Dryland and Irrigated Perennial Forage Research at NARC

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Pasture is an important part of livestock production in Montana, and can provide most of the required nutrients of the grazing animal. Important in providing nutrients, is establishing and maintaining a quality pasture, that has the ability to perform to your expectations, and fit your production goals. Integral in achieving this is choosing the proper forage species for your pasture. While native grasses are an excellent forage source, introduced or improved grass cultivars often show improved yield and quality over the native grass species.

A study was conducted with replicated sites at NARC (Havre, MT), and CARC (Moccasin, MT) to investigate the establishment of 32 cool season grasses, as well as some forage mixtures. At the NARC location, trial 1 investigated establishment of 32 cool season grasses in a dryland trial, while trial 2 was an irrigated trial which consisted of 13 cool season grasses and 2 grass/ legume mixtures. At the CARC location, trial 1 consisted of the same 32 grasses in a dryland setting, with trial 2 being an alternate row mixture trial, with a mixture of Shaw alfalfa and each of the 13 cool season grass species.

The results of the study illustrate the need for effective planning in your pasture management program. Important in deciding which species to plant is evaluation of: 1) local average precipitation amounts, 2) current location productivity (i.e. weedy pressure), and 3) production goals.

In trial 1 (Tables 1 and 2) at both sites, there were clear performance differences amongst the various cultivars. At the NARC site, which in the establishment year had an above-average amount of rainfall (9.69” from April 1 through July 31; 144% of 95-year average), both of the varieties of Siberian wheatgrass (Vavilov and Vavilov II) had high dry matter yields, at 5.34 and 5.54 Tons DM/ acre, respectively. The hybrid wheatgrass AC Saltlander also ranked among the highest producing, at 5.36 Tons DM/ acre, with ‘Rosana’ Western Wheatgrass right behind at 5.17 Tons DM/ acre. It should be noted that this was an exceptionally wet year, and yields this high should not always be expected. When comparing the same grass species at the CARC location, which had only 5.1” during the same time period (59.7% of 100-year average), Vavilov and Vavilov II yielded .35 and .41 tons/ DM acre, Rosana yielded .14 tons DM/ acre, and AC Saltlander produced .47 tons DM/ acre. The highest yielding cultivar in this year at CARC was ‘Pryor’ slender wheatgrass, with .75 tons DM/ acre.

There were also variety differences within species, particularly dependent on rainfall amounts. For instance, similar to results found in Idaho and Washington, ‘Anatone’ bluebunch wheatgrass is recommended for sites of 10” of precipitation, while ‘Goldar’ bluebunch wheatgrass is recommended for areas with at least 12” of precipitation.

Differences were also observed amongst species in absence or presence of weeds. At CARC, Indian ricegrass had significant amounts of cheatgrass present in the plots. In all forage species, there was a general decline in the percent of cheatgrass from the first year of sampling (2010) to 2012. At the NARC location, the grasses with the highest percent of weeds were: Nevada bluegrass (70% weeds), orchardgrass (65% weeds), and big bluegrass (60% weeds). Those species with the lowest percent of weeds were: creeping foxtail (30%), pubescent wheatgrass (32.5%), intermediate wheatgrass (32.5%), and green wheatgrass (32.5%).

In the CARC Trial 2 (Table 3), there were significant differences in forage yields. The plots containing Shaw alfalfa and ‘Trailhead’ basin wildrye produced 0.89 tons DM/ acre, while the plots with Shaw alfalfa and ‘AC Saltlander’ green wheatgrass produced 3.20 tons DM/ acre in 2010. The mixture containing ‘AC Saltlander’ continued to outperform the other mixtures through the next two years of sampling. There was also a trend observed that the rhizomatous species had higher stand percentages when compared to the bunchgrasses. The exception to this was altai wildrye, which was slower to establish.

Spacing also played a significant role in forage yields for some of the species. The Russian wildrye was negatively impacted by a narrow 14” row spacing, decreasing its potential yield. Russian wildrye prefers spacings of at least 18” between rows.

