Section 3

Section III: Species Culture and Biological Studies

A. Plant Biology and Life History Studies
B. Row Spacing and Irrigation Studies
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Project Locations: Colorado and Utah

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A. Plant Biology and Life History Studies

Project Description:
Various species considered important for development and eventual use in large-scale restoration projects have not been widely studied or attempts made to culture or grow these plants under cultivated conditions. In order to gain information and data of various native species proposed for restoration, general Life History Studies have been established at two primary locations: Fountain Green, Utah and Rogers Mesa, Colorado.

Project Activities:

Figure 13: Several Species Currently in Life History Studies
The Life History Studies were established by planting individual plants in a 20 x 20 block. Each block was replicated with two different species individually planted in four rows with 13 plants per row. The blocks were randomly placed with four replications of each species. A weed barrier was placed on the soil surface prior to planting and a drip irrigation system was installed after transplanting. Plantings were established in 2005 and 2006 as individual species became available. Vegetative and floral data has been collected throughout the growing season at both field locations each year following planting. Data collected of all species includes: survival, response to cultivation, vegetative growth, flowering sequence, seed development, seed maturation, seed harvesting requirements, seed quality and yields, and insect interaction.

Future Plans:
Studies will continue for each species for an additional two years to provide at least two years data from mature plants. Additional plantings of approximately ten new species are planned as wildland collected seeds become available. In addition, some species we initially considered easy to propagate have exhibited some significant problems, and we need to more carefully examine their floral features and flowering patterns. Seed germination and seed quality of a number of species appears to be related to the conditions at the rearing site. Of immediate concern is the germination of Indian ricegrass and needle-and-threadgrass. Seed germination of wildland collected seeds from these two species is very erratic, and studies are planned to investigate the effects of field culture on seed production and seed quality. Future plans also include the addition of tapertip hawksbeard *Crepis acuminata* and rock goldenrod *Petradoria pumila*. Some additional broadleaf forbs that are more common in upland communities administered by Region 2 and Region 4, USDA, Forest Service and BLM-administered sites in Utah are contemplated. An additional 3 to 5 acres of land is being fallowed at the Fountain Green site to remove weeds and prepare for expanded plantings in the spring 2008.
B. Row Spacing and Irrigation Studies

Project Description:
Optimized spacing and irrigation can have a major influence on the amount and timing of flowering and seed production of individual plants. Studies were started in 2004 at two locations, Ft. Green, Utah and Rogers Mesa, Colorado to investigate the effects that plant density and irrigation patterns have on flowering, seed maturation, seed production, and seed quality. Additional plantings were added to the studies in 2005 and 2006. The studies were established to determine the best row spacing and irrigation regime with individual plant species to maximize seed production.

Project Activities:
The individual species currently under study include: prairie junegrass Koeleria macrantha, muttongrass Poa fendleriana, needle-and-thread grass Hesperostipa comata, western wheatgrass Pascopyrum smithii, Alpine golden buckwheat Eriogonum flavum, blue flax Linum lewisii, bluestem penstemon Penstemon cyanocaulis, cushion buckwheat Eriogonum ovalifolium, dusty penstemon Penstemon comarrhenus, hairy goldenaster Heterotheca villosa, low fleabane Erigeron pumilis, lobe leaf groundsel Packera multilobatus, Oregon daisy Erigeron speciosus, scarlet globemallow Sphaeralcea coccinea, silky lupine Lupinus sericeus, sulfur flower buckwheat Eriogonum umbellatum, and Utah sweetvetch Hedysarum boreale. The spacing and irrigation studies were transplanted to include three row spacing; 18, 24, 30 inch spacing and two irrigation designs (Fig. 14). The first irrigation treatment includes providing supplemental water in the early summer, approximately May 30th to bring the soil to field capacity with no further irrigation beyond this date. The second irrigation treatment includes furnishing supplemental water until maximum flowering has occurred. At the Ft. Green location, a weed barrier has been established to control weedy competition. Mechanical and chemical weeding has been used at the Rogers Mesa site. A drip irrigation system has been installed and used to irrigate the plots at both study sites. At each study location data has been gathered to record the vegetative growth patterns, timing of and flowering patterns, seed maturation, seed production, harvesting practices, seed quality, insect interactions. Considerable amounts of seed have been harvested from both sites for a number of species. Other species have encountered problems with insect pollination and mortality. Funds were provided to BYU in 2004 to investigate the influence of row spacing and irrigation practices using the same study design as described for species under study by project personnel. The species being evaluated by BYU personnel at the Spanish Fork Farm include Erigeron pumilis, Erigeron speciosus, Heterotheca villosa, and Tetraneuns acaulis. These studies have been maintained by BYU cooperators and a final report is due in 2007.
Future Plans:
Data will continue to be collected from all plantings for another two to three years. The study plots continue to furnish seed needed to expand further plantings and studies. The study plots at Spanish Fork currently administered by BYU will be transferred to project personnel, and half of the plots will be retained for seed production. An additional 10 species are proposed to be added to seed increase studies over the next few years. We expect to add tapertip hawksbeard, rock goldenrod, and Indian ricegrass to the sites in 2008. Currently, an additional 3 to 4 acres at the Ft. Green site is being fallowed to allow expansion of additional species.