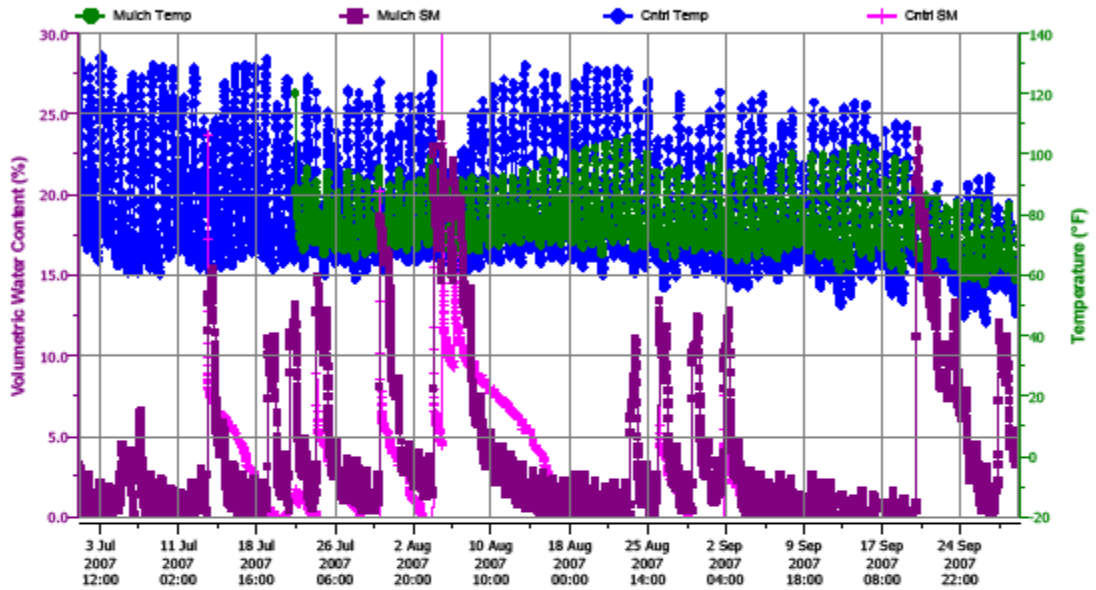
Despite several intense rainstorms during summer 2007 (Figure 11), the mulch stayed in place and did not show rilling or erosional features. In contrast, adjacent bare soil areas were significantly impacted by the intense storms. The mulch encouraged revegetation and treated areas were equal in cover to untreated areas.

Figure 3. DOT1 Data Logger, Summer 2007

DOT1

Farm: NMRC **Field:** None

Start: 7/1/2007 12:00:00 **Stop:** 9/30/2007 12:00:00



	P1	P2	P3	P4
	°F	%	°F	%
Avg:	75.91	3.75	81.01	-0.25
Min:	56.7	-1.6	44.3	-6.5
Max:	120.1	24.3	132.8	46
Total:	----	----	----	----
Events:	----	----	----	----

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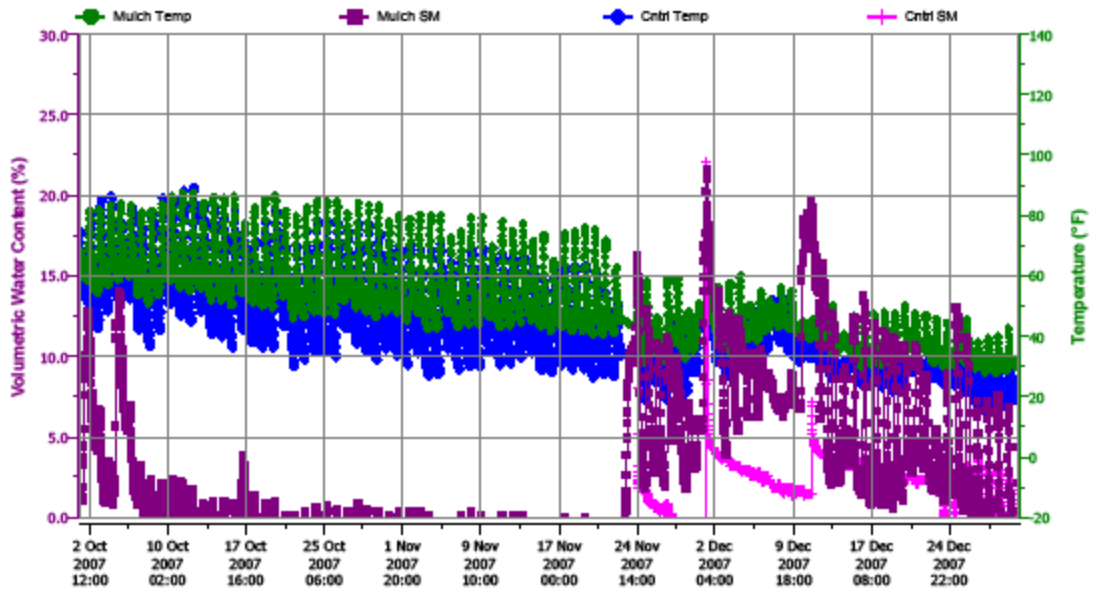
Figure 4. DOT1 Data Logger, Fall 2007

DOT1

Farm: NMRC **Field:** None

Start: 10/1/2007 12:00:00 **Stop:** 12/31/2007 12:00:00



	P1	P2	P3	P4
	°F	%	°F	%
Avg:	50.15	2.45	41.87	-3.23
Min:	27.6	-2.8	14.9	-7.8
Max:	87.5	21.5	89.1	22
Total:	----	----	----	----
Events:	----	----	----	----

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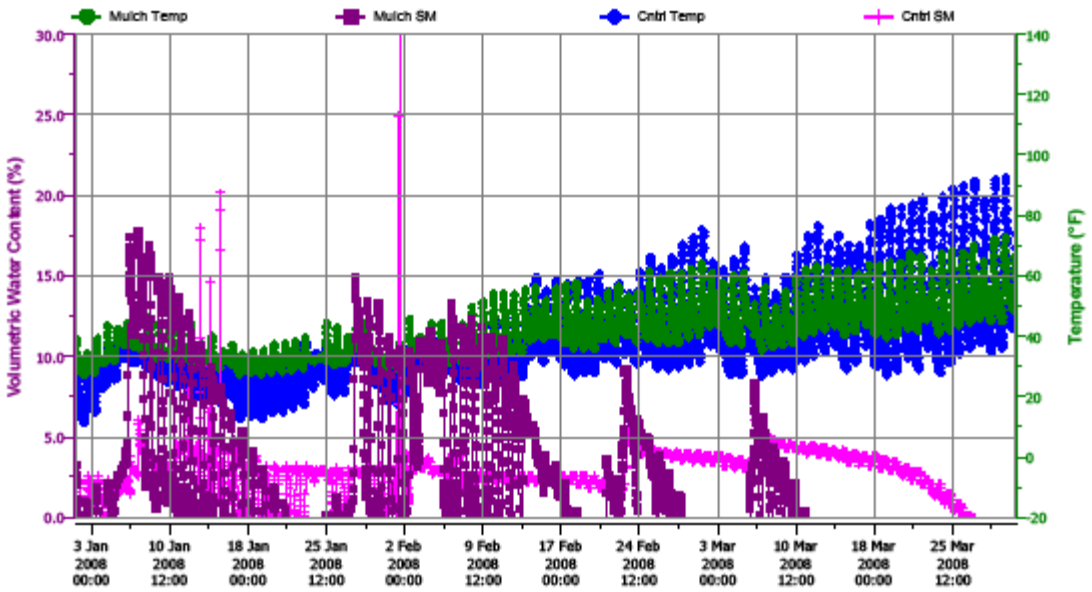
Figure 5. DOT1 Data Logger, Winter 2008

DOT1

Farm: NMRC **Field:** None

Start: 1/1/2008 12:00:00 **Stop:** 3/31/2008 12:00:00



	P1	P2	P3	P4
	°F	%	°F	%
Avg:	40.99	0.05	36.86	2.65
Min:	26.8	-8	11.3	-1.9
Max:	72.7	17.8	92.2	59.4
Total:	----	----	----	----
Events:	----	----	----	----

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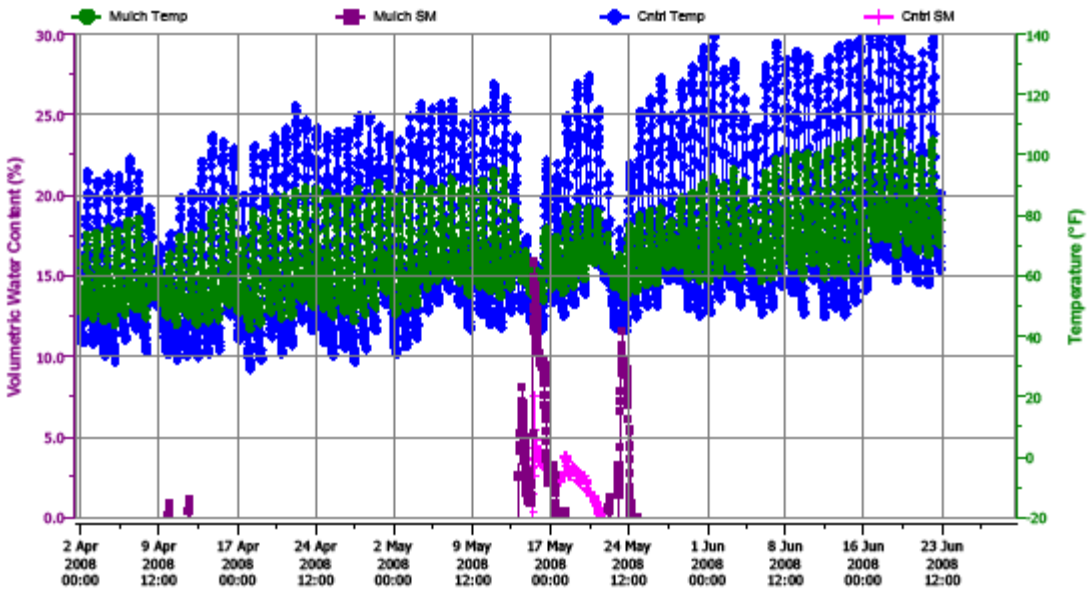
Figure 6. DOT1 Data Logger, Spring 2008

DOT1

Farm: NMRC **Field:** None

Start: 4/1/2008 12:00:00 **Stop:** 6/30/2008 12:00:00



	P1	P2	P3	P4
	°F	%	°F	%
Avg:	65.79	-5.59	72.13	-4.34
Min:	42.3	-8.4	29	-7.5
Max:	107.9	15.8	143	7.6
Total:	----	----	----	----
Events:	----	----	----	----

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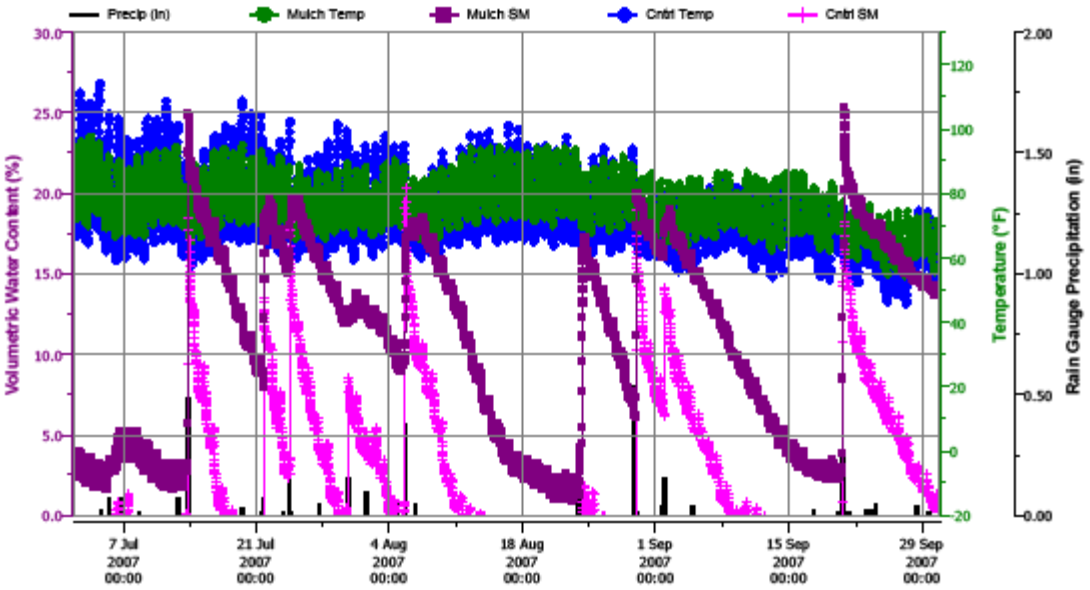
DOT2

Figure 7. DOT2 Data Logger, Summer 2007

Farm: My Farm **Field:** None

Start: 7/1/2007 7:00:00 **Stop:** 9/30/2007 7:00:00



	P1	P2	P3	P4	P5
	in	°F	%	°F	%
Avg:	—	76.15	10.74	74.22	2.15
Min:	—	54	0.9	45.8	-3.5
Max:	—	97.3	25.3	114.1	20.4
Total:	5.2	—	—	—	—
Events:	84	—	—	—	—

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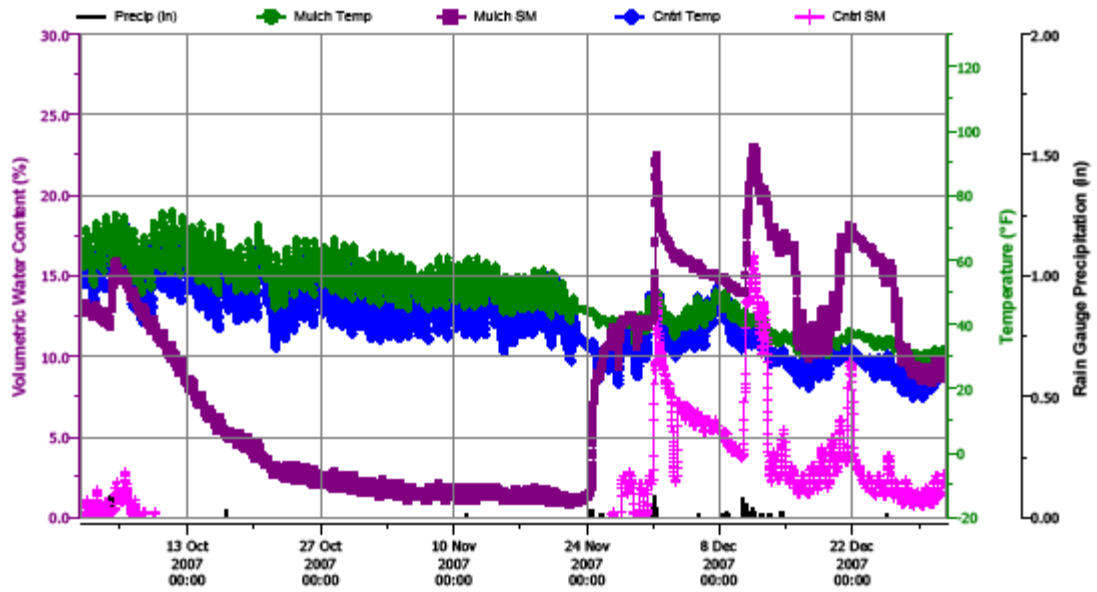
Figure 8. DOT2 Data Logger, Fall 2007

DOT2

Farm: My Farm **Field:** None

Start: 10/1/2007 7:00:00 **Stop:** 12/31/2007 7:00:00



	P1	P2	P3	P4	P5
	in	°F	%	°F	%
Avg:	—	47.78	8.39	41.38	0.34
Min:	—	26.9	0.7	16.9	-3.4
Max:	—	74.5	23	70.6	16.2
Total:	1.84	—	—	—	—
Events:	91	—	—	—	—

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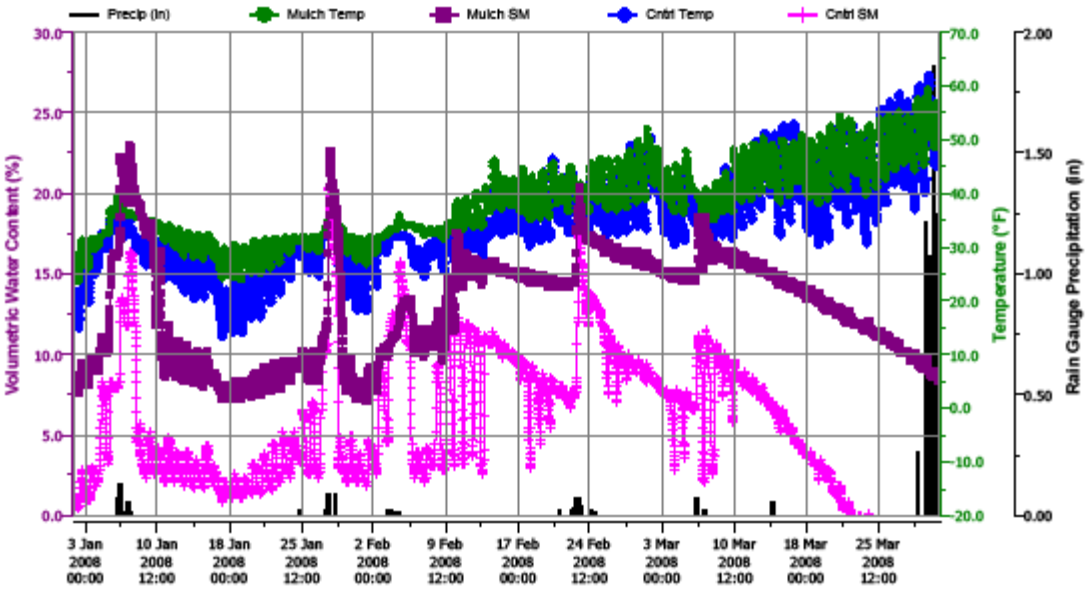
DOT2

Farm: My Farm Field: None

Figure 9. DOT2 Data Logger, Winter 2008

Start: 1/1/2008 7:00:00 Stop: 3/31/2008 7:00:00



	P1	P2	P3	P4	P5
	in	°F	%	°F	%
Avg:	—	37.78	12.81	34.24	5.56
Min:	—	23.6	7.1	13.2	-2.9
Max:	—	59.3	23	62	20.3
Total:	18.12	—	—	—	—
Events:	128	—	—	—	—

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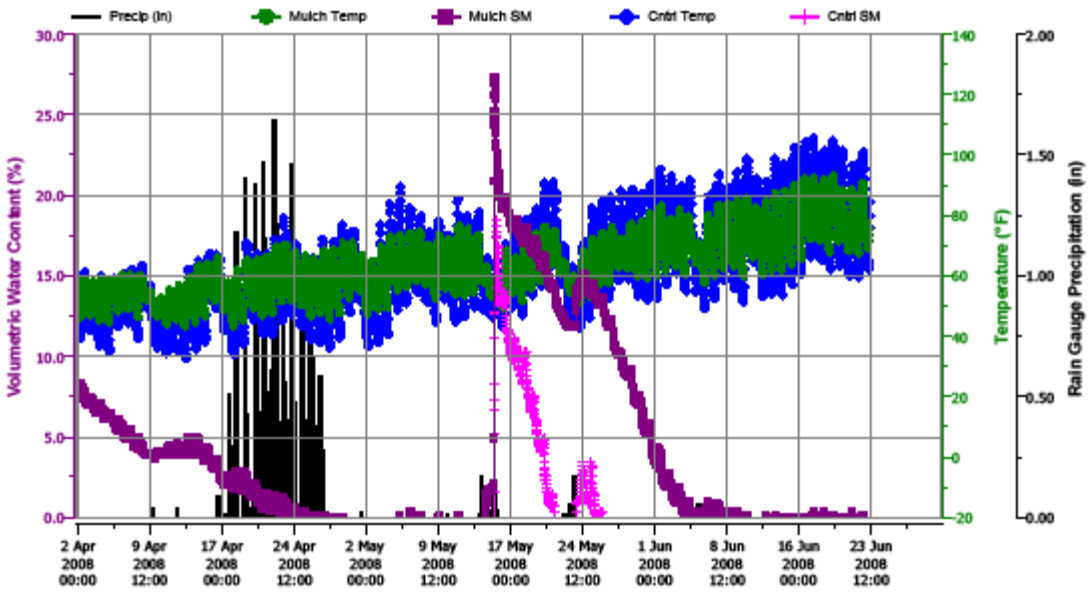
Figure 10. DOT2 Data Logger, Spring 2008

DOT2

Farm: My Farm **Field:** None

Start: 4/1/2008 7:00:00 **Stop:** 6/30/2008 7:00:00



	P1	P2	P3	P4	P5
	in	°F	%	°F	%
Avg:	—	62.97	3.58	62.92	-2.83
Min:	—	43	-1.5	32.8	-5.9
Max:	—	93.2	27.3	105.7	18.5
Total:	67.5	—	—	—	—
Events:	241	—	—	—	—

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Figure 11. Close-up of DOT2 Data showing soil moisture responses to precipitation