SECOND YEAR RESULTS OF THE 2002-2006 DRIP IRRIGATED ALFALFA FORAGE VARIETY TRIAL

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Ontario, OR, 2003

Introduction

The purpose of this trial is to compare the productivity of alfalfa varieties in the Treasure Valley area of Malheur County, to test the hay quality of the varieties, and provide information about the adaptation of alfalfa hay production to drip irrigation. In this trial, over of 5 years, 10 proprietary varieties are being compared to 2 public check varieties. This trial was established with a portable sprinkler irrigation system and then grown with a subsurface drip-irrigation system.

Methods

The trial was established on Owyhee silt loam where winter wheat was the previous crop and alfalfa had not been grown in that field for more than 10 years. The alfalfa seed was planted on June 20, 2002, at a rate of 20 lb/acre, in plots 20 ft long by 5 ft wide, separated at their ends by 3-ft alleys, with each variety replicated five times in a randomized complete block design. Pathfinder (Nelson Irrigation Corp., Walla Walla, WA) drip tape (15 mil thick, 0.22 gal/min/100-ft flow rate, 12-inch emitter spacing) was shanked in at a depth of 12 inches on 30-inch spacing between the drip tapes. Portable mini-sprinklers (R10 Turbo Rotator, Nelson Irrigation Corp., Walla Walla, WA) were used to provide uniform irrigation for germination and seedling establishment. Full details of the establishment of this trial can be found on the internet at: www.cropinfo.net/AnnualReports/2002/B5aDripAlf02.htm.

Irrigations before first cutting were managed by manually starting and stopping the drip irrigation system based on the appearance of the soil. After the first cutting, six Watermark sensors (Irrometer Co. Inc., Riverside, CA), connected to an AM400 data logger (M.K. Hansen, East Wenatchee, WA), were installed at 12-inch depth in the center of six alfalfa plots, midway between drip tapes. Crop evapotranspiration (Et) was calculated based on data collected by an AgriMet (U.S. Bureau of Reclamation, Boise, ID) weather station located on the Malheur Experiment Station. Water applied was measured by a totalizing water meter on the inlet of the irrigation system.

The alfalfa was harvested at bud stage on May 7, June 12, July 14, August 8, and September 12, 2003. A 3-ft by 20-ft swath was cut from the center of each plot using a flail mower, and the alfalfa was weighed. Ten samples of alfalfa were hand cut from border areas of plots over the entire field on the same day just before each cutting, quickly weighed, dried in a forage drier at 140°F with forced air, and re-weighed to

determine the average alfalfa moisture content at each cutting. Yield was reported as tons per acre of alfalfa hay at 88 percent dry matter.

Samples of alfalfa from approximately 1 ft of row per plot were taken June 12, before the second cutting, to measure forage quality. The forage quality samples were dried, ground to pass a 1-mm screen, subsampled, and sent to the Oregon State University Forage Quality Lab at Klamath Falls, Oregon, where they were reground to pass a 0.5-mm screen. Near infrared spectroscopy (NIRS) was used to estimate percent crude protein, percent acid detergent fiber (ADF), and percent neutral detergent fiber (NDF). Relative feed quality (RFQ) was calculated by the formula:

$$RFQ = \{[88.9 - (ADF * 0.779)] * (120/NDF)\}/1.29$$

Quality standards based on RFQ are: Supreme, RFQ higher than 180; Premium, RFQ 150-179; Good, RFQ 149-125; Fair, RFQ 124-100, and Low, RFQ below 99. Hay with a higher RFQ requires less grain or feed concentrate to formulate the dairy ration.

Fall regrowth was mowed with a flail mower and removed from the field on November 6, 2003, to reduce soil cover and improve herbicide spray penetration and effectiveness. Alfalfa cover during winter can also promote rodent colonization of the alfalfa stand.

Results and Discussion

Three irrigations, on March 21, April 14, and April 21, applied a total of 1.5 inches of water before first cutting. Irrigation before first cutting caused the alfalfa to grow quickly and lodge before the first flower buds appeared.

Rodents chewing holes in the drip tape were a problem in this trial. During the winter, voles burrowed down to the drip tape and chewed holes that were found and repaired at the first irrigation. During the period of regrowth after the second cutting, a gopher moved into the plot area and caused extensive damage to tapes in the border plots at the bottom end of the trial. The gopher was removed and the tapes were spliced to repair the leaks.

