

CURRICULUM VITAE - DOUGLAS A. JOHNSON

Present Address:

USDA-ARS Forage and Range Research Lab., Utah State Univ., Logan, UT,
84322-6300; Phone: 435-797-3067; Fax: 435-797-3075; Email: doug.johnson@ars.usda.gov

Educational Background:

1967-71 Augustana College; major, Biology; B.A. (Magna Cum Laude)
1971-73 Utah State University; major, Range Ecology; M.S.
1973-75 Utah State University; major, Range Ecology; Ph.D.

Employment Experience:

Pre-1967 Farm experience on family farm near Milan, MN
1967-69 Summer crew foreman for Minnesota Department of Natural Resources, Lac Qui Parle Game Refuge, Watson, MN
1968-71 Undergraduate Teaching and Research Assistant at Augustana College, Sioux Falls, SD and Naval Arctic Research Laboratories, Barrow, AK
1971-75 NDEA Fellow, Research Assistant, and Teaching Assistant, Range Science Department, Utah State University, Logan, UT
1975 Research Associate at Naval Arctic Research Laboratories, Barrow, AK
1980-81 Visiting Scientists, CSIRO Division of Plant Industry, Canberra, Australia
1976-pres. Plant Physiologist, USDA-ARS, Logan, UT

Honors and Awards:

Frank N. Meyer Medal for Plant Genetic Resources, Crop Science Society of America, 2007; Range Manager of Year Award, Utah Section of Society for Range Management, 2004; Agricultural Leadership Award, Mongolian Ministry of Agriculture, 2003; Professional Achievement Award, Utah State University, 2003; Certificate of Honor, Mongolian Academy of Sciences (1999); Outstanding Alumni Service and Achievement Award, Augustana College (1999); Fellow Award, Society for Range Management, 1999; Honorary Professor Award, Hubei University, China, 1998; USDA-ARS Special Service Award, 1998; Fellow Award, Crop Science Society of America, 1997; Honorary Professor Award, Xinjiang Agricultural University, China, 1997; Outstanding Achievement Award, Society for Range Management, 1996; Fellow Award, American Society of Agronomy, 1994; N.I Vavilov Medal for Plant Genetic Resources, 1993; Outstanding Performance Award, USDA-ARS, 1990, 1991; USDA-FS Certificate for Heroic Action, 1983; Visiting Scientist Award, CSIRO, Canberra, Australia, 1981-82; NDEA Fellowship, 1971-73; Magna Cum Laude, 1971; Beta Beta Beta Honor Society, 1969-71; Blue Key Honor Society, 1969-1971; Outstanding Sophomore Award, 1969; Academic Scholarship Awards, 1967-1971

Membership in Professional Societies:

American Society of Agronomy
Crop Science Society of America
Society for Range Management

Research Assignment:

Dr. Douglas Johnson has been a Plant Physiologist with the Forage and Range Research Laboratory (FRRL) at Logan, Utah since January 1976. The overall FRRL mission is to broaden the genetic base of rangeland, pasture, and reduced-input turf plants and provide improved plant germplasm for upgrading private and public lands in the western U.S. He provides technical leadership in developing and guiding a research program in basic and applied plant physiology and ecology. Dr. Johnson is responsible for determining which factors are of critical importance in the establishment and production of rangeland, pasture, and reduced-input turf plants. In cooperation with the team's plant breeders, he develops practical selection procedures for improving key plant species. His particular responsibility involves the ecology and physiology of rangeland, pasture, and reduced-input turf plants; the effects of environmental stress on seedling establishment, forage production, and persistence; forage legume nitrogen fixation; and germplasm collection. These activities directly contribute to the development of improved cultivars and germplasms for animal utilization, resource conservation, and reduced-input turf applications in the western U.S.

Current Research Objectives:

1. Determine the basic ecological responses of important plant species growing on rangelands, pastures, and reduced-input turf grass areas in the western U.S. and quantify the effects of environmental stress on their establishment and production efficiency. Field and greenhouse experiments focus on how water and nitrogen control seedling growth and establishment of invasive weeds and desirable perennial plants.
2. Develop practical selection techniques for screening grass and legume breeding populations for resistance to environmental stress, particularly drought. A field rainout facility and a companion line-source sprinkler system are used to examine plant gas exchange and water relations responses to a drought-stress gradient.
3. Conduct interdisciplinary research to develop cultivars, hybrids, and germplasms of native and introduced species for use on rangelands, pastures, and reduced-input turf areas. Research involves close interaction with research geneticists to identify breeding populations with superior characteristics related to seedling establishment, resistance to grazing, agronomic performance, and water-use efficiency.
4. Examine the symbiotic relationships of important legume-*Rhizobium* combinations on western rangelands and determine the effects of environmental stress on these combinations. Research focuses on identifying infective and effective *Rhizobium* strains on adapted legumes for symbiotic nitrogen fixation on sagebrush-steppe rangelands.
5. Expand the genetic resources of perennial forage species and reduced-input turf grasses in the National Plant Germplasm System (NPGS) through plant exploration. Domestic and overseas seed collections target grass and legume species adapted for use in forage production, conservation, and reduced-input turf applications.

Summary of Accomplishments and Impact:

Following completion of his Ph.D. in 1975, he was a postdoctoral researcher on an NSF-sponsored research project in Point Barrow, Alaska that involved the influence of grazing on arctic tundra plants. He joined the USDA-ARS-FRRL on January 18, 1976, and has been involved in rangeland plant physiological and ecological research there since. He has authored or co-authored 166 publications, including 124 refereed journal papers, 1 book, 6 book chapters,

16 international congress or national symposium papers, and 1 symposium volume. His research has contributed directly to the release of 15 forage cultivars or germplasms. His active involvement in team research efforts and his high capacity for contributing to multi-disciplinary research efforts is well demonstrated by his publication record. He has served on and presided over numerous professional committees and research meetings, has served as Associate Editor for *Crop Science* and the *Agronomy Journal*, was elected President of the Utah Section of the Society for Range Management, served on two review panels for the USDA Competitive Grants Program, was invited to serve on a site-review team for the Pakistan Agricultural Research Program by the Board on Science and Technology for International Development (BOSTID) of the National Academy of Sciences, served a three-month assignment on the USDA-ARS National Program Staff, and is frequently sought out for consultation on research and policy issues in China, Mongolia, and Central Asia. He has presented invitational papers at various national and international meetings and symposia, including invited participation in major conferences at Stanford University; Aleppo, Syria; Adelaide, Australia; Montpellier, France; Riverside, California; Rio Gallegos and Bariloche, Argentina; Punta Arenas, Chile; and Huhhot, China. He has developed collaborative research projects with scientists in Spain, Pakistan, Nepal, India, Russia, Kazakhstan, China, Argentina, Chile, and Mongolia.

Dr. Johnson has contributed to the development of novel approaches concerning the selection and improvement of rangeland plants for commercial use in the U.S. and internationally. His research led to the development of screening procedures that are routinely used to improve the establishment of important rangeland grasses and legumes for semiarid rangelands. He has been involved in the release of 15 cultivars or pre-variety germplasms with significant economic benefits. He has also made major contributions concerning our understanding of nitrogen fixation in rangeland legumes, the co-evolution of *Rhizobium* and perennial *Medicago* species, distribution of *R. meliloti* on western rangelands, the use of stable isotopic composition for improving water-use efficiency in range forages, assessments of rangeland CO₂ fluxes, and the collection of important plant genetic resources. He identified specific rhizobial strains for commercial use in the U.S. and other countries. He also took the lead role in the design and construction of a rainout shelter facility for use in examining key physiology-genetic relationships in important rangeland grasses and legumes, which has facilitated both applied plant selection and basic drought response research.

