TECHNICAL NOTE

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REVISION

SWITCHGRASS FOR THE INTERMOUNTAIN WEST

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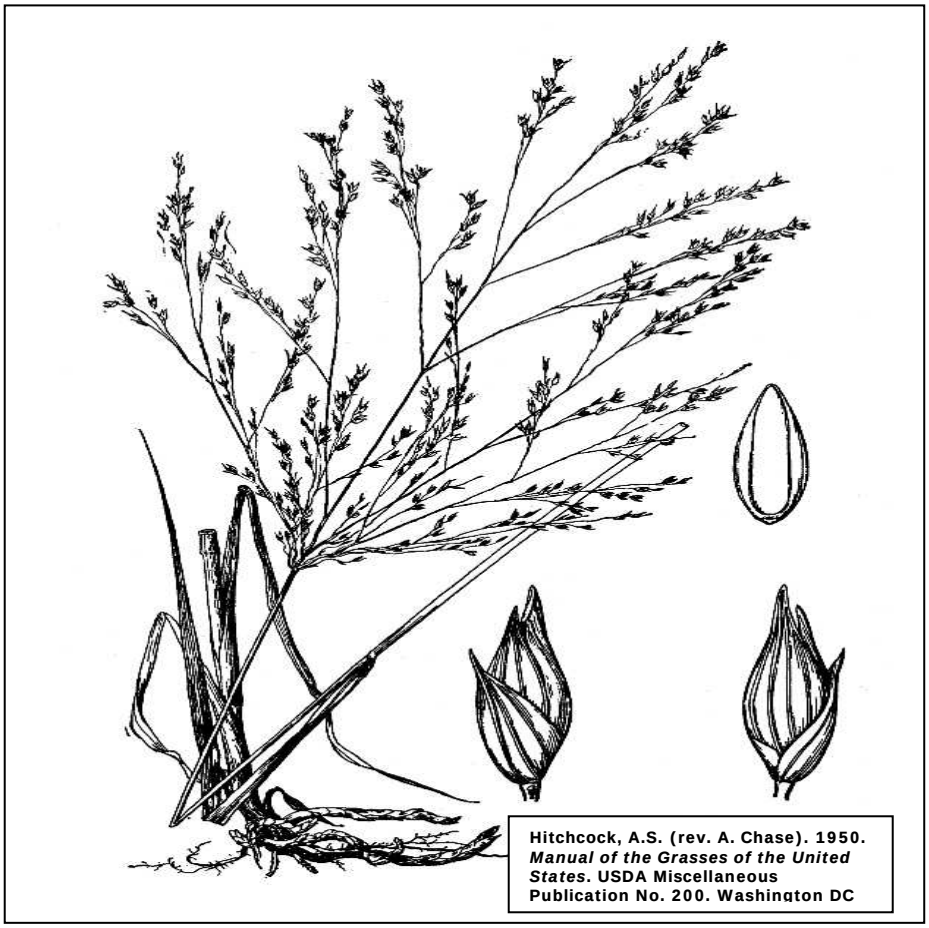
This Technical Note includes results from test plantings of switchgrass cultivars under irrigated pasture conditions. This information should be applicable to areas in southern Idaho, eastern Oregon, northern Nevada and northern Utah where climate is similar to Fallon, Nevada.



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SWITCHGRASS FOR THE INTERMOUNTAIN WEST

INTRODUCTION

Switchgrass, *Panicum virgatum*, is a warm season, perennial, sod-forming grass. It is a major native grass component of the tall grass prairie ecosystems of the Midwest and Eastern United States. Switchgrass grows 3- 5 feet tall with a potential rooting depth greater than 5 feet. Switchgrass spreads primarily vegetatively by short rhizomes and is among the few forage grasses which are true natives to North America. Switchgrass is grown primarily for livestock pasture or hay and provides excellent wildlife food and cover. Switchgrass forage production is highest during the hotter months of July and August in the Intermountain West. Switchgrass is also being promoted as a grass with good bio-fuel production potential. Tests are currently underway to more fully understand switchgrass traits for the bio-fuel industry.

The test site near Fallon, Nevada (elevation 4000 feet) is situated in west-central Nevada, just 60 miles east of the Reno, Nevada area. The high desert climate is characterized by hot sunny days, cool nights, low rainfall and low humidity. The average growing season is 140-160 days. Average annual precipitation is approximately 5 inches. Summer daytime high temperatures average 88^0F with nighttime low temperatures averaging 51^0F. Irrigated pasture in this area is typically comprised of improved cool season grass cultivars. These cool season pastures provide abundant forage during spring, early summer and fall; but production is often inadequate during the hottest period of the year in July and August.

OBJECTIVE

To determine the adaptation and production potential of five switchgrass cultivars for use under irrigated pasture and hayland conditions in the Intermountain West.