Soil moisture was monitored at the 12-inch depth after first cutting (Fig. 1). Sensor data show that the sensors did not respond until a heavy irrigation in early June moved water into the centers of the alfalfa beds. From mid-June to early July, irrigations were not sufficient to prevent gradual drying. After the third cutting on July 14 the soil in the sensor areas became moist and remained in the –15 to –30 kPa (centibar) range for the rest of the season.

Irrigations in April did not match the AgriMet crop Et value (Fig. 2). Because of the early season deficit, the total amount of irrigation applied through the growing season never caught up with the predicted accumulated Et value. Season-long AgriMet alfalfa Et totaled 43.75 inches. The drip-irrigation system applied 31.21 inches, as calculated from the water meter measurement, or 71.4 percent of crop Et. After the second

cutting, water applications matched the Et curve. The actual irrigation water available to the alfalfa during the growing season was something less than 71.4 percent of crop Et because some water ran off the plot area when there were leaks caused by rodents.

The average second-year total hay yield was 8.15 ton/acre (Table 1). The first cutting average yield was 2.38 ton/acre, with 'Ruccus', 'Tango', 'Orestan', 'Somerset', 'Plumas', 'SX1005A', and 'SX1001A' yielding among the highest. In the second cutting 'Masterpiece', Tango, Ruccus, and SX1001A were among the highest yielding varieties. In the third cutting, Masterpiece, Ruccus, and Tango were among the highest yielding varieties. In the fourth cutting, Ruccus, 'Lahontan', Tango, and Orestan were among the highest yielding. In the fifth cutting, Ruccus, Tango, and Masterpiece were among the highest yielding varieties.

The crude protein averaged 21.7 percent in the second cutting, and ranged from 20.5 percent for Ruccus to 22.6 percent for Lahontan. Acid detergent fiber, ADF, averaged 33.4 percent. Neutral detergent fiber, NDF, averaged 39.5 percent. Relative feed value averaged 148.7, with Lahontan, SX1001A, SX1005A, and Somerset producing hay with RFQ scores higher than 151.

Total hay production in the first 2 years was highest with the varieties Ruccus, at 11.70 ton/acre, Tango, at 11.42 ton/acre, Masterpiece, at 11.14 ton/acre, and Somerset, at 10.98 ton/acre (Table 2).

Information on the disease, nematode, and insect resistance of the varieties in this trial was provided by the participating seed companies and/or the North American Alfalfa Improvement Council (Table 3). Most alfalfa varieties have some resistance to diseases and pests that could limit hay production in our area. Growers should choose varieties that have stronger resistance ratings for disease or pest problems known to be present in their fields. The yield potential of a variety should be evaluated based on performance in replicated trials at multiple sites over multiple years.