He has been successful in competing for various competitive grants (total exceeding \$2 million) for research related to nitrogen fixation of rangeland legumes, co-evolution of *Rhizobium* and perennial *Medicago* species, distribution of *R. meliloti* on western rangelands, the use of stable isotopic composition for improving water-use efficiency in range forages, assessments of rangeland CO₂ fluxes, and the collection and evaluation of North American rangeland legume species. He was instrumental in securing funding through USAID and ARS Headquarters to establish CO₂ flux monitoring sites on rangelands in three Central Asian countries and scale up CO₂ fluxes to landscape and regional levels. Ingenuity and creativity have also been demonstrated in Dr. Johnson's efforts to expand the germplasm base of important rangeland grass and legume germplasm in the NPGS with the addition of more than 4,000 accessions to NPGS. In addition, he secured funding and co-authored a 563-page English/ Mongolian book entitled "Forage Plants in Mongolia" that summarizes the characteristics of 323 forage plants in the Mongolian flora. His research accomplishments have been recognized nationally and

internationally with Fellow Awards from three major professional societies (Crop Science Society of America, American Society of agronomy, and Society for Range Management), the N.I. Vavilov Medal for Plant Genetic Resources, an ARS Special Service Award, Certificate of Honor from the Mongolian Academy of Sciences, the Frank N. Meyer Medal for Plant Genetic Resources from the Crop Science Society of America, and honorary professorships at two Chinese universities.

Specific Accomplishments:

1. **Accomplishment:** Rangeland grass and legume breeding programs for western U.S. rangelands did not have efficient and effective procedures for selection of enhanced seedling establishment and improved response to environmental stresses. He conducted research that identified laboratory and greenhouse techniques for effectively selecting forage breeding lines, which exhibit enhanced seedling establishment on semiarid rangelands. **Role:** Dr. Johnson formulated, designed, and led the physiology portion of cooperative research with the Unit's plant breeders to develop a better understanding of the responses of range plants to drought and devise more effective methods to evaluate seedling responses of large, genetically diverse breeding populations. **Impact:** Comparisons between laboratory evaluations and actual field establishment led to the determination of the most effective selection indices for enhanced seedling establishment in forage species. Because of these studies, the physiological screening procedures that he developed became an integral part of forage improvement programs for western rangelands at Tucson, AZ; Mandan, ND; and Logan, UT. This has led to improved seedling establishment characteristics in several important rangeland grasses and legumes that are being used widely by farmers, ranchers, and land managers in western North America for enhancing production efficiency and resource conservation.

2. **Accomplishment:** Several important crested and Siberian wheatgrass cultivars were released for improved forage production and conservation use and have had a major impact on rangeland improvement in the western U.S. **Role:** Dr. Johnson provided key physiological input and interacted closely with Dr. K.H. Asay in his FRRL breeding program to develop improved cultivars within the crested wheatgrass complex. Dr. Johnson led the physiological portion of these collaborative efforts in developing screening procedures to effectively evaluate, select, and improve seedling establishment characteristics in these important grasses. His physiological contributions directly led to the release of several key cultivars of crested wheatgrass including 'Hycrest', 'CD-II', 'Vavilov', and 'Vavilov II'. **Impact:** 'Hycrest' was released in 1985 and was the first interspecific hybrid of crested wheatgrass, has demonstrated significant genetic advance in stand establishment on difficult range sites, and is now the predominant crested wheatgrass cultivar in the U.S. Hycrest has been estimated to provide economic benefits of more than \$50 million annually, and was the most widely used grass in the 40 million acres seeded nationally in the Conservation Reserve Program. The Bureau of Land Management (BLM) alone in 2007 purchased seeds of Hycrest that exceeded \$1.3 million. 'CD-II', an improved variety of Hycrest released in 1997, holds promise for even greater economic benefits. 'Vavilov' Siberian wheatgrass (released in 1995) does extremely well on dry, sandy soils of western rangelands, and in 2007 seed sales just to the BLM exceeded \$1.2 million. 'Douglas' crested wheatgrass, a hexaploid cultivar of crested wheatgrass released

in 1995, has exceptionally broad leaves and retains green leaves much longer during the summer months than typical crested wheatgrass cultivars. ‘Roadcrest’, a rhizomatous cultivar of crested wheatgrass for use on roadsides or similar low-maintenance turf applications, was released in 1999. These crested wheatgrass cultivars are having a significant impact on stabilizing and increasing productivity of deteriorated semiarid rangelands in the western U.S. Cultivars of Hycrest and Vavilov demonstrated significant improvements in stand establishment on harsh range sites and have become the prominent cultivars used in rehabilitation projects on semiarid rangelands. Based on Foundation seed records, certified seed sales of Hycrest, Vavilov, and Roadcrest are estimated at about \$42 million for a four-year period. Cooperative investigations are demonstrating the utility of Hycrest in the Patagonian Region of South America and the semi-arid steppes of Central Asia. Vavilov II was released in 2007 and is currently under commercial seed production with several private seed companies.

3. **Accomplishment:** Fertilizer application is not economically viable on rangelands, but biological nitrogen fixation has the potential of enhancing production efficiency and forage quality on millions of acres of rangelands. Dr. Johnson directed key research efforts concerning the distribution of naturalized populations of *R. meliloti* in the major vegetation zones of the Intermountain Region, the spread and effectiveness of these *R. meliloti* populations, and the effects of environmental stress on important legume-*Rhizobium* interactions. **Role:** Dr. Johnson successfully obtained competitive grant funding, recruited a microbiologist from New Zealand (Dr. Lowther), recruited and supervised the research of three graduate students (Ford, Athar, and Bhattarai), provided critical physiological/ecological input in formulating a series of field and greenhouse studies, and cooperatively conducted research to evaluate legume-*Rhizobium* interactions in important rangeland legumes species. He initiated research to compare native legume-*Rhizobium* combinations on western rangelands. **Impact:** This research was the first to document the distribution of this important soil bacterium in rangelands of the western U.S. and formed the basis for USDA-NRCS recommendations concerning the need to inoculate rangeland alfalfa with effective and competitive strains of *R. meliloti* on millions of acres of rangeland. Close interaction with a geneticist (Dr. Rumbaugh) examined the use of diallel analysis for quantifying relationships between legume-*Rhizobium* combinations and in identifying the most beneficial host-strain combinations for maximizing N₂ fixation. Cooperative research with scientists at Pennsylvania State University resulted in a phylogenetic framework of genetic relatedness, which forms the basis for a taxonomic revision of *R. meliloti*. Other studies identified the most effective legume-*Rhizobium* combinations for commercial development in Pakistan. Rhizobial strains identified from this work have been requested by scientists and companies in the U.S., Pakistan, and Saudi Arabia. Results from his research led to the release of the first two native rangeland legume species for use in restoring rangelands in the Intermountain Region of the western U.S. (‘Timp’ Utah sweetvetch released in 1994 and ‘NBR-1’ basalt milkvetch released in 2008). Dr. Johnson identified a rhizobial strain for basalt milkvetch that is now being commercially produced by EMD Crop BioScience in Milwaukee, WI.
4. **Accomplishment:** Evaluation of breeding lines for enhanced water-use efficiency has not been feasible within crop improvement programs because of a lack of suitable screening

techniques. Dr. Johnson's research showed that carbon isotope discrimination (CID) was related negatively to water-use efficiency, breeding lines of crested wheatgrass differed in their CID responses, and heritabilities for CID were relatively high. **Role:** As Principal Investigator of two competitively funded grants, he designed, conducted, and supervised experiments by a postdoctoral associate (Dr. Read) funded through ARS Headquarters to test the hypothesis that CID is related to the efficient use of water in a wide range of cool-season grasses and alfalfa. **Impact:** These results were the first to establish genetic parameters for CID in range grasses and demonstrated that selection for CID holds promise in screening for improved water-use efficiency in range forages. Results from these studies also provided definitive documentation that CID could be used for improving water-use efficiency in alfalfa, but would need to involve the use of more diverse germplasm from plant introductions to increase diversity in CID response. This research provided a firm foundation for careful evaluation of the applicability of using CID for the possible improvement of water-use efficiency in several forage species that fix carbon by the C3 pathway.

