2012 WEATHER REPORT

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Introduction

Air temperature and precipitation have been recorded daily at the Malheur Experiment Station since July 20, 1942. Installation of additional equipment in 1948 allowed for evaporation and wind measurements. A soil thermometer at 4-inch depth was added in 1967. Since 1962, the Malheur Experiment Station has participated in the Cooperative Weather Station system of the National Weather Service. The daily readings from the station are reported to the National Weather Service forecast office in Boise, Idaho.

A biophenometer, to monitor degree days, and pyranometers, to monitor total solar and photosynthetically active radiation, were added in 1985. Starting in June 1997, the daily weather data and the monthly weather summaries have been posted on the Malheur Experiment Station web site at <www.cropinfo.net>.

On June 1, 1992, in cooperation with the U.S. Department of the Interior, Bureau of Reclamation, a fully automated weather station, linked by satellite to the Northwest Cooperative Agricultural Weather Network (AgriMet) computer in Boise, Idaho, began transmitting data from Malheur Experiment Station. The automated Agrimet station continually monitors air temperature, relative humidity, dew point temperature, precipitation, wind run, wind speed, wind direction, solar radiation, and soil temperature at 8-inch and 20-inch depths. Data are transmitted via satellite to a computer in Boise every 4 hours and are used to calculate daily Malheur County crop water-use estimates. The AgriMet database can be accessed at www.usbr.gov/pn/agrimet and from links on the Malheur Experiment Station web page at www.cropinfo.net.

Materials and Methods

The ground under and around the weather stations was bare until October 17, 1997, when it was covered with turfgrass. The grass is irrigated with subsurface drip irrigation. The manually observed weather data are recorded each day at 8:00 a.m. Consequently, the data in the tables of daily observations refer to the previous 24 hours.

Evaporation is measured from April through October as inches of water evaporated from a standard class A pan (10 inches deep by 4-ft diameter) over 24 hours. Evapotranspiration (ET_c) for each crop is calculated by the AgriMet computer using data from the AgriMet weather station and the Kimberly-Penman equation (Wright 1982). Agrimet calculates reference evapotranspiration (ET_0) for a theoretical 12- to 20-inch-tall crop of alfalfa assuming full cover for the whole season. Evapotranspiration for all crops is calculated using ET_0 and crop coefficients for each crop. These crop coefficients vary throughout the growing season based on the plant growth stage (crop cover). The crop coefficients are tied to the plant growth stage by three dates: start, full cover, and termination dates. Start dates are the beginning of vegetative growth in the spring for perennial crops or the emergence date for row crops. Full cover dates

are typically when plants reach full foliage. Termination dates are defined by harvest, frost, or dormancy. Alfalfa mean ET_c is calculated for an alfalfa crop using ET_0 and assuming a 15 percent reduction to account for cuttings.

Wind run is measured as total wind movement in miles over 24 hours at 24 inches above the ground. Weather data averages in the tables, except evapotranspiration, refer to the years preceding and up to, but not including, the current year.

2012 Weather

The total precipitation for 2012 (9.1 inches) was lower than the 10-year (10.7 inches) and 68-year (10.2 inches) averages (Table 1). Total snowfall for 2012 (4.0 inches) was lower than the 10-year average (13.8 inches) and the 68-year average (17.9 inches) (Table 2).

The highest air temperature for 2012 was 102°F on July 10, 12, and 13 (Table 3). The lowest temperature for the year was 4°F on December 28.

The total number of accumulated growing degree-days (50 to 86°F) in 2012 was 5 percent higher than the 26-year average (Table 4, Fig. 1). April, July, August, and September had a higher number of growing degree-days than the 26-year average (Table 4). The total number of degree-days in the above-optimal range (86 to 104°F) in July and August was higher than the 22-year average (Table 5).

Total wind runs for all months, except April, September, and October were higher than the 10-year and 64-year averages (Table 6). Total pan evaporation for 2012 was close to the 10-year average and higher than the 64-year average (Table 7). In 2012, total accumulated reference evapotranspiration and ET_c estimated values for all crops except winter grain were higher than the 20-year averages (Table 8).