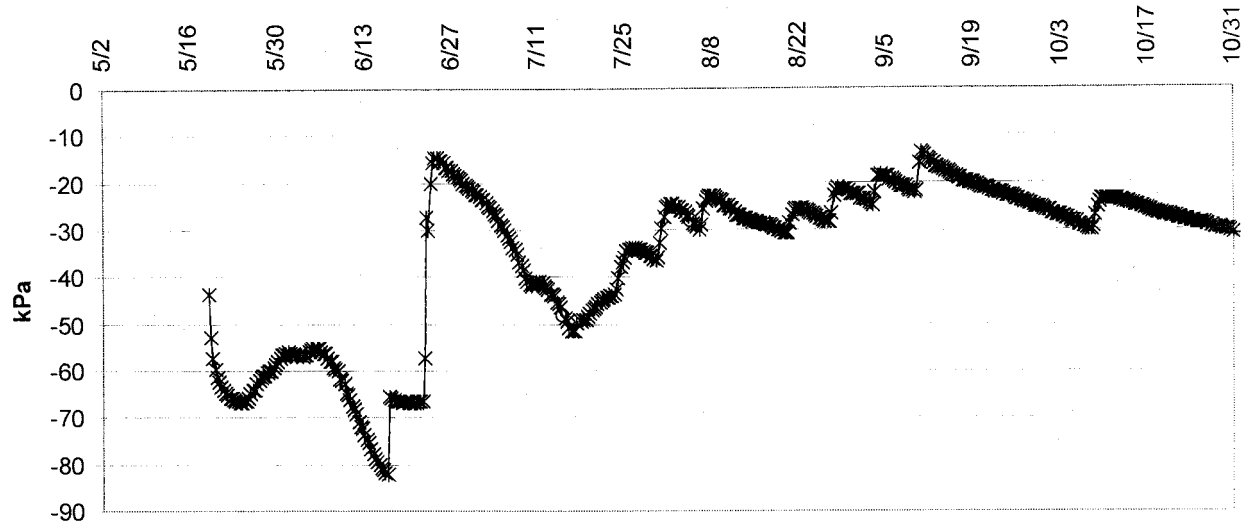

Figure 1. Soil moisture in the drip irrigated alfalfa variety trial during the 2003 growing season, Malheur Experiment Station, Oregon State University, Ontario, OR.

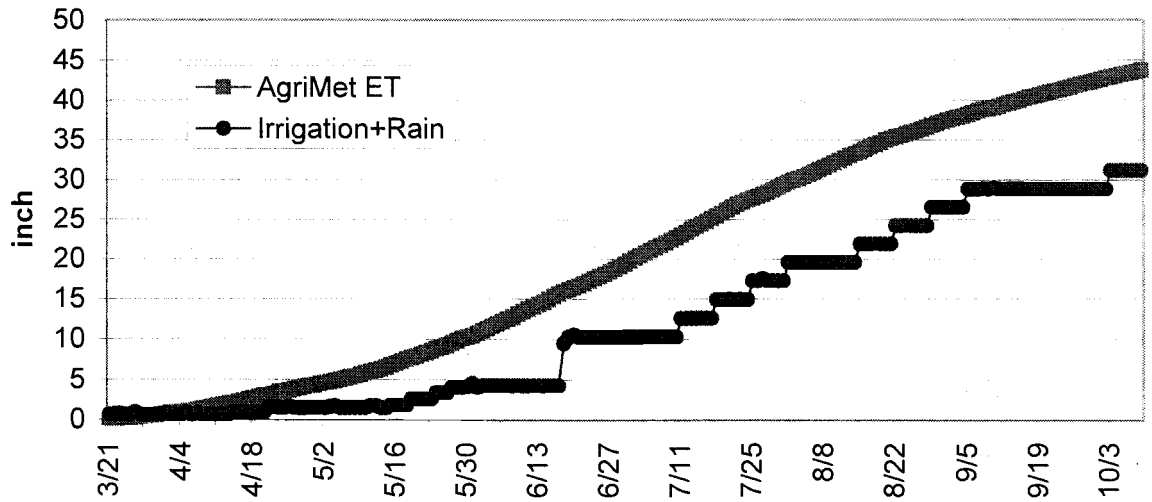

Figure 2. Irrigation applied plus rain in summer of 2003 compared to the AgriMet Et calculation for alfalfa forage, Malheur Experiment Station, Oregon State University, Ontario, OR.

Table 1. Alfalfa variety hay yields and second cutting crude protein*, ADF*, NDF*, and relative feed quality for 2003, Malheur Experiment Station, Oregon State University, Ontario, OR.

Variety	Cutting date 5/7	6/12	7/14	8/8	9/12	2003 total	Crude protein	ADF‡	NDF§	Relative feed quality
	ton/acre†						% of DW¶			RFQ
Ruccus	2.56	2.04	1.76	1.36	1.38	9.10	20.5	35.1	41.7	137.5
Tango	2.54	2.06	1.74	1.30	1.26	8.96	21.9	33.6	39.7	147.3
Masterpiece	2.38	2.12	1.80	1.18	1.24	8.72	20.9	33.5	39.6	147.6
Somerset	2.50	2.00	1.66	1.24	1.06	8.54	21.8	32.6	38.6	153.2
Orestan	2.54	1.86	1.66	1.28	1.14	8.44	21.8	33.2	39.5	148.5
Lahontan	2.24	1.84	1.66	1.32	1.18	8.14	22.6	31.9	37.8	157.6
Plumas	2.40	1.92	1.60	1.10	1.02	8.06	21.8	34.3	40.1	144.5
SX1001A	2.36	2.02	1.64	1.06	0.88	7.96	22.4	32.4	38.3	155.0
SX1005A	2.38	1.94	1.54	1.02	0.88	7.74	22.1	32.5	38.5	153.8
SX1002A	2.30	1.80	1.56	1.08	0.96	7.72	21.9	33.2	39.5	149.1
SX1004A	2.18	1.82	1.52	1.02	0.88	7.46	21.9	33.5	39.3	149.1
SX1003A	2.18	1.80	1.42	1.02	0.90	7.00	21.2	34.4	41.0	141.7
Mean	2.38	1.93	1.63	1.17	1.07	8.15	21.7	33.4	39.5	148.7
LSD (0.05)	0.21	0.14	0.11	0.11	0.14	0.54	NS	1.6	2.2	10.8