In the irrigated trial at NARC (Trial 2; Table 4), mean stand percentages ranged from 70.75% for ‘Manifest’ intermediate wheatgrass, to 4.25% for ‘Sherman’ big bluegrass. The only species which had cultivar differences within species in stand percentages were ‘AC Saltlander’ green wheatgrass over ‘Newhy’ and ‘Manifest’ intermediate wheatgrass over ‘Oahe’. The “Mix 2” had greater regrowth for second cutting compared to the “Cooper Mix”. Hot, dry conditions led to decreased production in several of the cool season cultivars. The forage species that had the highest yields were: ‘Jose’ tall wheatgrass, ‘Manifest’ intermediate wheatgrass, ‘Newhy’ hybrid wheatgrass, and ‘Largo’ tall wheatgrass at 4.94, 4.89, 4.78, and 4.75 tons/ acre, respectively.

In the same trial, plots with the mixed species had the lowest number of non-species in 2013, as well as having some of the highest stand establishment rates. Yields were also ranked among the highest of all plantings, with “Mix 2” (consisting of orchardgrass, meadow brome, intermediate wheatgrass, creeping foxtail, and alfalfa) only lagging behind monocultures of ‘Jose’ tall wheatgrass, ‘Largo’ tall wheatgrass, and ‘Newhy’ hybrid wheatgrass in 2010. It was still among the highest yielding in 2011, however, the yields did fall in the middle in 2012, with only one harvest produced that year.

There are many variables to consider when establishing a perennial pasture. This study illustrates the importance of some of these, such as precipitation, weed pressure, and even planter spacing. In order to establish productive pastures, we have to tailor our seedings, and seed mixes, to best fit our environment and production needs.