The average monthly maximum and minimum 4-inch soil temperatures for all months were close to the 10-year average (Table 9).

The last spring frost (≤32°F) occurred on April 29, the same as the 36-year-average date of April 29; the first fall frost occurred on October 4, 3 days earlier than the 36-year-average date of October 7 (Table 10).

No local weather records were broken in 2012 (Table 11).

References

Wright, J.L. 1982. New evapotranspiration crop coefficients. Journal of Irrigation and Drainage Division, American Society of Civil Engineers 108:57-74.

Table 1. Monthly precipitation at the Malheur Experiment Station, Oregon State University, Ontario, OR, 1991-2012.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
	---------- inches ----------												
1990										0.49	0.69	0.29	
1991	0.59	0.44	0.88	0.81	1.89	1.09	0.01	0.04	0.35	1.01	1.71	0.43	9.25
1992	0.58	1.36	0.25	0.74	0.21	1.43	0.36	0.01	0.09	0.95	1.15	1.51	8.64
1993	2.35	1.02	2.41	2.55	0.70	1.55	0.18	0.50	0.00	0.80	0.64	0.60	13.30
1994	1.20	0.57	0.05	1.02	1.62	0.07	0.19	0.00	0.15	1.23	2.46	1.49	10.05
1995	2.67	0.28	1.58	1.16	1.41	1.60	1.10	0.13	0.07	0.57	0.88	2.56	14.01
1996	0.97	0.86	1.03	1.19	2.39	0.12	0.32	0.31	0.59	0.97	1.18	2.76	12.69
1997	2.13	0.17	0.25	0.66	0.67	0.86	1.40	0.28	0.40	0.43	1.02	0.94	9.21
1998	2.26	1.45	0.95	1.43	4.55	0.36	1.06	0.00	1.00	0.04	1.07	1.11	15.28
1999	1.64	2.50	0.59	0.23	0.28	1.02	0.00	0.09	0.00	0.40	0.49	0.73	7.97
2000	2.01	2.14	0.97	0.72	0.28	0.26	0.03	0.06	0.39	1.74	0.38	0.66	9.64
2001	1.15	0.41	1.11	0.70	0.37	0.64	0.32	0.00	0.10	0.68	1.33	1.00	7.81
2002	0.77	0.27	0.49	0.77	0.09	0.60	0.14	0.10	0.36	0.29	0.44	1.86	6.18
2003	1.46	0.48	0.99	1.12	1.52	0.24	0.36	0.11	0.15	0.02	0.86	1.47	8.78
2004	1.82	1.54	0.25	0.98	1.70	0.43	0.13	0.64	0.56	2.03	0.93	0.97	11.98
2005	0.41	0.12	1.66	0.80	2.94	1.02	0.22	0.06	0.14	1.38	1.58	3.92	14.25
2006	1.91	0.67	3.33	2.00	0.62	0.45	0.00	0.08	0.55	0.28	1.14	1.76	12.79
2007	0.07	0.95	0.12	0.82	0.47	0.63	0.03	0.15	0.92	0.68	1.07	1.56	7.47
2008	0.50	0.43	0.79	0.14	0.74	0.27	0.43	0.03	1.26	0.44	1.12	1.47	7.62
2009	0.65	0.43	0.86	0.13	1.47	2.27	0.09	1.39	0.02	1.24	0.63	1.82	11.00
2010	2.13	1.19	0.59	1.21	1.18	1.95	0.02	0.86	0.19	1.16	1.09	4.19	15.76
2011	1.05	0.42	2.97	0.44	2.61	0.81	0.19	0.02	0.08	1.59	0.57	0.45	11.20
2012	1.65	0.49	1.36	1.03	0.77	0.45	0.00	0.04	0.10	0.83	1.13	1.25	9.10
10-yr avg.	1.08	0.65	1.21	0.84	1.33	0.87	0.16	0.34	0.42	0.91	0.94	1.95	10.70
69-yr avg.	1.27	0.93	0.98	0.78	1.09	0.83	0.22	0.35	0.44	0.75	1.14	1.37	10.15

Table 2. Annual snowfall totals (inches) at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2001-2012.