*Based on percent of dry weight. †Yield at 88 percent dry matter.
‡ ADF: acid detergent fiber. §NDF: neutral detergent fiber. ¶DW: dry weight.

Table 2. Alfalfa variety hay yields in the first and second years of the 2002-2006 drip-irrigated alfalfa variety forage trial, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Variety	2002* yield	2003 yield	Cumulative yield
	ton/acre†		
Ruccus	2.60	9.10	11.70
Tango	2.46	8.96	11.42
Masterpiece	2.42	8.72	11.14
Somerset	2.44	8.54	10.98
Plumas	2.64	8.06	10.70
Orestan	2.24	8.44	10.68
Lahontan	1.98	8.14	10.12
SX1005A	2.36	7.74	10.10
SX1001A	2.10	7.96	10.06
SX1002A	1.90	7.72	9.62
SX1004A	2.12	7.46	9.58
SX1003A	2.00	7.00	9.00
Mean	2.27	8.15	10.42
LSD (0.05)	0.4	0.54	0.79

*Two cuttings, 8/6 and 9/5/2002.
†Yield at 88 percent dry matter.

Table 3. Variety source, year of release, fall dormancy, and level of resistance to pests and diseases for 12 varieties in the 2002-2006 drip-irrigated forage variety trial, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Variety	Source	Release year	FD[†]	Pest Resistance rating[‡]									
				BW	FW	VW	PRR	AN	SAA	PA	SN	AP	RKN
Orestan	public	1934	3[§]	R	-	-	-	-	-	-	-	-	-
Lahontan	public	1954	6	MR	LR	-	LR	-	MR	LR	R	-	-
Tango	Eureka Seeds	1997	6	MR	HR	HR	HR	HR	HR	HR	MR	-	R
Plumas	Eureka Seeds	1997	4	HR	HR	R	HR	HR	R	R	HR	R	MR
Masterpiece	Simplot Agribusiness	2000	4	HR	HR	R	HR	HR	R	-	HR	R	R
Somerset	Croplan Genetics	2000	3	HR	HR	HR	HR	HR	R	-	R	HR	-
Ruccus	Target Seed	2001	5	R	HR	R	HR	MR	R	R	R	-	MR
SX1001A[††]	Seedex	-	-	-	-	-	-	-	-	-	-	-	-
SX1002A	Seedex	-	-	-	-	-	-	-	-	-	-	-	-
SX1003A	Seedex	-	-	-	-	-	-	-	-	-	-	-	-
SX1004A	Seedex	-	-	-	-	-	-	-	-	-	-	-	-
SX1005A	Seedex	-	-	-	-	-	-	-	-	-	-	-	-

[‡]Pest Resistance Rating: >50 percent = HR (high resistance), 31-50 percent = R (resistant), 15-30 percent = MR (moderate resistance), 6-14 percent = LR (low resistance).

[†]FD: fall dormancy, BW: bacterial Wilt, FW: Fusarium wilt, VW: Verticillium wilt, PRR: Phytophthora root rot, AN: Anthracnose, SAA: spotted alfalfa aphid, PA: pea aphid, SN: stem nematode, AP: Aphanomyces, RKN: root knot nematode (Northern).

[§]Fall Dormancy: 1 = Norseman, 2 = Vernal, 3 = Ranger, 4 = Saranac, 5 = DuPuits, 6 = Lahontan, 7 = Mesilla, 8 = Moapa 69, 9 = CUF 101.

[††]Experimental varieties, not released, pest resistance data not available.