METHODS

The test plots were located in a renovated alfalfa field. The field was divided into 6 test strips approximately 15 feet wide and 300 feet long. In late June 1993, the plot area was disced and harrowed to kill the existing vegetation. On June 24, five switchgrass cultivars were drill planted 1/4 to 1/2 inch deep, in 7 inch wide rows, at a rate of 5 pounds Pure Live Seed (PLS)/acre. 'Fawn' tall fescue, *Festuca arundinacea*, was seeded at the same rate in one strip as a standard of comparison. After seeding, the test plots were firmed with a cultipacker and then irrigated.

To control weeds, the test plots were clipped at a 10 inch stubble height once during the first growing season. The plots were clipped twice the second growing season, once prior to the switchgrass breaking dormancy and once during the growing season (mid-July). Stubble height following clipping was 2- 3 inches. (Note: recommended stubble height is 6- 8 inches for the clipping of actively growing switchgrass.)

The residues from clipping were mechanically removed from the site. To control broadleaf weeds, the plots were sprayed with 2, 4-D the first week of August 1994.

The five switchgrass cultivars used in this study, along with their area of origin, precipitation requirements, and adaptation to average annual minimum temperatures are as follows:

Variety	Area of Origin	Precipitation Requirements	Average Min. Temperatures
'Alamo'	Southern Texas	25 + inches	0 to 10^0 F
'Blackwell'	Oklahoma	20 + inches	-10 to 20^0 F
'Cave-In-Rock'	Illinois	30 + inches	-20 to 30^0 F
'Dacotah'	North Dakota	15 + inches	-20 to 40^0 F
'Kanlow'	Oklahoma	38 + inches	-10 to 20^0 F

During the 1993 growing season the test plots received 42 inches of irrigation water. Cool spring temperatures delayed planting until late June. Normal recommended planting dates are May 15 - June 15. Summer temperatures averaged 4^0F below normal. The 1993-1994 winter was dry with below normal precipitation. The 1994 water year was 57% of normal and the test plots only received 20 inches of irrigation. Summer temperatures were near average. Winter 1994-1995 precipitation in the valley was near average and temperatures were near normal. Spring and early summer 1995, temperatures were below normal and averaged 50^0F. Precipitation was twice the average during this period. During the summer of 1995 the plots received 42 inches of irrigation water. Summer temperatures were near normal. See overall average climate summary table below and 1996-1998 precipitation and temperature by month

1971-2000 Monthly Climate Summary

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	44.7	52.2	59.0	65.0	73.1	82.5	90.1	88.5	80.1	68.4	53.2	45.4	67.0
Average Min. Temperature (F)	20.0	24.6	29.1	34.3	41.5	48.1	53.4	51.6	43.6	34.0	24.9	18.8	35.4
Average Total Precipitation (in.)	0.55	0.48	0.49	0.60	0.67	0.49	0.22	0.28	0.35	0.42	0.39	0.37	5.31

Average Precipitation by month (inches) and yearly totals

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot
1996	0.58 a	0.55	0.50	0.09	1.10	0.78	0.01 b	0.33	0.05	0.15	0.67	0.08	4.89
1997	1.55	0.34	0.00	0.45	0.07	0.85	0.07	0.11	0.34	0.04	0.07	0.41	4.30
1998	0.30 a	1.12	1.02 a	1.00	0.00 z	0.72	0.06	0.00	1.47	0.44	0.23	0.25	6.61

Average Temperature by month in Deg F and yearly totals

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Tot
1996	38.16	40.88	45.48	51.88	58.56	67.70	77.21	73.08	62.73	53.29	43.03	38.94	54.25
1997	35.47	38.50	48.65	48.92	62.40	64.92	70.95	72.44	64.45	50.94	43.13	30.31	52.59
1998	38.00	38.54	44.32	47.15	----- z	63.72	75.89	74.50	64.77	49.68	42.03 a	30.45	51.73

RESULTS

No data was collected during the establishment year in 1993. A second establishment year was needed (1994) to fully establish stands. In early September 1994, the plots were evaluated for plant vigor, height, and density by comparing the switchgrass plots to the 'Fawn' tall fescue standard of comparison plot. The tall fescue plot was given an arbitrary rating of "5" on a scale of 1-10, with 10 being the most vigorous. Each strip was randomly sampled 10 times with the results averaged.

In 1995- 1998, random samples were measured, forage samples clipped, air-dried and weighed to determine yield. The results are summarized below.

1993 (Establishment Year)

No data was collected during the establishment year.

1994 (Establishment Year 2)

Variety	Plants/Meter^2	Height (inches)	(cm)	Vigor
'Alamo'	5	8	20	3.0
'Blackwell'	35	16	41	8.0
'Cave-In-Rock'	20	14	36	6.7
'Dacotah'	31	7	18	4.0
'Kanlow'	24	13	32	4.3
'Fawn' tall fescue	8	9	23	5.0

'Alamo' was the slowest establishing cultivar. 'Fawn' tall fescue had better density, height and vigor than 'Alamo', but was out-performed by the other switchgrass cultivars during this period. 'Blackwell' switchgrass was the best over-all performing grass in 1994 through 1998.