Table 1. Percent downy brome and cool season dryland forage yields from 2010-2013, MSU-CARC, Moccasin, MT.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Species |  Cultivar | % Stand1  | % Downy Brome | Yield DM Tons/Acre2 |
|  |  | *2009* | *2010* | *2011* | *2012* | *2010* | *2011*3 | *2012* | *2013* | Mean |
| Altai wildrye | Mustang | 65.0† | 32.5 | 25.0 | 2.5§ | 0.23 | 0.90 | 0.73 | 1.58 | 0.86 |
| Altai wildrye | Prairieland | 48.8 | 32.5 | 7.5‡ | 1.25 | 0.20 | 1.27 | 0.97† | 1.44 | 0.97 |
| many-stem wildrye | Shoshone | 25.0 | 43.8 | 56.3 | 7.5§ | 0.11 | 0.43 | 0.21 | 1.41 | 0.54 |
| basin wildrye | Trailhead | 63.8† | 35.0 | 4.5†‡ | 0.0 | 0.22 | 1.88† | 0.88 | 1.68 | 1.17 |
| basin wildrye | Washoe | 43.8 | 36.3 | 43.3 | 2.5§ | 0.21 | 1.01 | 0.79 | 1.48 | 0.87 |
| Russian wildrye | Bozoisky-Select | 68.8 | 18.8 | 1.0 | 0.0 | 0.25 | 1.43 | 0.56 | 1.46 | 0.93 |
| Russian wildrye | Mankota | 61.3 | 18.8 | 2.0 | 0.0 | 0.17 | 1.25 | 0.59 | 1.14 | 0.79 |
| tall wheatgrass | Jose | 75.0 | 17.5 | 5.5 | 1.25 | 0.26 | 2.13† | 0.98† | 2.17 | 1.39 |
| tall wheatgrass | Largo | 83.8 | 28.8 | 8.3‡ | 0.0 | 0.23 | 1.58 | 0.74 | 1.87 | 1.11 |
| slender wheatgrass | Pryor | 86.3 | 0.0 | 1.5 | 0.0 | 0.75† | 2.18† | 0.92† | 2.67† | 1.63 |
| slender wheatgrass | Copperhead | 76.3 | 13.8 | 10.5 | 1.3 | 0.37 | 1.39 | 0.47 | 1.94 | 1.04 |
| thickspike wheatgrass | Critana | 72.5 | 30.0 | 19.5 | 0.0§ | 0.24 | 0.72 | 0.46 | 1.19† | 0.65 |
| thickspike wheatgrass | Bannock | 75.0 | 3.8 | 27.0‡ | 1.3§ | 0.25 | 0.76 | 0.57 | 0.21 | 0.45 |
| pubescent wheatgrass | Manska | 90.0 | 22.5 | 4.3 | 0.0 | 0.44 | 2.88† | 1.06 | 2.35 | 1.68 |
| pubescent wheatgrass | Luna | 90.0 | 1.3 | 1.8 | 0.0 | 0.58 | 2.37 | 1.01 | 2.57 | 1.63 |
| western wheatgrass | Rosana | 76.3 | 12.5 | 9.0 | 1.3 | 0.14 | 0.93 | 0.41 | 1.58 | 0.77 |
| western wheatgrass | Rodan | 70.0 | 13.8 | 18.8 | 0.0§ | 0.29 | 1.10 | 0.50 | 1.73 | 0.91 |
| hybrid wheatgrass | Newhy | 61.3 | 15.0 | 0.8 | 0.0 | 0.41 | 1.63 | 0.86† | 2.25 | 1.29 |
| hybrid wheatgrass | AC Saltlander | 80.0† | 10.0 | 1.3 | 0.0 | 0.47 | 1.99 | 0.67 | 1.87 | 1.25 |
| Siberian wheatgrass | Vavilov | 77.5 | 26.3 | 1.0‡ | 0.0 | 0.35 | 2.43 | 1.19 | 2.54 | 1.63 |
| Siberian wheatgrass | Vavilov II | 67.3 | 25.0 | 1.5‡ | 0.0 | 0.41 | 2.54 | 1.12 | 2.34 | 1.60 |
| Indian ricegrass | Rimrock | 13.8 | 42.5 | 77.5‡ | 16.3§ | 0.28 | 0.15 | 0.28 | 2.13† | 0.71 |
| Indian ricegrass | Nezpar | 22.5 | 45.0 | 76.3‡ | 15.0§ | 0.29 | 0.27 | 0.39 | 0.97 | 0.48 |
| bottlebrush squirreltail | Fish Creek | 58.8 | 20.0 | 18.8 | 0.0§ | 0.27 | 0.99 | 0.82† | 1.32 | 0.85 |
| bottlebrush squirreltail | Wapiti | 75.0† | 31.3 | 10.0‡ | 1.3 | 0.32 | 1.57† | 0.58 | 1.17 | 0.91 |
| green needlegrass | Lodorm | 32.5 | 42.5 | 18.3 | 1.3§ | 0.15 | 1.54 | 0.85 | 0.44 | 0.75 |
| Nevada bluegrass | Opportunity | 7.5 | 28.8 | 34.3 | 6.3§ | 0.07 | 0.68 | 0.69 | 1.70 | 0.79 |
| Sandberg bluegrass | Sherman | 11.3 | 26.3 | 16.5 | 2.5 | 0.17 | 1.61† | 1.02† | 1.69 | 1.12 |
| Sandberg bluegrass | High Plains | 6.3 | 41.3 | 17.8‡ | 2.5 | 0.12 | 0.97 | 0.33 | 1.57 | 0.75 |
| bluebunch wheatgrass | Goldar | 63.8 | 26.3 | 1.5‡ | 0.0 | 0.39 | 1.82 | 1.12 | 1.87 | 1.30 |
| bluebunch wheatgrass | Anatone | 76.3 | 1.5 | 2.8 | 0.0 | 0.46 | 1.57 | 0.98 | 1.92 | 1.23 |
| tall fescue | Bridgestone | 56.3 | 2.50 | 0.8 | 0.0 | 0.49 | 2.45 | 0.84 | 1.33 | 1.28 |
|  |  |  |  |  |  |  |  |  |  |  |
| DRS (0.05) |  | 12.65 | NS | 21.2  | 16.55 | 0.17 | 0.42 | 0.17 | 0.474747 | NS |

1 Stand percentages equal to or below 50% were replanted under dormant conditions on

 November 24, 2009.

2 Yields are reported as dry matter. To convert dry tons per acre to hay at 12% moisture, multiply by 1.136.

3 Yields are reported as the total of two harvests.

† Significantly different than the other accession of the same species.

‡ Significantly different in % downy brome than in 2010.

§ Significantly different in % downy brome than in 2011.

DRS = degree requiring significance or critical value for comparison at the 0.05 level.

Table 2. Dryland cool season forage yields from 2010 to 2013 at MSU-NARC, Ft. Assiniboine, MT.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Species |  Cultivar | % Stand1 Ssk,vlfsSStand | Yield DM Tons/Acre2  | Non-Species |
|  |  | *2009* | *20103* | *20113* | *2012* | *2013* | *Mean* | *% 2013* |
| Altai wildrye | Mustang | 69.75 | 4.27 | 4.64 | 2.40 | 3.39† | 3.68 | 21.25 |
| Altai wildrye | Prairieland | 63.00 | 3.61 | 3.68 | 2.21 | 2.45 | 2.99 | 28.75 |
| many-stemmed wildrye | Shoshone | 27.00 | 2.32 | 2.63 | 1.51 | 1.76 | 2.06 | 30.00 |
| basin wildrye | Trailhead | 65.00 | 3.75 | 4.28 | 2.43† | 2.21 | 3.17 | 30.00 |
| basin wildrye | Washoe | 59.50 | 2.85 | 3.45 | 1.55 | 2.19 | 2.51 | 22.50 |
| Russian wildrye | Bozoisky-Select | 81.25 | 4.15 | 5.13 | 1.44 | 3.67 | 3.60 | 3.75 |
| Russian wildrye | Mankota | 74.25 | 4.44 | 4.03 | 1.90 | 4.19 | 3.64 | 1.25 |
| tall wheatgrass | Jose | 75.50 | 4.64 | 2.79 | 3.00 | 1.35 | 2.95 | 40.00 |
| tall wheatgrass | Largo | 78.90 | 4.21 | 4.86†  | 2.39 | 1.58 | 3.26 | 52.50 |
| slender wheatgrass | Pryor | 76.25 | 3.67 | 4.45† | 2.64† | 1.16 | 2.98 | 56.25† |
| slender wheatgrass | Copperhead | 59.50 | 5.07 | 2.68 | 1.10 | 0.36 | 2.30 | 81.25 |
| thickspike wheatgrass | Critana | 72.75 | 3.09 | 2.74  | 1.39 | 1.99† | 2.30 | 13.75† |
| thickspike wheatgrass | Bannock | 72.50 | 4.74 | 2.64 | 1.35 | 1.03 | 2.44 | 58.75 |
| pubescent wheatgrass | Manska | 75.75 | 4.54 | 4.10 | 2.72 | 3.14 | 3.63 | 11.25 |
| pubescent wheatgrass | Luna | 88.75 | 4.27 | 3.27 | 2.73 | 2.71 | 3.25 | 7.50 |
| western wheatgrass | Rosana | 78.75 | 5.17 | 2.71 | 1.24 | 2.00 | 2.78 | 18.75 |
| western wheatgrass | Rodan | 71.25 | 3.89 | 1.86 | 1.70 | 2.18 | 2.41 | 13.75 |
| hybrid wheatgrass | Newhy | 73.75 | 4.81 | 3.91 | 2.09 | 2.20 | 3.25 | 22.50 |
| hybrid wheatgrass | AC Saltlander | 77.50 | 5.36 | 3.24 | 1.76 | 2.14 | 3.13 | 20.00 |
| Siberian wheatgrass | Vavilov | 72.50 | 5.34 | 4.08 | 2.74 | 3.10 | 3.82 | 7.50 |
| Siberian wheatgrass | Vavilov II | 75.75 | 5.54 | 3.86 | 2.79 | 2.96 | 3.79 | 10.00 |
| Indian ricegrass | Rimrock | 48.75 | 2.32 | 1.65 | 0.10\* | 0.42 | 1.12 | 77.50 |
| Indian ricegrass | Nezpar | 65.00 | 2.32 | 2.83 | 0.10\* | 0.24 | 1.37 | 87.50 |
| bottlebrush squirreltail | Fish Creek | 67.50 | 3.89 | 2.90 | 0.71 | 0.57 | 2.02 | 91.25† |
| bottlebrush squirreltail | Wapiti | 57.50 | 3.46 | 1.80 | 0.97 | 0.18 | 1.60 | 65.00 |
| green needlegrass | Lodorm | 53.75 | 3.68 | 4.26 | 2.41 | 1.30 | 2.91 | 42.50 |
| Nevada bluegrass | Opportunity | 3.750 | 1.14 | 2.05 | 0.10\* | 0.62 | 0.98 | 60.00 |
| Sandberg bluegrass | Sherman | 17.50 | 3.89† | 3.32 | 2.13† | 0.64 | 2.50 | 65.00 |
| Sandberg bluegrass | High Plains | 20.50 | 3.06 | 2.23 | 0.10\* | 0.69 | 1.52 | 57.5 |
| bluebunch wheatgrass | Goldar | 64.25 | 1.46 | 3.42 | 1.63 | 1.01 | 1.88 | 57.5 |
| Snake River wheatgrass | Secar | 68.25 | 3.06 | 2.46 | 1.64 | 1.14 | 2.08 | 37.5 |
| tall fescue | Bridgestone | 62.50 | 2.79 | 0.89 | 0.10\* | 0.14 | 0.98 | 87.5 |
|  |  |  |  |  |  |  |  |  |
| DRS (0.05) |  | NS | 1.97 | 1.37 | 0.74 | 0.89 | NS | 20.35 |

1 Stand percentages equal to or below 50% were replanted under dormant conditions on

 November 25, 2009.

2 Yields are reported as dry matter. To convert dry tons per acre to hay at 12% moisture, multiply by 1.136.

3 Yields are reported as the total of two harvests.

† Significantly different than the other cultivar of the same species.

\* Ocular estimates of 200 pounds per acre.

DRS = degree requiring significance or critical value for comparison at the 0.05 level.

NS = No significant differences between cultivars of the same species.

Table 3. Alternate row Shaw alfalfa/grass dryland forage yields at MSU-CARC, 2010–2012,

Moccasin, MT.

|  |  |  |  |
| --- | --- | --- | --- |
| Species | Cultivar | 2009 Stand1 | Yield DM Tons/Acre2 |
|  |  | *%* | *2010* | *2011* | *2012* | *Mean* |
| Altai wildrye | Mustang | 31.75 | 1.29 | 1.73 | 1.22 | 1.41 |
| basin wildrye | Trailhead | 50.00 | 0.89 | 1.63 | 1.13 | 1.22 |
| Russian wildrye | Mankota | 50.50 | 0.92 | 1.55 | 1.05 | 1.17 |
| tall wheatgrass | Jose | 53.00 | 2.09 | 1.54 | 1.16 | 1.60 |
| thickspike wheatgrass | Critana | 62.50 | 1.91 | 1.92 | 1.09 | 1.64 |
| pubescent wheatgrass | Manska | 51.25 | 1.46 | 1.95 | 1.36 | 1.59 |
| western wheatgrass | Rosana | 53.25 | 0.91 | 1.84 | 0.97 | 1.24 |
| hybrid wheatgrass | AC Saltlander | 74.25 | 3.42† | 2.46‡ | 1.16 | 2.35¶ |
| Indian ricegrass | Rimrock | 30.00 | 1.33 | 1.92 | 0.99 | 1.41 |
| Nevada bluegrass | Opportunity  | 27.75 | 1.72 | 1.77 | 1.14 | 1.54 |
| bluebunch wheatgrass | Goldar | 40.25 | 1.52 | 1.96 | 1.11 | 1.53 |
| Siberian wheatgrass | Vavilov | 54.00 | 2.37 | 2.16 | 1.35 | 1.96 |
| tall fescue | Bridgestone | 43.00 | 1.58 | 1.67 | 1.17 | 1.47 |
|  |  |  |  |  |  |  |
| DRS (0.05) |  | 25.71 | 0.33 | 0.66 | NS | 0.85 |

1 Stand percentages equal to or below 50% were replanted under dormant conditions on

 November 24, 2009.

2 Yields are reported on a dry matter basis. To convert dry tons per acre to hay at 12%

 moisture, multiply by 1.136.

 † Significantly higher in yield than any other cultivar/alfalfa mix.

‡ Significantly higher in yield than Bridgestone tall fescue, Jose tall wheatgrass, Mankota

 Russian wildrye, Mustang altai wildrye, Opportunity Germplasm Nevada bluegrass, and

 Trailhead basin wildrye/Shaw alfalfa mixes.

¶ Significantly higher in yield than Bridgestone tall fescue, Mustang altai wildrye, Rimrock Indian

 ricegrass, Rosana western wheatgrass, Trailhead basin wildrye, and Mankota Russian wildrye/

 Shaw alfalfa mixes.

DRS = degree requiring significance or critical value for comparison at the 0.05 level.

NS = Not significantly different from any other grass/alfalfa mix.

Table 4. Irrigated cool season grass stand percentages and forage yields from 2010 to 2012 and

percent non-species present in 2013 at MSU-NARC, Ft. Assiniboine, MT.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Cultivar | Stand 20091 | Yield DM Tons/Acre2 | 2013 Non-Species |
|  |  | *%* | *20103* | *20113* | *2012* | *Mean* | *%* |
|  birdsfoot trefoil, spreading alfalfa, sainfoin, meadow brome, orchardgrass | Cooper Mix | 76.00 | 4.29 | 4.34 | 2.84 | 3.82 | 32.5 |
|  orchardgrass, meadow brome, intermediate wheatgrass, creeping foxtail, alfalfa | Mix 2 | 59.50 | 5.08 | 4.88 | 3.07 | 4.34 | 38.75 |
| basin wildrye | Trailhead | 27.50 | 3.84 | 4.37 | 3.22 | 3.81 | 60.0 |
| basin wildrye | Continental | 29.50 | 3.50 | 3.77 | 2.61 | 3.29 | 50.0 |
| tall wheatgrass | Jose | 63.75 | 5.19 | 5.28 | 4.35 | 4.94 | 50.0 |
| tall wheatgrass | Largo | 68.00 | 6.11 | 4.56 | 3.57 | 4.75 | 45.0 |
| western wheatgrass | Rosana | 62.50 | 4.13 | 3.78 | 2.50 | 3.47 | 42.5 |
| hybrid wheatgrass | AC Saltlander | 65.00†  | 4.07 | 4.50 | 3.71 | 4.09 | 32.5 |
| hybrid wheatgrass | Newhy | 41.25 | 5.24 | 5.16 | 3.94 | 4.78 | 40.0 |
| Nevada bluegrass | Opportunity | 6.00 | 1.14 | 3.51 | 0.15\* | 1.60 | 70.0 |
| big bluegrass | Sherman | 4.25 | 2.71 | 4.17 | 0.15\* | 2.34 | 60.0 |
| meadow brome | McBeth | 67.25 | 4.93 | 4.33 | 3.12 | 4.13 | 52.5 |
| pubescent wheatgrass | Manska | 70.00 | 4.29 | 4.79 | 4.30 | 4.46 | 32.5 |
| intermediate wheatgrass | Manifest | 70.75†  | 4.97 | 4.84 | 4.87 | 4.89 | 32.5 |
| intermediate wheatgrass | Oahe | 48.75 | 3.79 | 5.07 | 4.20 | 4.35 | 40.0 |
| orchardgrass | Potomac | 53.25 | 2.64 | 3.84 | 0.15\* | 2.12 | 70.0 |
| timothy | Climax | 70.00 | 3.60 | 4.11 | 2.30 | 3.34 | 65.0 |
| creeping foxtail | Garrison | 25.25 | 3.68 | 3.35 | 2.42 | 3.15 | 30.0 |
| tall fescue | Bridgestone | 68.75 | 4.38 | 3.88 | 1.57 | 3.28 | 57.0 |
|  |  | 20.13 | NS | NS | NS | NS | NS |

1 Stand percentages equal to or below 50% were replanted under dormant conditions on

 November 25, 2009.

2 Yields are reported on a dry matter basis. To convert dry tons per acre to hay at 12% moisture,

 multiply by 1.136.

3 Yields are reported as the total of two harvests.

† Significantly different than the other cultivar of the same species.

\* Ocular estimates of 300 pounds per acre.

NS = No significant differences between cultivars of the same species.