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	10-yr avg.	69-yr avg.
15.5	11.5	4.5	24.0	13.5	12.3	3.8	26.0	13.8	28.0	1.0	4.0	13.8	17.9

Table 3. Maximum and minimum air temperatures by month, Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Month		Highest	Lowest	2012 avg.	10-yr avg.	68-yr avg.
		---------- °F ----------				
Jan	Max	54	34	42	36	35
	Min	39	14	25	24	20
Feb	Max	57	35	47	44	43
	Min	35	19	27	26	25
Mar	Max	69	42	56	56	55
	Min	43	22	33	33	31
Apr	Max	89	50	67	63	64
	Min	55	23	39	38	37
May	Max	90	54	72	73	74
	Min	54	33	45	46	45
Jun	Max	94	54	80	82	82
	Min	60	37	49	53	52
Jul	Max	102	85	95	94	92
	Min	70	48	61	60	58
Aug	Max	101	82	95	90	90
	Min	66	47	57	56	56
Sep	Max	93	69	83	81	80
	Min	57	37	46	47	46
Oct	Max	86	41	64	66	65
	Min	51	24	34	39	37
Nov	Max	66	35	50	49	48
	Min	43	16	30	29	28
Dec	Max	60	25	42	40	37
	Min	42	4	24	24	22