1995- 1998 Production Years

	Yield (Tons/Acre)				
Variety	1995	1996	1997	1998	4 Yr. Ave.
'Alamo'	2.9	3.8	3.8	4.3	3.5
'Blackwell'	6.0	5.7	3.6	4.7	5.0
'Cave-In-Rock'	4.3	5.0	3.0	4.3	4.2
'Dacotah'	2.3	2.7	2.1	2.5	2.4
'Kanlow'	3.8	3.9	3.2	2.8	3.4
'Fawn' tall fescue	2.0	3.4	3.4	3.3	3.0

The switchgrass varieties were harvested to approximately a 6- inch stubble height. The tall fescue variety was cut to a 2- inch stable height. 'Blackwell' and 'Cave-In-Rock' switchgrasses significantly out-performed 'Fawn' tall fescue and the other switchgrass varieties.

1996 Fertilizer Application Results

Variety	Yield (Tons/Acre) 100 lbs/ac	50 lbs/ac	0 lbs/ac
'Alamo'	3.8	3.8	3.8
'Blackwell'	7.5	5.5	4.1
'Cave-In-Rock'	5.4	4.6	4.9
'Dakotah'	2.8	2.7	2.7
'Kanlow'	3.9	5.8	2.1
'Fawn' tall fescue	2.8	3.9	3.4

During 1996 the plots were divided into 3 equal sections and fertilized with 100, 50 or 0 pounds of actual nitrogen per acre. No other fertilizers were applied. Applications of nitrogen fertilizer generally improved yields. Production was variable with some varieties increasing dramatically while others varieties improved only slightly.

'Blackwell' switchgrass was the best over-all yielding variety at 7.5 tons per acre when fertilized with 100 pounds of nitrogen per acre. 'Fawn' tall fescue', 'Cave-In-Rock' switchgrass and 'Kanlow' switchgrass also demonstrated improved yields when fertilized. 'Alamo' and 'Dakotah' did not respond to increased levels of nitrogen.

CONCLUSIONS AND RECOMMENDATIONS

All cultivars tested appear to be adapted for use as irrigated pasture. Cool weather during establishment increased weed competition, affecting the quality of the stands. Chemical weed control during the second year improved stand uniformity, density and plant vigor by controlling competing weed species during the regrowth period.

'Blackwell' and 'Cave-In-Rock' varieties had the best yields and should be considered suitable for summer pastures and hayland in the Intermountain West.

Further trials with better weed control may be necessary to fully determine suitability of the 'Alamo', 'Dacotah' and 'Kanlow' cultivars. Note: Accessions 905439 switchgrass from Bridger, MT PMC and 'Forestburg' switchgrass from Bismarck, ND PMC were not tested in this trial and may also have potential for summer pastures and hayland in the Intermountain West.

MANAGEMENT RECOMMENDATIONS

Switchgrass should be drill seeded at a rate of 4- 5 pounds PLS/acre and planted 1/4 to 1/2 inch deep. Planting should take place when soil temperatures have reached at least 55^0F. Seedbed should be weed-free and firm. Phosphorous and potassium fertilizers should be applied as indicated by a soil test prior to planting and incorporated into the soil profile. In lieu of a soil test, apply 300 pounds of 0-20-20 fertilizer per acre. Nitrogen fertilizer should be avoided during the

establishment year as it encourages weed growth. Once stands are fully established, nitrogen fertilizer should be applied (based on soil test results) for higher forage production levels. It may require two growing seasons to fully establish productive stands of switchgrass.

When clipping stands for weed control and forage regrowth, maintain a minimum stubble height of 6 inches. Studies have shown that chemical weed control (Atrazine (restricted use pesticide) and 2, 4-D) aid in the establishment of switchgrass by controlling cool season grasses and broadleaf weeds.

In established stands, do not graze switchgrass until new growth reaches 12- 16 inches. Rapidly graze switchgrass, removing animals when stubble is 8- 10 inches in height, allow regrowth to 12- 16 inches before reintroducing livestock. If plants are over-grazed the amount of time required for regrowth increases. Early spring grazing (February-April) prior to switchgrass initiating growth will aid in the removal of excess vegetation and cool season weed control.

For hay production, harvest switchgrass when the plant height reaches 18- 24 inches. Plants should be cut before head emergence (plants should be in the late boot stage) for best hay quality. Cut switchgrass to a 6- 8 inch stubble height. Allowing regrowth to 12- 16 inches before frost in fall permits the plant to store carbohydrates in the crowns and roots. This will help produce vigorous plant growth the following spring.

Switchgrass should not be mixed with cool season grasses in the same pasture. The switchgrass will be grazed out early in the year and will not be able to provide adequate forage during the hot summer months. Switchgrass and other warm season grasses should be managed as separate pasture(s) and grazed in rotation with cool season grass pastures.

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