5. **Accomplishment:** Drought is the most overriding environmental constraint that limits forage production on western rangelands. Dr. Johnson provided comprehensive research data concerning the effect of cattle grazing on soil moisture and plant water status in crested wheatgrass pastures. In addition, he supervised greenhouse and laboratory research that evaluated root architectural characteristics in range grass seedlings and applied image analysis software to characterize their root branching patterns, which were previously impossible to quantify. **Role:** Dr. Johnson designed a comprehensive research program to address key questions concerning root development, water-use patterns, and competition for soil nitrogen in important rangeland grasses, which was accomplished through four graduate students that he recruited and supervised (Wraith, Aguirre, Arredondo, and Shewmaker). He was Principal Investigator of a USDA competitive grant that addressed key hypotheses concerning the role of nitrogen form and function in shifting competitive balances between weedy annual species and desirable rangeland plants. **Impact:** This research was the first definitive demonstration that ability to maintain turgor under drought differed among genotypes within a species. Field studies detected important differences in water-use patterns that influenced growth and competitive interactions in semiarid pastures. Results from other studies directed by Dr. Johnson helped interpret competitive interactions with weedy annual species and identified important root characteristics useful for improving seedling establishment in important range grasses. These results make important contributions to understanding the role that root development and competition for nitrogen sources play in rangeland ecosystems, which laid the foundation for research being conducted by other rangeland scientists who are testing hypotheses concerning weedy plant competition on rangelands.
6. **Accomplishment:** It is important to have a diversity of grass and legume species for use on western rangelands. Although Russian wildrye holds promise for extending the grazing season into the dry summer months on western rangelands, this grass has been notoriously difficult to establish because of poor seedling vigor. Similarly, although Kura clover has potential for use as an alternative legume for increasing forage production and quality, it was not particularly effective at nitrogen fixation. Also, germplasms of squirreltail and

basalt milkvetch (species native to western North America) were not available for rangeland restoration efforts in the western U.S. Germplasms of Russian wildrye, Kura clover, squirreltail, and basalt milkvetch were physiologically evaluated, selected, and released for use by ranchers and public land managers. **Role:** Dr. Johnson identified emergence from a deep seeding depth as the best method for genetically improving seedling establishment characteristics in Russian wildrye. He also designed field selection techniques for identifying genetic variability for nodule development and nitrogen fixation activity in breeding lines of Kura clover. He physiologically evaluated genetic diversity in squirreltail, which directly contributed to the release of two germplasms of this important North American grass species. **Impact:** ‘Bozoisky-Select’ Russian wildrye was released in 1985 and has demonstrated enhanced seedling vigor and productivity on western range sites. Bozoisky-Select has become the principal Russian wildrye cultivar in rangeland improvement programs in the western U.S., and seed sales just to the BLM exceeded \$900,000 in 2007. Bozoisky-II was released in 2005, and estimated revenues for this release from certified seed sales already exceeds \$150,000. ARS-2678 Kura clover was released as a germplasm in 1991 and was used in the development of ‘Cossack’ and another Kura clover cultivar from Wisconsin that is nearing release. ‘Sand Hollow’ squirreltail was the first germplasm release of this important native grass (released in 1998), and seeds of this release purchased just by the BLM in 2007 exceeded a value of \$336,000. Fish Creek and Toe Jam Creek bottlebrush squirreltail germplasms were released in 2004 and are high-priority germplasm for BLM rangeland restoration efforts. NBR-1 basalt milkvetch germplasm was released in 2008 and is expected to be in great demand as a native legume for rangeland restoration.

7. **Accomplishment:** Because of their expansiveness, the world’s rangelands play an important role in the global carbon cycle. Research quantified the magnitudes and dynamics of CO₂ fluxes in important rangeland ecosystems in the western U.S. and Central Asia. **Role:** Dr. Johnson formulated plans, obtained competitive grant funding, and conducted research designed to evaluate CO₂ fluxes on sagebrush-steppe rangelands in Idaho and similar rangelands in Kazakhstan, Uzbekistan, and Turkmenistan. **Impact:** With the assistance of funding from USDA-ARS Headquarters and a competitive grant through the Global Livestock/Collaborative Support Program (GL/CRSP) of USAID, three sites in Idaho and three additional sites in Central Asia were equipped with Bowen ratio systems for monitoring CO₂ fluxes. He obtained funding to recruit a research associate (Dr. Saliendra) and a visiting scientist (Dr. Gilmanov) to allow the continuous monitoring of CO₂ and water vapor fluxes throughout the year and provided critical data for determining yearly carbon budgets on representative range sites. Additional funding of \$250,000 facilitated by Dr. Johnson from eight participating USDA-ARS locations, USDA-ARS Headquarters, and GL/CRSP allowed flux data from individual sites to be scaled up to landscape and regional scales. These data provided the first definitive documentation of the magnitudes and dynamics of fluxes on rangelands and the effect of various range management practices on these fluxes. Research results from these studies were critical in establishing the levels of carbon sequestration attributable to semiarid rangelands for possible carbon crediting and the role of rangelands in the global carbon cycle. Results from these studies also provided the basis for a ten-year project funded through the World Bank/Global Environmental Facility (WB/GEF) Program to support

rangeland restoration and carbon sequestration activities to improve rangelands of Kazakhstan and other Central Asian countries.

8. **Accomplishment:** Because of expanding human population pressures and subsequent overgrazing by livestock on many of the world's most diverse rangelands, the preservation of plant germplasm from these areas is critical for the benefit of future generations and immediate use in range plant improvement programs. Germplasm was also lacking for reduced-input turf grasses. Dr. Johnson undertook efforts to collect, preserve, and expand the germplasm base of important rangeland species and reduced-input turf grasses. **Role:** He evaluated germplasm needs, prepared proposals, obtained competitive grant funding, and executed 18 overseas plant exploration expeditions, including trips to Spain and Pakistan in 1985; Pakistan and Nepal in 1986; USSR in 1988; People's Republic of China in 1991, 1993, 1997, 2000, and 2006; Kazakhstan in 1992; Mongolia in 1994, 1996, and 1998; Chile and Argentina in 1996; Kyrgyzstan in 2006; and Russia in 2007 and 2008. He was team leader on ten of these expeditions. **Impact:** These expeditions resulted in the addition and preservation of more than 4,000 forage accessions to the NPGS. Prior to these efforts, only limited numbers of forage collections from Central Asian countries were available in NPGS. Consequently, these collections have greatly expanded the genetic diversity of germplasm available for forage and turf grass breeding programs. These materials already have led to the release of one crested wheatgrass variety and two tetraploid Russian wildrye germplasms; an orchard grass release from his collections is expected in a few years. This collected germplasm will serve as a valuable basis for characteristics involving drought and salt resistance, seedling emergence, disease resistance, and forage and turf quality for breeding programs for forage species and reduced-input turf grasses for decades to come. Dr. Johnson's role in these significant germplasm collection activities was recognized by presentation of the N.I. Vavilov Medal for Plant Genetic Resources from the N.I. Vavilov Research in Plant Industry in St. Petersburg, Russia in 1993, a USDA-ARS Special Service Award in 1998, Certificate of Honor for recognition of cooperative germplasm research from the Mongolian Academy of Sciences in 1999, and the Frank N. Meyer Medal for Plant Genetic Resources from the Crop Science Society of America in 2007

9. **Accomplishment/Role:** The epicuticular wax layer is the outermost surface of the plant and provides critical protection against both the biotic and abiotic environment. Dr. Johnson led a research effort to quantify the physiological effects of epicuticular wax characteristics in wheat and forage species. **Impact:** These studies led to the development of a rapid screening procedure to estimate the amount of epicuticular wax on leaves and demonstrated that glaucousness is a yield-positive characteristic for wheat in water-limited environments. This work stimulated breeders in Australia, Mexico, Canada, and the U.S. to initiate selection programs for enhanced glaucousness in wheat. Dr. Johnson recruited and supervised two graduate students (Jefferson and Galeano) to conduct research on alfalfa and several Triticeae range grasses. This research showed that epicuticular wax did influence the water relations of forage species; however, this effect did not translate into increased forage yield. Therefore, these results were critical in determining that expanded efforts to select for enhanced epicuticular wax in these forage species would not be warranted.

10. **Accomplishment/Role:** The importance of biological nitrogen fixation by legumes is well established in mesic cropping systems, but its importance was not systematically documented for semiarid rangelands. Field studies showed that inclusion of legumes as well as shrubs in crested wheatgrass plantings markedly increased the amount and quality of forage even on semiarid rangelands. Dr. Johnson formulated, designed, and conducted field studies to estimate biological nitrogen fixation in a number of introduced and native range legume species. **Impact:** These studies were the first to document that legumes growing in severely drought- and temperature-stressed western rangelands biologically fix nitrogen. This work substantiated that legume species do represent a viable alternative for increasing productivity on rangelands receiving less than 350 mm annual precipitation. This work is being used by the Natural Resource Conservation Service and Extension Service in recommending the use of mixed species rather than grass monocultures in rangeland improvement projects in the Intermountain West. Use of these additional species will enhance the production efficiency on millions of acres of rangeland throughout the world.

Research Grants:

As Co-Principal Investigator of USDA Competitive Grants Program sponsored grant, awarded \$50,000 for project entitled "Biological Nitrogen Fixation in Semiarid Western Rangelands." 1979-1981.

Received \$83,000 as Co-Principal Investigator from the USDA-OICD Binational Research Program for project with Spain entitled "Selection and Evaluation of *Trifolium* germplasm and *Rhizobium* strains." 1984-1988.

As Co-Principal Investigator of a Western Regional Integrated Pest Management Competitive Grant Program project, awarded \$81,000 for project entitled "The Interactive Effect of *Meloidogyne hapla* and *Phytophthora megasperma* on *Rhizobium* Nodulation, Nitrogen Fixation, Yield, and Mortality of *Phytophthora* Resistant and Susceptible Alfalfa." 1985-1988.

Granted \$87,000 by the USDA-CSRS Competitive Grants Program as Principal Investigator for project entitled "Biological Nitrogen Fixation in Co-Evolved *Rhizobium* and *Medicago falcata* Ecotypes." 1985-1988.

Received \$77,000 from the USDA-CSRS Competitive Grants Program as Principal Investigator for project entitled "Stable Isotope Composition: Potential for Screening Range Forages." 1987-1989.

Competitively awarded \$43,600 from the USDA-ARS Research Associate Program as Principal Investigator to fund a post-doctoral scientist to work on project entitled "Carbon Isotopic Composition: A Potential Tool for Selecting Crops with Improved Performance Under Drought." 1990-1991.

Competitively selected as Principal Investigator for four separate projects to collect forage germplasm as part of agricultural exchange program through the USDA's Foreign Agricultural Service Office of International Cooperation and Development (USDA-FAS-OICD) and the Ministry of Agriculture in the People's Republic of China. 1991, 1993, 1997, 2000.

Granted \$77,000 from the USDA-CSRS Competitive Grants Program as Principal Investigator for project entitled "Genetic Improvement of Water-Use Efficiency via Carbon Isotope Discrimination." 1992-1994.

Selected to receive a total of \$150,000 from the USDA Germplasm Exploration Fund to collect forages and reduced-input turf grasses including Kazakhstan in (1992), Mongolia (1994, 1996, 1998), China (2000), Kyrgyzstan (2006), and Russia (1988, 2007, 2008).

Competitively awarded \$100,000 from USDA-ARS Research Associate Program as Principal Investigator to fund a post-doctoral scientist to work on project entitled "Carbon Isotope Discrimination: Germplasm Enhancement for More Efficient Water Use." 1996-1998.

In cooperation with Dr. Harvey Blackburn at the U.S. Sheep Station awarded USDA-ARS Headquarters Grant (\$212,055) for collaborative research with International Center for Agricultural Research in Dry Areas (ICARDA) in Central Asia. 1997-2002.

As Principal Investigator, received \$79,490 from USDA Competitive Grants Office for project entitled "N-Assimilation in Rangeland Grass Establishment: Perennials vs Weedy Annuals." 1998-2001.

As team member and coordinator of the CO₂ flux subproject, received grants totaling \$500,000 for five-year period from Global Livestock/Collaborative Research Support Program (GL/CRSP) through University of California-Davis for project entitled "Integrated Tools for Livestock Development and Rangeland Conservation in Central Asia" conducted in Kazakhstan, Uzbekistan, and Turkmenistan. 1998-2003.

As Co-Principal Investigator received \$53,500 from the USDA-Foreign Agricultural Service for project "Collaborative Evaluation of Mongolian Forage Germplasm Collections" and preparation and publication of English/Mongolia book entitled "Forage Plants in Mongolia" with collaborating scientists from the Research of Animal Husbandry in Ulaanbaatar, Mongolia. 1999-2003.

As team coordinator, facilitated \$250,000 in collaborative funding for multi-institutional CO₂ flux scaling project (\$50,000 from ARS research locations, \$50,000 from ARS Headquarters, and \$150,000 from the Global Livestock/Collaborative Research Support Program). 2002-2003.

As Co-Principal Investigator, received \$65,000 from the U.S. Forest Service Shrub Sciences Lab for project on North American native entitled "Great Basin Native Plant Selection and Increase Project." 2004-2008.

Special Invitations (20 most significant):

- a. Invited to present a paper and author a book chapter "Improvement of Perennial Herbaceous Plants for Drought-Stressed Western Rangelands." U.S.-Australia Workshop on Adaptation of Plants to Water and High Temperature Stress, Carnegie Institution of Washington, Stanford University, California. November 6-10, 1978.
- b. Invited to organize a special symposium session and edit a book entitled "Special Management Needs of Alpine Ecosystems." This highlighted session and volume brought together outstanding specialists in alpine ecology and identified key knowledge gaps relating to the management of alpine tundra areas. Soc. for Range Manage. Annual Meeting. Casper, Wyoming. February 14, 1979.
- c. Invited to present a paper and author a book chapter "Plant Improvement for Semiarid Rangelands: Approach for Increasing Drought Resistance and Possibilities for Enhancing Nitrogen Fixation" at ICARDA/UNDP Workshop on Water and Nitrogen in Rainfed Farming Systems in Mediterranean-type Environments, International Center for Agricultural Research in the Dry Areas, Aleppo, Syria. January 13-18, 1980.
- d. Invited to preside as Chairman over symposium "Plant-Microorganism Interactions in N₂-Fixation" and presented and authored a paper entitled "Forage Yield and Quality Contributions from a Grass-Legume-Shrub Planting on a Semiarid Rangeland." XIV International Grassland Congress, Lexington, Kentucky. June 15-24, 1981.
- e. While in Australia on a nine-month cooperative research leave as a CSIRO Visiting Scientist, invited to present a series of seven seminars at various universities and research institutions across Australia at Canberra, Deniliquin, Perth, Adelaide, Alice Springs, and Brisbane. (1981-82).
- f. Invited to present and author paper "Improved Rangeland Species: A Physiological Perspective" as part of Symposium on Ecophysiology of Rangeland Plants. Second International Rangeland Congress, Adelaide, Australia. May 13-18, 1984.
- g. Invited to present seminar "Plant Improvement for the Semiarid Rangelands of the Western U.S.A." Indian Grassland and Fodder Research Institute, Jhansi, India. January 28, 1988. Also asked to present same seminar at the National Bureau of Plant Genetic Resources, New Delhi, India. February 2, 1988.
- h. Invited to preside as Chairman over Symposium "Functioning and Productivity of Rangeland Ecosystems" and presented and authored paper entitled "Carbon Isotope Discrimination in Crested Wheatgrass: Relationship to Physiological Characteristics." IV International Rangeland Congress, Montpellier, France. April 22-26, 1991.

- i. Invited to present paper and author a book chapter "Genotypic and Environmental Variation for Carbon Isotope Discrimination in Crested Wheatgrass, a Perennial Forage Grass." 15th Annual International Symposium in Plant Physiology, University of California, Riverside, California. January 9-11, 1992.
- j. Invited to deliver plenary paper entitled "Possible Germplasm Evaluation Procedures for Water-limited, Over grazed Environments in Patagonia" and served on panel to make recommendations for future conservation actions. International Workshop on Plant Genetic Resources, Desertification, and Sustainability, Rio Gallegos, Argentina. November 7-11, 1994.
- k.
 - l. Asked to serve as Program Co-Chair in charge of organizing and executing all aspects of the scientific program. Fifth International Rangeland Congress, Salt Lake City, UT. July 23-28, 1995.
 - m. Invited to present paper entitled "Evaluation of Water-Use Efficiency in Semiarid Range Grasses and Legumes." Workshop on Patagonian Germplasm Collection and Utilization, Bariloche, Argentina. March 2-5, 1996.
 - n. Presented invitational seminar "Forage Germplasm Improvement for Semiarid Rangelands of the Western U.S." Xinjiang Agricultural University, Urumqi, China. August 18, 1997.
 - o. Invited to present seminar "CO₂ Fluxes on Sagebrush Steppe Rangelands in the Western U.S.A." International Center for Research in Dry Areas (ICARDA), Aleppo, Syria. March 19, 1998.
 - p. Presented invitational seminars "Forage Germplasm Collection and Improvement at the USDA-ARS Forage and Range Research Laboratory" and "Germplasm Collection: Basis for Forage Improvement Programs" at Sichuan Grassland Research Institute, Hongyuan, China on August 29, 2000 and Ganzi Prefecture Institute of Research for Animal Husbandry, Kangding, Sichuan, China. September 9, 2000.
 - q. Invited to present paper "Overseas and Domestic U.S. Exploration for Cool-season Grass Germplasm" at special symposium on the U.S. National Plant Germplasm System. Crop Science Society of America Annual Meeting, Charlotte, NC. October 25, 2001.
 - r. Invited to deliver keynote presentation and author a proceeding paper "Improved Forages for Rangelands and Pasturelands of the Western U.S.A.: Possibilities for Their Use in Southern Chile." Instituto de Investigaciones Agropecuarias, Punta Arenas, Chile. December 11, 2002.
 - s. Invited to present seminar "Forage Improvement Research for Sagebrush-Steppe Ecosystems of the Western U.S.A." Grassland Research Institute, China Agricultural University, Beijing, China. October 6, 2003.

t. Invited to present a series of five seminars on rangeland ecology and plant physiology at Beijing Forestry University in Beijing, the Grassland Research Institute, and Inner Mongolia Agricultural University, Hohhot, Inner Mongolia, China. October 23 to November 1, 2006.

u. Invited to deliver a keynote presentation and invited paper “Collection and Domestication of Rangeland Plants with Emphasis on Mongolia and China” at joint International Grassland Congress/International Rangeland Congress at Hohhot, Inner Mongolia, China. July 3, 2008.

Participation in Professional and Honorary Societies (20 most significant):

Society for Range Management

Member, Board of Directors, Northern Chapter of the Utah Section of Society for Range Management. 1978-1981.

Member and Co-Chair, Affiliations Committee, Society for Range Management. Liaison with the American Society of Agronomy, 1979-1981. Co-Chairman, 1981-1983.

Member and Chair, Program Committee for the Annual Meeting, Utah Section of the Society for Range Management. 1988, 1989.

President-Elect, President, and Past President of the Northern Chapter of the Utah Section of the Society for Range Management. 1988-1990.

Member, Research Affairs Committee, Society for Range Management. 1988-1990; Chairman, 1991.

Member, Affiliations Committee, Crop Science Society of America. Liaison with the Society for Range Management, 1989-1993.

President-Elect, President, Past President. Utah Section of the Society for Range Management. 1991-1993.

Member, International Affairs Committee, Society for Range Management. 1993-1995.

Member and Chair, Publications Committee, Society for Range Management, 1993-1996; Chair, 1995.

Co-Chair, Society for Range Management Planning Committee for 2004 Annual Meetings in Salt Lake City, UT. 2001-2004.

Member and Co-Chair, Annual Meeting Planning Committee, Society for Range Management. 2003-2006.

Member, Nominations Committee, Society for Range Management. 2001-2007.

Member, Finance Committee, Society for Range Management. 1997-2008.

Crop Science Society of America/American Society of Agronomy

Member, Multi-Society Forage and Grassland Terminology Committee, representing the American Society of Agronomy. 1989-1990.

Associate Editor, Agronomy Journal. 1989-1991.

Associate Editor, Crop Science. 1995-1997.

Member, Frank N. Meyer Medal Committee for Plant Genetic Resources for Crop Science Society of America. 1997-2001.

Member, Forage, Grassland, and Range Resources Committee, American Society of Agronomy. 1997-1999.

International Rangeland Congress

Co-Chairman, Program Committee for Fifth International Rangeland Congress. 1995.

Elected to Continuing Committee of International Rangeland Congress as North American Representative. 2008-2014.

Participation in Professional Meetings, Technical Conferences, Workshops, etc.:

Participated in National Science Foundation, U.S. International Biological Program, Tundra Biome Meetings. Attended 7 meetings and made 5 presentations. 1972-1975.

Participated in Society for Range Management. Attended 16 annual meetings of the Society for Range Management and made 16 presentations. 1974-present.

Participated in Crop Science Society of America and American Society of Agronomy. Attended 11 annual meetings and made 10 presentations. 1976-present.

Participated in U.S.-Australia Cooperative Science Program Workshop on Plant Response to Salinity at the U.S. Salinity Laboratory. 1976.

Participated in three annual meetings of the Grass Breeder's Work Planning Conference. 1977-1985.

Served as Utah's representative of W-126 Regional Research Project entitled "Physiological Criteria for Forage Plant Breeding". Attended 10 meetings and made 10 presentations. 1977-1990.

Attended XIII International Botanical Congress in Sydney, Australia. 1981.

Attended annual meeting of the Spanish Society of Nitrogen Fixation and developed cooperative research plans for U.S.-Spain Agricultural Program in Seville, Spain. 1985.

Presented paper at North American Rhizobium Conference and Workshop on Factors Limiting Biological Nitrogen Fixation in Developing Countries in Kahului, Hawaii. 1985.

Attended 4 annual meetings and gave 4 presentations at annual meetings of the National Alfalfa Improvement Conference. 1980-1989.

Participated in International Rangeland Congress. Attended 4 meetings and made 4 presentations. 1986-2008.

Presented paper at XVI International Grassland Congress in Nice, France. 1989.

Participated in working discussions and served as Chairman for Physiology Work Group at USDA-ARS Forage Grass and Pasture Research Planning Workshop in Raleigh, North Carolina. 1991.

Presented paper at Symposium on the Ecology, Management and Restoration of Intermountain Annual Rangelands. 1992.

Delivered paper at Second International Triticeae Symposium. 1994.

Participated as USDA-ARS representative on the Technical Committee of WCC-091 "Improving Stress Resistance of Forages in the Western U.S.". Attended 2 annual meetings and made 2 presentations. 1996-1997.

Participated in working discussions and presented reports on CO₂ flux work at annual meetings of USDA-ARS Rangeland CO₂ Flux Network. Attended 7 meetings and made 7 presentations. 1997-2003.

Participated in work coordinating discussions for Global Livestock/ Collaborative Research Support Program (GL/CRSP) project "Integrated Tools for Livestock Development and Rangeland Conservation in Central Asia". Attended 4 meetings and made 4 presentations. 1998-2002.

Participated in organizing and conducting the USDA-ARS National Program Workshop for USDA-ARS Forage and Pastures National Program. 1999.

Organized invitational symposium and gave presentation at annual meetings of the Agricultural and Forest Meteorology and American Meteorological Society. 2002.

Participated in and made presentation at USDA-ARS National Program Workshop for Global Change. 2004.

Presented invited keynote paper at International Grassland/International Rangeland Congress in Hohhot, China. 2008.

Professional Advisory and Consulting Activities (20 most significant):

- a. Provided numerous technical reviews of manuscripts for various journals including: Crop Science, Journal of Range Management, Agronomy Journal, Ecology, Canadian Journal of Plant Science, Arctic and Alpine Research, Plant Physiology, and Irrigation Science. 1978-Present.
- b. Asked to review and evaluate project proposals for plant physiological work by the Utah Agricultural Experiment Station, Southwest Consortium on Plant Genetics and Water Resources, the National Science Foundation's Division of International Programs, USDA Competitive Grants Program, National Research Council, and the U.S.-Israel Agricultural Research and Development Fund (BARD). 1979-Present.
- c. Invited to review and evaluate the field progress of BID-CONACYT funded range improvement project in northern Mexico entitled "Adaptation and Productivity of Introduced Cool Season Grass Species in the Mountainous Area of Chihuahua." Site reviews in Chihuahua, Mexico. 1981, 1982, 1983.
- d. Invited to serve as External Reviewer for dissertation examination for Ph.D. candidate in the Research School of Biological Sciences at the Australian National University in Canberra, Australia. University of Florida, Gainesville, Florida. 1987.
- e. Asked by the Ministry of Agriculture in Mexico (INIFAP-SARH) to provide advice and consultation on ongoing and future range ecology research in the state of Chihuahua. 1987.
- f. Invited to provide advice and consultation on ongoing and future research program on rangeland research at Xinjiang August 1st Agricultural College, Urumqi, People's Republic of China. 1990.
- g. Asked by Board on Science and Technology for International Development (BOSTID) of the National Academy of Sciences and served on site-review team for Pakistan Agricultural Research Program at several locations throughout Pakistan. 1991.
- h. Invited to serve as External Examiner for dissertation examination for Ph.D. candidate in the Department of Crop Science and Plant Ecology at the University of Saskatchewan, Saskatoon, Sask., Canada. 1995.
- i. Invited to be a member of joint Chilean-Argentine Expedition to the southern foothills of the Andes Mountains for collecting forage germplasm to combat desertification in southern Patagonia. 1996.
- j. Invited by University of California-Davis to participate in discussions to finalize collaborative research linkages for Global Livestock/Collaborative Research Support Program (GL/CRSP) project entitled "Integrated Tools for Livestock Development

and Rangeland Conservation in Central Asia.” Ashgabat, Turkmenistan and Astana, Kazakhstan, 1998.

k. Invited by USDA-Foreign Agricultural Service to finalize plans for a three-year collaborative research project with Mongolian scientists to evaluate Mongolian forage germplasm. Ulaanbaatar, Mongolia, 1999.

l. Invited by USDA-Foreign Agricultural Service to represent ARS on ten-member U.S. delegation to meetings of the U.S.-China Joint Working Group for Scientific and Technical Exchanges in Agriculture. Beijing, Yangling, and Guangzhou, China, 2000.

m. Invited by The World Bank to participate in mission to recommend location and focus of new \$12 million Kazakhstan Dryland Management Project. Almaty and Astana, Kazakhstan. 2000.

n. Asked by USDA-ARS Office of International Research Programs to lead discussions and advise on policy issues concerning mutually beneficial research related to rangeland and germplasm research between U.S. and China. Beijing and Lanzhou, China. 2002.

o. Invited by USDA-Foreign Agricultural Service to review collaborative project, hold discussions with staff at the U.S. Embassy, and participate in special release ceremony by the Mongolian Ministry of Agriculture for collaborative book “Forage Plants in Mongolia.” Ulaanbaatar, Mongolia, 2003.

p. Invited by China Agricultural University and Hebei Province to review forage research projects at China Agricultural University and the Animal Husbandry Research Institute at the Chinese Academy of Agricultural Sciences, and the Grassland research Institute and Inner Mongolia Agricultural University. Beijing and Hohhot, China, 2004.

q. Invited by Samarkand State University, Karakul Sheep and Desert Ecology Research Institute, and Samarkand Branch of the Uzbekistan Academy of Sciences to review and discuss ongoing and future research projects involving rangeland research. Samarkand, Uzbekistan, 2005.

r. Invited by the Director-General of the N.I. Vavilov Research Institute of Plant Industry in St. Petersburg, Russia to join teams to collect forage and reduced-maintenance germplasm in northwest Russia and the South Ural Mountain Region of Russia. 2007, 2008.

Special Assignments (20 most significant):

a. Regularly presents guest lectures to biology and geography classes at Logan High School. 1978-Present.

- b. Asked by Dr. H C Cox, USDA-ARS Western Regional Administrator, to serve on a five-member panel to choose the Western Region nominee for ARS Research Scientist of the Year Award. Oakland, California. 1983.
- c. Regularly asked to serve as Acting Research Leader in absence of Research Leader. 1985-Present.
- d. Asked by Utah State University to serve on Organizing Committee for International Conference on Measurement of Soil and Plant Water Stress held at Logan, Utah. 1987.
- e. Invited to serve as panel member to review and prioritize proposals for the USDA Competitive Grants Program entitled "Plant Response to Environmental Stress." Washington, DC. 1987, 1988.
- f. Requested by the USDA Far Eastern Regional Research Office to travel to India and assist Indian scientists in the development of proposals to the U.S.-India Fund for the collection of forage germplasm in northern India. New Delhi, India. 1988.
- g. Requested by USDA-ARS National Program Staff to initiate and coordinate the English translation of the Russian book by N. I. Vavilov entitled "Origin and Geography of Cultivated Plants." 1989-1992.
- h. Served as judge for Mount Logan Middle School Science Fair; arranged for presentation of Agricultural Award to top two students. 1991-2004.
- i. Served as USDA-ARS representative on Core Committee and Selection Committee for Utah's Nature High Youth Camp (collaborative workforce diversity program). 1993-Present.
- j. Organized and hosted scientific tour to key labs, field sites, and universities in Utah, Idaho, Montana, Wyoming, and Colorado for scientists from South Africa, Australia, Nepal, and Argentina. July 28-Aug. 9, 1995.
- k. Requested by Utah State University to serve on Selection Committees for Department Head of Range Science (1985), faculty member in range improvement (1987), NRCS grazing land specialist (1995), Dean of the College of Natural Resources (1997), faculty member in water relations (2000), and faculty member in range ecology (2001).
- l. Organized and hosted scientific tour covering all aspects of forage germplasm-related research to key locations in Utah, Idaho, Washington, Montana, Wyoming, Colorado, and Maryland for scientists from Argentina, Chile, and China. June 8-July 2, 1998.

- m. Recruited and served as Supervisor to one Visiting Scientist from New Zealand (Dr. W. L. Lowther, 1985), two Visiting Scientists from China (Dr. Yang Zhuomeng and Dr. Li Baojun), and three Postdoctoral Research Associates (Dr. K. A. Lawson, 1986-1988; Dr. J. J. Read, 1989-1991; Dr. N.Z. Saliendra, 1995-2004).
- n. Asked by Dr. Allen R. Dedrick, USDA-ARS Associate Deputy Administrator for Natural Resources and Systems, to serve assignment as Acting National Program Leader for Forage and Pastures. November 1, 1998 to January 8, 1999.
- o. Served on Planning Committee for USDA-ARS Rangeland, Pasture and Forages National Program Workshop held in Kansas City, MO, September 13-17, 1999. December 1998 to September 1999.
- p. Invited to serve on USDA-ARS National Program Writing Team for drafting National Program Plan for Range, Pasture, and Forage National Program. September 1998 to March 2000.
- q. Conceived plans, wrote proposal and received funding from ARS and USDA-FAS, and organized and hosted trip for nine visiting scientists from Mongolia and China to visit key U.S. germplasm locations. June 5-July 2, 2001.
- r. Invited by the USDA-ARS National Program Staff to participate in visioning discussions with seed industry representatives, scientists from Oregon State University, ARS scientists, and National Program Staff at Corvallis, OR, concerning program development for structuring research activities with the Chinese Ministry of Agriculture. September 23-34, 2001.
- s. Invited by USDA-ARS National Program Staff to give presentation concerning the ARS Rangeland CO₂ Flux Network to the National Program 204 Workshop in Denver, CO. May 28-31, 2002.

Other Significant Information:

Dr. Johnson has an adjunct appointment in the Wildland Resources Department and Department of Plants, Soils, and Climate at Utah State University, is a member of the Graduate Faculty, and maintains close ties with departmental activities through guest presentations in graduate and undergraduate classes, academic and search committee assignments, and active participation in various departmental seminars. Dr. Johnson recruited and served as Major Professor for 3 M.S. and 6 Ph.D. students and is or has been on the graduate committees of an additional 13 M.S. and 12 Ph.D. students. He has served on two Utah State University Tenure and Promotion Committees for two faculty members and has served on Selection Committees for Department Head of Range Science (1985), faculty member in range improvement (1987), NRCS grazing land specialist (1995), Dean of the College of Natural Resources (1997), faculty member in water relations (2000), and faculty member in range ecology (2001). He actively participates in regular faculty meetings and annual work planning conferences. Dr. Johnson also served as President of the College of Natural Resources Alumni Association and was presented the 2003

Professional Achievement Award by the College of Natural Resources and Utah State University.

He has provided significant input and guidance to ARS programs at both the national and international level during his three-month service as Acting National Program Leader for Forage and Pastures on the National Program Staff (1998-1999), his active role on the Planning Committee for the ARS Rangeland, Pasture, and Forages National Program Workshop (1999), his service as a member of the National Program Writing Team for drafting the National Program Plan for the Rangeland, Pasture, and Forage National Program (1998-1999), service as ARS representative on an official USDA delegation to China (2000), and regular advice to the ARS Office of International Research Programs and USDA-Foreign Agricultural Service concerning research activities in China, Mongolia, and Central Asia.

Dr. Johnson served as Secretary (1977, 1986, 1989), Vice Chairman (1978, 1990), Chairman (1979, 1991) of W-126 Western Regional Research Project entitled "Physiological Criteria for Forage Plant Breeding." In 1988, Dr. Johnson was offered (but declined) the position as Research Leader of the Rangeland Resources Research Unit at the USDA-ARS Crops Research Laboratory at Fort Collins, CO. In 1997, he was offered (but declined) the position as Department Head of the Plant, Soil, and Environmental Science Department (29 faculty members) at Montana State University in Bozeman, MT.

Peer-Reviewed Journal Articles:

Johnson, D. A., and M. M. Caldwell. 1974. Field measurements of photosynthesis and leaf growth rates of three alpine plant species. *Arctic Alpine Research* 6: 245-251.

Tieszen, L. L., **D. A. Johnson**, and M. M. Caldwell. 1974. A portable system for the measurement of photosynthesis using ^{14}C -carbon dioxide. *Photosynthetica* 8: 151-160.

Tieszen, L. L., **D. A. Johnson**, and M. L. Alessio. 1974. Translocation of photosynthetically assimilated carbon-14 in three arctic grasses *in situ* at Barrow, Alaska. *Canadian Journal of Botany* 52: 2189-2193.

Tieszen, L. L., and **D. A. Johnson**. 1975. Seasonal pattern of photosynthesis in individual grass leaves and other plant parts in arctic Alaska with a portable $^{14}\text{CO}_2$ system. *Botanical Gazette* 136: 99-105.

Johnson, D. A., and M. M. Caldwell. 1975. Gas exchange of four arctic and alpine tundra plant species in relation to atmospheric and soil moisture stress. *Oecologia* 21: 93-108.

Johnson, D. A., and M. M. Caldwell. 1976. Water potential components, stomatal function, and liquid phase water transport resistances of four arctic and alpine species in relation to moisture stress. *Physiologia Plantarum* 36: 271-278.

Johnson, D. A., and L. L. Tieszen. 1976. Aboveground biomass allocation, leaf growth, and photosynthesis patterns in tundra plant forms in arctic Alaska. *Oecologia* 24: 159-173.

- Johnson, D. A.**, and R. W. Brown. 1977. Psychrometric analysis of turgor pressure response: A possible technique for evaluating plant water stress resistance. *Crop Science* 17: 507-510.
- Johnson, D. A.**, and K. H. Asay. 1978. A technique for assessing seedling emergence under drought stress. *Crop Science* 18: 520-522.
- Brown, R. W., R. S. Johnston, and **D. A. Johnson**. 1978. Rehabilitation of alpine tundra disturbances. *Journal of Soil and Water Conservation* 33: 154-160.
- Johnson, D. A.** 1978. Environmental effects on turgor response in range grasses. *Crop Science* 18: 945-948.
- Chapin, F. S., III, **D. A. Johnson**, and J. D. McKendrick. 1980. Seasonal movements of nutrients in plants of differing growth form in an Alaskan tundra ecosystem: Implications for herbivory. *Journal of Ecology* 68: 189-209.
- Asay, K. H., and **D. A. Johnson**. 1980. Screening for improved stand establishment in Russian wild ryegrass. *Canadian Journal of Plant Science* 60: 1171-1177.
- Johnson, D. A.**, M. D. Rumbaugh, and K. H. Asay. 1981. Plant improvement for semi-arid rangelands: Possibilities for increasing drought resistance and enhancing nitrogen fixation. *Plant and Soil* 58: 279-303.
- Johnson, D. A.**, and M. D. Rumbaugh. 1981. Nodulation and acetylene reduction by certain rangeland legume species under field conditions. *Journal of Range Management* 34: 178-181.
- Rumbaugh, M. D., and **D. A. Johnson**. 1981. Screening alfalfa germplasm for seedling drought resistance. *Crop Science* 21: 709-713.
- Caldwell, M. M., J. H. Richards, **D. A. Johnson**, R. S. Nowak, and R.S.Dzurec. 1981. Coping with herbivory: Photosynthetic capacity and resource allocation in two semiarid *Agropyron* bunchgrasses. *Oecologia* 50: 14-24.
- Johnson, D. A.**, M. D. Rumbaugh, L. S. Willardson, K. H. Asay, D.N. Rinehart, and M. R. Aurasteh. 1982. A greenhouse line-source sprinkler system for evaluating plant response to a water application gradient. *Crop Science* 22: 441-444.
- Rumbaugh, M. D., **D. A. Johnson**, and G. A. Van Epps. 1982. Forage yield and quality in a Great Basin shrub, grass, and legume pasture experiment. *Journal of Range Management* 35: 604-609.
- Rumbaugh, M. D., and **D. A. Johnson**. 1983. Changes in alfalfa cultivars grown in a semiarid environment. *Crop Science* 23: 477-480.

- Rumbaugh, M. D., **D. A. Johnson**, and D. N. Rinehart. 1983. Stand density, shoot weight, and acetylene reduction activity of alfalfa populations subjected to field and greenhouse moisture gradients. *Crop Science* 23: 784-789.
- Asay, K. H., and **D. A. Johnson**. 1983. Breeding for drought resistance in range grasses. *Iowa State Journal of Research* 57: 441-455.
- Johnson, D. A.**, R. A. Richards, and N. C. Turner. 1983. Yield, water relations, gas exchange, and surface reflectances of near-isogenic wheat lines differing in glaucousness. *Crop Science* 23: 318-325.
- Asay, K. H., and **D. A. Johnson**. 1983. Genetic variability for characters affecting stand establishment in crested wheatgrass. *Journal of Range Management* 36: 703-706.
- Rumbaugh, M. D., and **D. A. Johnson**. 1984. Nodulation and acetylene reduction by two legumes with rhizobia indigenous to northern Great Basin Soils. *Great Basin Naturalist* 44: 151-158.
- Rumbaugh, M. D., K. H. Asay, and **D. A. Johnson**. 1984. Influence of drought stress on genetic variances of alfalfa and wheatgrass seedlings. *Crop Science* 24: 297-303.
- Johnson, D. A.**, M. L. Tonnet, and R. A. Richards. 1984. Estimation of epicuticular wax amounts in wheat using wide-line proton magnetic resonance. *Crop Science* 24: 679-682.
- Asay, K. H., D. R. Dewey, F. B. Gomm, **D. A. Johnson**, and J. R. Carlson. 1985. Registration of 'Hycrest' crested wheatgrass. *Crop Science* 25: 368-369.
- Asay, K. H., D. R. Dewey, F. B. Gomm, **D. A. Johnson**, and J. R. Carlson. 1985. Registration of 'Bozoisky-Select' Russian wildrye. *Crop Science* 25: 575-576.
- Johnson, D. A.** 1985. Plant establishment characteristics for successful revegetation of semiarid rangeland: crested wheatgrass, a case study. *Scientific Reviews of Arid Zone Research* 3: 149-200.
- Rumbaugh, M. D., and **D. A. Johnson**. 1986. Annual medics and related species as reseeding legumes for northern Utah pastures. *Journal of Range Management* 39: 52-58.
- Chapin, F. S., J. D. McKendrick, and **D. A. Johnson**. 1986. Seasonal changes in carbon fractions in Alaskan tundra plants of differing growth form: Implications for herbivory. *Journal of Ecology* 74: 707-731.
- Young, J. A., R. A. Evans, **D. A. Johnson**, and K. H. Asay. 1986. Cold-temperature germination of *Elytrigia repens* X *Pseudoroegneria spicata* hybrids. *Journal of Range Management* 39: 300-302.

- Johnson, D. A.**, and M. D. Rumbaugh. 1986. Field nodulation and acetylene reduction activity of high-altitude legumes in the western United States. *Arctic Alpine Research* 18: 171-179.
- Galeano, R., M. D. Rumbaugh, **D. A. Johnson**, and J. L. Bushnell. 1986. Variation in epicuticular wax content of alfalfa cultivars and clones. *Crop Science* 26: 703-706.
- Richards, R. A., H. M. Rawson, and **D. A. Johnson**. 1986. Glauousness in wheat: Its development and effect on water-use efficiency, gas exchange and photosynthetic tissue temperatures. *Australian Journal of Plant Physiology* 13: 465-473.
- Willardson, L. S., D. M. Oosterhuis, and **D. A. Johnson**. 1987. Sprinkler selection for line-source irrigation systems. *Irrigation Science* 8: 65-76.
- Lowther, W. L., **D. A. Johnson**, and M. D. Rumbaugh. 1987. Distribution and symbiotic effectiveness of *Rhizobium meliloti* in rangeland soils of the Intermountain West. *Journal of Range Management* 40: 264-267.
- Lowther, W. L., M. D. Rumbaugh, and **D. A. Johnson**. 1987. Populations of *Rhizobium meliloti* in areas with rangeland alfalfa. *Journal of Range Management* 40: 268-271.
- Wraith, J. M., **D. A. Johnson**, R. J. Hanks, and D. V. Sisson. 1987. Soil and plant water relations in a crested wheatgrass pasture: Response to spring grazing by cattle. *Oecologia* 73: 573-578.
- Jefferson, P. G., **D. A. Johnson**, and M. D. Rumbaugh. 1988. Genetic analysis of epicuticular wax production in alfalfa. *Genome* 30: 896-899.
- Jefferson, P. G., **D. A. Johnson**, M. D. Rumbaugh, and K. H. Asay. 1989. Water stress and genotypic effects on epicuticular wax production of alfalfa and crested wheatgrass in relation to yield and excised leaf water loss rate. *Canadian Journal of Plant Science* 69: 481-490.
- Jefferson, P. G., **D. A. Johnson**, and K. H. Asay. 1989. Epicuticular wax production, water status, and leaf temperature in Triticeae range grasses of contrasting visible glauousness. *Canadian Journal of Plant Science* 69: 513-519.
- Johnson, D. A.**, T. M. J. Ford, M. D. Rumbaugh, and B. Z. Richardson. 1989. Morphological and physiological variation among ecotypes of sweetvetch (*Hedysarum boreale* Nutt.). *Journal of Range Management* 42: 496-501.
- Eardly, B. D., L. A. Materon, N. H. Smith, **D. A. Johnson**, M. D. Rumbaugh, and R. K. Selander. 1990. Genetic structure of natural populations of the nitrogen-fixing bacterium *Rhizobium meliloti*. *Applied and Environmental Microbiology* 56: 187-194.

- Asay, K. H., and **D. A. Johnson**. 1990. Genetic variances for forage yield in crested wheatgrass at six levels of irrigation. *Crop Science* 30: 70-82.
- Johnson, D. A.**, K. H. Asay, L. L. Tieszen, J. R. Ehleringer, and P.G. Jefferson. 1990. Carbon isotope discrimination: Potential in screening cool-season grasses for water-limited environments. *Crop Science* 30: 338-343.
- Gray, F. A., G. D. Griffin, **D. A. Johnson**, J. W. Eckert, and J. E. Kazimir. 1990. Interrelationships between *Meloidogyne hapla* and *Phytophthora megasperma* f. sp. *medicaginis* in seedling damping-off and root infection of alfalfa. *Phytopathology* 80: 228-232.
- Rumbaugh, M. D., K. L. Lawson, and **D. A. Johnson**. 1990. Paired rhizobia general and specific effects on subterranean clover seedling growth. *Crop Science* 30: 682-685.
- Ehleringer, J. R., J. W. White, **D. A. Johnson**, and M. Brick. 1990. Carbon isotope discrimination, photosynthetic gas exchange, and transpiration efficiency in beans and range grasses. *Acta Oecologia* 11:611-625.
- Rumbaugh, M. D., **D. A. Johnson**, and J. R. Carlson. 1991. Registration of ARS-2678 kura clover germplasm. *Crop Science* 31: 497.
- Aguirre, L., and **D. A. Johnson**. 1991. Root morphological development in relation to shoot growth in seedlings of four range grasses. *Journal of Range Management* 44: 341-346.
- Aguirre, L., and **D. A. Johnson**. 1991. Influence of temperature and cheatgrass competition on seedling development of two bunchgrasses. *Journal of Range Management* 44: 347-354.
- Johnson, D. A.**, and L. Aguirre. 1991. Effect of water on morphological development in seedlings of three range grasses: Root branching patterns. *Journal of Range Management* 44: 355-360.
- Read, J. J., **D. A. Johnson**, K. H. Asay, and L. L. Tieszen. 1991. Carbon isotope discrimination, gas exchange, and water-use efficiency in crested wheatgrass clones. *Crop Science* 31: 1203-1208.
- Rumbaugh, M. D., and **D. A. Johnson**. 1991. Field acetylene reduction rates of *Lupinus argenteus* along an elevational gradient. *Great Basin Naturalist*. 51: 192-197.
- Read, J. J., **D. A. Johnson**, K. H. Asay, and L. L. Tieszen. 1992. Carbon isotope discrimination: relationship to yield, gas exchange, and water-use efficiency in field-grown crested wheatgrass. *Crop Science* 32: 168-175.
- Johnson, D. A.**, and K. H. Asay. 1993. Viewpoint: Selection for improved drought response in cool-season grasses. *Journal of Range Management* 46: 194-202.

- Mayland, H. F., **D. A. Johnson**, K. H. Asay, and J. J. Read. 1993. Ash, carbon isotope discrimination, and silicon as estimators of transpiration efficiency in crested wheatgrass. *Australian Journal of Plant Physiology* 20: 361-369.
- Read, J. J., K. H. Asay, and **D. A. Johnson**. 1993. Divergent selection for carbon isotope discrimination in crested wheatgrass. *Canadian Journal of Plant Science* 73: 1027-1035.
- Rumbaugh, M. D., **D. A. Johnson**, and B. M. Pendery. 1993. Germination inhibition of alfalfa by two-component salt mixtures. *Crop Science* 33: 1046-1050.
- Griffin, G. D., F. A. Gray, **D. A. Johnson**, and D. L. Crebs. 1993. Pathological relationships of *Meloidogyne hapla* and *Phytophthora megasperma* f. sp. *medicaginis* in *Medicago sativa* L.: Importance of inoculation timing, soil texture, and temperature. *Nematropica* 23: 183-193.
- Clark, D. H., **D. A. Johnson**, K. D. Kephart, and N. A. Jackson. 1995. Near infrared reflectance spectroscopy estimation of ^{13}C discrimination in forages. *Journal of Range Management* 48: 132-136.
- Johnson, D. A.**, and M. D. Rumbaugh. 1995. Genetic variation and inheritance characteristics for carbon isotope discrimination in alfalfa. *Journal of Range Management* 48: 126-131.
- Asay, K. H., **D. A. Johnson**, K. B. Jensen, N. J. Chatterton, W. H. Horton, W. T. Hansen and S. A. Young. 1995. Registration of 'Vavilov' Siberian crested wheatgrass. *Crop Science* 35: 1510.
- Asay, K. H., K. B. Jensen, **D. A. Johnson**, N. J. Chatterton, W. T. Hansen, W. H. Horton, and S. A. Young. 1995. Registration of 'Douglas' crested wheatgrass. *Crop Science* 35: 1510-1511.
- Johnson, D. A.**, and K. H. Asay. 1995. Breeding and selection of grasses for improved drought response: A review. *Annals of Arid Zone* 34: 163-178.
- Athar, M., and **D. A. Johnson**. 1996. Nodulation, biomass production, and nitrogen fixation in alfalfa under drought. *Journal of Plant Nutrition* 19: 185-199.
- Asay, K. H., **D. A. Johnson**, K. B. Jensen, W. M. Sarraj, and D. H. Clark. 1996. Potential of new tetraploid germplasm in Russian wildrye. *Journal of Range Management* 49: 439-442.
- Athar, M., and **D. A. Johnson**. 1996. Competitive ability of *Rhizobium meliloti* strains from Pakistan and Nepal for nodulation in three alfalfa accessions. *Vereinigung für Angewandte Botanik* 70: 128-133.

- Athar, M., and **D. A. Johnson**. 1996. Influence of drought on competition between selected *Rhizobium meliloti* strains and naturalized soil rhizobia in alfalfa. *Plant and Soil* 184: 231-241.
- Asay, K. H., N. J. Chatterton, K. B. Jensen, R. R.-C Wang, **D. A. