Screening for Salt Tolerant Forage Species

Greenhouse Experiment Conducted by Allison Levy
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This page shows the progression of a greenhouse experiment that took place at Montana State University Plant Growth Center in Bozeman during 2002.

ABSTRACT

The purpose of this experiment was to determine the survivability and early plant biomass production of sixteen forage species irrigated with water qualities chosen to represent surface water supplies that could result from coal bed methane (CBM) development. The water qualities represented water comparable to Powder River water during the irrigation season, CBM product water in Montana and the Gillette area in Wyoming, and saline-sodic water of coal aquifers in the Tongue River watershed. The objective of this screening was to define a short list of species to be used in a long-term experiment to assess biomass production potential utilizing CBM x surface water mixes.

Stage I. Construction of Trays

Nine 45 x 35 x 9 inch trays were assembled at the Montana State University Post Farm. Each tray had one drainage hole on the bottom side and a water line receiving one of the three water qualities from a water supply tank. Each tray contained four flats, each 20 x 14 x 4.5 inches, with holes evenly dispersed on the bottom to allow absorption and drainage of water. The flats were lined with cheesecloth and nylon window screen and filled with 3.5 inches of sterile sand blasting sand. Sand was selected as the planting medium in order to display the interaction between seed and water quality without the possible confounding effects of salinity x sodicity on the growth medium.

Stage II. Planting

This stage was completed on May 10, 2002

Each flat contained eight rows of seeds with 20 seeds per row. There were four species per flat and, therefore, two rows per species. The position of species within specific rows was randomized within each flat to ensure that seed survivability and biomass production were due to water quality effects and not seed placement. Each of 3 blocks (replications) consisted of three trays, each containing four flats, each of which contained four species. Hence, there were 16 species per block and 3 replications.

Table 1.1 Species Used in Screening for Salt Tolerance

Common Name	Scientific Name
Corn	*Zea mays*
Altai	*Elymus angustus*
Tall Wheatgrass	*Agropyron elongatum*
Crested Wheatgrass	*Agropyron cristatum*
Kochia	*Kochia scorparia*
Sorghum	*Bicolor (L.) moench*
Intermediate Wheatgrass	*Agropyron intermedium*
Newhly Wheatgrass	*Elyrtigia repens x Pseudoroegneria spicata*
Tall Fescue	*Festuca arundinacea*
Paiute Orchardgrass	*Dactylis glomerata L.*
Slender Wheatgrass	*Agropyron trachycaulum*
Perennial Ryegrass	*Lolium perennal*
Valier	*Hordeum valier*
Sugarbeets	*Beta vulgaris L.*
Hi Mag Tall Fescue	*Festuca arundinacea hi mag*
2nd Gen. Alfalfa	*Medicago sativa*

Stage III. Water Treatments

This stage was started on May 10, 2002

Table 1.2 Water Qualities Used for Irrigation

Water Quality	EC mmhos/cm	SAR
Powder River	2.5	4
CBM	3.5	12
Saline-Sodic	8	23

The nine metal trays were arranged in blocks of three (replications) of three trays each; each tray in a block received a different water quality treatment. Irrigation was accomplished by supplying the appropriate water treatment to each tray until the water level reached a predetermined elevation relative to the sand surface in the flats. The trays were then drained. This procedure was repeated on a daily basis for a period of five weeks. The water chemistries were applied for five-day intervals, after whic water supplies was dicarded and replaced with new 100L stock solutions of identical water type. Each 100 L of stock solution contained 500mL of Miracle-Gro.

The stock solution was tested with a portable pH/EC/TDS meter every two days. Water samples were collected and sent to an independent lab and analyzed for electrical conductivity (salinity), SAR (sodium adsorption ratio), base cations (Na^{+}, Ca^{2+}, and Mg^{2+}), pH, and bicarbonates. This process was repeated once a week for five weeks. The results were used in analyzing survivability and early biomass production of the sixteen species. This analysis determined species to be represented on the short list.

Stage IV. The Short-list

At the end of the five-week germination period, the number of live seedlings in each replicate of each species x water quality combination was determined. These values were used to determine germination/survivability of each species. Above ground biomass was harvested, oven dried for 7 days, and weighed.

The Short List

The objective of the screening was to define a short list of species to be used in a long-term experiment to assess forage biomass production in greenhouse conditions. The short-list (Table 1.3) consists of the 8 highest performing forage species in the screening test.

Table 1.4 Short list of top 8 forage species

Common Name	**Scientific Name**
Tall fescue	*Festuca arundinacea*
Intermediate wheatgrass	*Agropyron intermedium*
Slender wheatgrass	*Agropyron trachycaulum*
Altai	*Elymus angustus*
Sorghum	*Bicolor (L.) moench*
Corn	*Zea mays*
Valier	*Hordeum valier*
Tall Wheatgrass	*Agropyron elongatum*

If you are interested or have any questions contact Allison Levy.