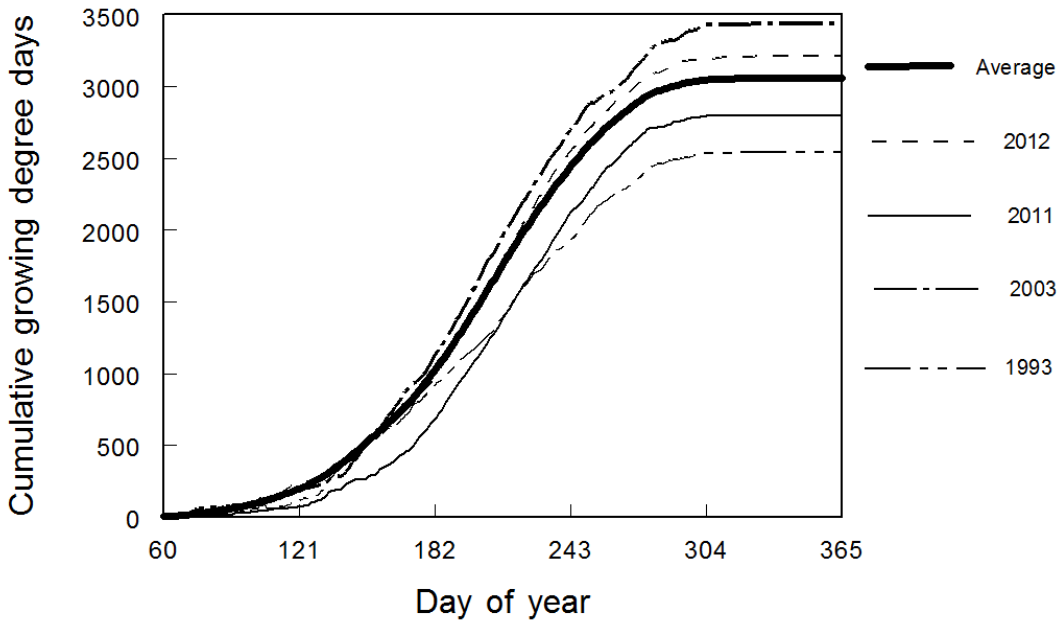

Figure 1. Cumulative growing degree-days (50-86°F) over time for years with lowest (1993) and highest (2003) totals since 1990, compared to 2011, 2012, and to the 22-year average (1990-2011), Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Table 4. Monthly total growing degree-days (50-86°F), Malheur Experiment Station, Oregon State University, Ontario, OR, 1986-2012.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	total
1986	0	16	85	119	338	639	650	796	296	158	14	0	3111
1987	0	0	43	275	423	547	641	649	486	223	29	2	3318
1988	0	5	51	180	318	585	911	691	376	309	20	0	3446
1989	0	0	13	184	272	549	733	581	389	117	14	0	2852
1990	2	7	79	239	261	497	734	635	585	38	0	0	3077
1991	0	13	16	124	212	389	776	718	436	194	1	0	2879
1992	0	13	106	202	482	574	639	704	385	174	4	0	3283
1993	0	0	23	81	423	358	464	524	408	252	6	0	2539
1994	0	2	92	189	369	523	794	774	509	144	2	0	3398
1995	0	29	32	106	293	433	680	588	472	101	3	10	2747
1996	0	5	53	135	243	446	805	658	364	194	18	2	2923
1997	4	0	81	117	419	509	661	706	481	157	20	0	3154
1998	0	2	52	112	68	571	802	749	515	151	16	4	3042
1999	0	2	43	72	329	459	683	703	416	184	30	0	2921
2000	0	4	36	194	342	536	751	743	368	133	2	0	3109
2001	0	0	63	126	401	488	715	761	472	155	27	0	3208
2002	0	2	32	137	319	562	805	621	437	142	14	2	3073
2003	0	4	72	112	319	594	846	754	448	281	11	2	3443
2004	0	0	115	187	311	607	776	680	365	180	4	0	3225
2005	0	7	59	126	286	419	749	733	383	133	4	0	2899
2006	0	4	22	131	364	599	866	668	394	151	31	0	3230
2007	0	7	99	146	405	551	871	682	398	115	20	0	3294
2008	0	0	13	86	333	504	774	700	387	144	16	2	2959
2009	0	2	27	144	369	486	758	670	535	72	13	0	3074
2010	0	0	45	104	191	439	716	632	423	205	25	0	2780
2011	0	4	11	56	202	400	697	760	508	158	4	2	2800
2012	0	4	52	178	283	463	823	767	463	155	25	4	3216
Avg. 1986 to 2011	0	5	52	142	319	510	742	688	432	164	13	1	3069

Table 5. Monthly total degree-days in the above-ideal (86-104°F) range, Malheur Experiment Station, Oregon State University, Ontario, OR, 1990-2012.

Year	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
1990	0	0	13	56	41	14	0	124
1991	0	0	2	41	36	4	0	83
1992	0	5	20	23	54	2	0	104
1993	0	4	4	2	11	5	0	26
1994	0	2	16	68	54	7	0	147
1995	0	0	4	23	22	7	0	56
1996	0	0	5	54	32	4	0	95
1997	0	4	0	27	31	5	0	67
1998	0	0	0	63	45	14	0	122
1999	0	1	2	21	16	1	0	41
2000	0	0	7	41	43	4	0	95
2001	0	5	7	25	45	4	0	86
2002	0	0	14	54	11	5	0	85
2003	0	5	9	74	36	5	0	130
2004	0	0	18	43	31	2	0	94
2005	0	0	4	43	36	4	0	86
2006	0	5	13	81	23	5	0	128
2007	0	0	14	79	29	5	0	128
2008	0	4	9	41	31	0	0	85
2009	0	4	5	41	32	11	0	94
2010	0	0	2	32	25	0	0	59
2011	0	0	4	20	38	11	0	73
2012	0	0	4	58	47	4	0	112
Mean (1990-2011)	0	2	8	43	33	5	0	91

Table 6. Daily and monthly wind-run, Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Daily	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	---------- miles/day ----------											
Mean	63	73	109	72	72	68	59	55	40	40	45	70
Max.	196	210	239	229	186	134	110	104	131	158	179	396
Min.	16	15	24	28	21	17	28	21	8	12	3	6
Monthly total	---------- miles/month ----------											
2012	1942	2118	3372	2150	2244	2045	1842	1696	1188	1228	1349	2155
64-yr average				2192	1966	1606	1498	1342	1256	1311		
10-yr average	1354	1536	2339	2431	2126	1800	1589	1400	1222	1426	1349	1430

Table 7. Daily and monthly pan-evaporation, Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Totals	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Daily		---------- inches/day ----------						
Mean	0.20	0.27	0.33	0.41	0.37	0.22	0.12	
Max.	0.45	0.56	0.50	0.57	0.52	0.46	0.32	
Min.	0.02	0.09	0.10	0.25	0.22	0.05	0.00	
Monthly		---------- inches/month ----------						
2012	6.14	8.29	9.96	12.61	11.35	6.74	3.71	58.80
10-yr avg.	6.26	8.53	10.07	12.48	10.27	7.06	4.17	58.84
64-yr avg.	5.69	7.82	9.07	11.33	9.72	6.41	3.37	53.41

Table 8. Total accumulated reference evapotranspiration (ET_0) and estimated crop evapotranspiration (ET_c) (acre-inches/acre), Malheur Experiment Station, Oregon State University, Ontario, OR, 1992-2012.

										Poplar		
Year	ET_o	Alfalfa (mean)	Winter grain	Spring grain	Sugar beet	Onion	Potato	Dry bean	Field corn	Yr. 1	Yr. 2	Yr. 3 +
1992	53.7	44.4	26.9	27.9	36.1	30.3	28.8	21.3	29.8			
1993	51.9	36.4	21.3	22.7	29.3	24.1	22.8	17.9	23.7			
1994	57.6	40.6	21.3	22.6	34.5	29.5	28.2	21.1	27.7			
1995	49.6	37.1	18.9	22.2	29.0	26.7	23.6	16.7	23.7			
1996	52.8	39.8	22.3	24.1	32.9	27.2	26.3	19.5	25.7			
1997	55.2	41.5	23.8	25.3	33.4	28.0	26.6	19.7	25.1			
1998	55.0	40.7	21.3	23.9	32.4	28.2	26.2	21.0	27.9	23.9	37.1	44.0
1999	58.6	43.9	25.0	26.4	33.7	28.9	26.5	21.7	28.5	24.3	37.8	45.5
2000	58.7	45.5	26.0	25.7	38.3	32.0	29.5	24.1	30.6	24.9	38.9	47.1
2001	57.9	43.8	25.5	27.2	34.8	30.3	27.4	21.4	29.1	23.7	37.0	44.7
2002	58.8	41.7	25.9	28.7	35.2	30.4	27.7	21.9	27.8	23.6	36.7	44.4
2003	54.2	44.1	27.5	31.7	39.1	31.6	31.9	22.4	29.3	24.3	37.9	45.9
2004	52.8	43.5	27.8	30.6	34.3	30.2	27.9	22.1	28.4	23.3	36.3	44.1
2005	53.8	44.5	26.5	27.0	36.0	32.8	30.2	20.0	29.2	24.3	37.8	45.3
2006	57.7	47.9	24.4	31.4	38.5	33.8	29.4	23.9	30.3	26.3	41.0	49.3
2007	59.0	47.2	27.6	26.7	38.9	33.7	29.7	24.5	30.5	25.7	40.1	48.6
2008	58.0	46.4	28.1	30.4	36.4	32.7	30.0	24.0	30.4	23.3	36.5	44.5
2009	58.1	42.5	26.3	28.4	34.7	28.4	27.6	20.3	26.7	22.6	35.2	42.7
2010	51.5	41.9	21.0	26.8	33.4	28.9	27.7	21.1	26.7	22.2	34.5	41.4
2011	51.0	41.9	23.3	25.8	34.4	29.2	27.5	22.8	28.0	23.6	36.8	44.5
2012	57.3	45.3	23.6	27.6	36.4	31.5	31.6	24.0	31.2	25.3	39.4	47.4
Avg.												
inch	55.3	42.8	24.5	26.8	34.8	29.8	27.8	21.4	28.0	24.0	37.4	45.1
mm	1404	1086	623	680	883	758	705	543	710	610	950	1147

Table 9. Monthly soil temperature at 4-inch depth, Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Month		2012 Average	2012 Highest	2012 Lowest	10-yr avg.	45-yr avg.
		---------- °F ----------				
Jan	Max	34	37	30	33	33
	Min	33	35	28	32	32
Feb	Max	36	39	34	35	37
	Min	35	37	32	33	34
Mar	Max	42	46	36	43	49
	Min	40	45	34	40	40
Apr	Max	49	57	41	50	60
	Min	46	56	37	46	47
May	Max	57	64	50	60	71
	Min	53	59	48	55	57
Jun	Max	63	67	56	68	80
	Min	60	63	54	62	66
Jul	Max	72	74	68	75	88
	Min	68	72	65	68	73
Aug	Max	72	74	69	73	86
	Min	69	72	64	67	73
Sep	Max	64	68	61	65	75
	Min	62	67	57	61	63
Oct	Max	54	62	46	55	60
	Min	52	60	44	51	51
Nov	Max	46	51	40	43	44
	Min	45	50	39	41	39
Dec	Max	39	45	33	35	34
	Min	38	45	32	33	33

Table 10. Last and first frost (32°F) dates and number of frost-free days, Malheur Experiment Station, Oregon State University, Ontario, OR, 1976-2012.

Year	Date of last frost Spring	Date of first frost Fall	Total frost-free days
1976	23 Apr	5 Oct	165
1977	20 Apr	22 Sep	155
1978	23 Apr	14 Oct	174
1979	20 Mar	27 Oct	221
1980	13 Apr	17 Oct	187
1981	14 Apr	1 Oct	170
1982	5 May	5 Oct	153
1983	27 Apr	20 Sep	146
1984	7 May	25 Sep	141
1985	13 May	30 Sep	140
1986	23 May	12 Oct	142
1987	21 Apr	11 Oct	173
1988	2 May	30 Oct	181
1989	19 May	13 Sep	117
1990	8 May	7 Oct	152
1991	30 Apr	4 Oct	157
1992	24 Apr	14 Sep	143
1993	20 Apr	11 Oct	174
1994	15 Apr	6 Oct	174
1995	16 Apr	22 Sep	159
1996	6 May	23 Sep	140
1997	3 May	8 Oct	158
1998	18 Apr	17 Oct	182
1999	11 May	28 Sep	140
2000	12 May	24 Sep	135
2001	29 Apr	10 Oct	164
2002	8 May	12 Oct	157
2003	19 May	11 Oct	145
2004	16 Apr	24 Oct	191
2005	15 Apr	6 Oct	174
2006	19 Apr	22 Oct	186
2007	4 May	11 Oct	160
2008	2 May	13 Oct	164
2009	13 May	1 Oct	141
2010	7 May	12 Oct	158
2011	4 May	25 Oct	174
2012	29 Apr	4 Oct	158
Avg. 1976 - 2011	29 Apr	7 Oct	161

Table 11. Record weather events at the Malheur Experiment Station, Oregon State University, Ontario, OR.

Record event	Measurement	Date
---------- Since 1943 ----------		
Highest annual precipitation	16.87 inches	1983
Lowest annual precipitation	5.16 inches	1949
Highest monthly precipitation	4.55 inches	May 1998
Highest June precipitation	2.27 inches	June 2009
Highest December precipitation	4.19 inches	Dec 2010
Highest 24-hour precipitation	1.52 inches	Sep 14, 1959
Highest annual snowfall	40 inches	1955
Highest 24-hour snowfall	10 inches	Nov 30, 1975
Earliest snowfall	1 inch	Oct 25, 1970
Highest air temperature	110°F	July 22, 2003
Total days with maximum air temp. ≥100°F	17 days	1971
Lowest air temperature	-26°F	Jan 21 and 22, 1962
Total days with minimum air temp. ≤0°F	35 days	1985
---------- Since 1967 ----------		
Lowest soil temperature at 4-inch depth	12°F	Dec 24, 25, and 26, 1990
---------- Since 1986 ----------		
Most yearly growing degree-days	3,446 degree-days	1988
Fewest yearly growing degree-days	2,539 degree-days	1993
Fewest growing degree-days in March	11	2011
Fewest growing degree-days in April	56	2011
Highest reference evapotranspiration	59.0 inches	2007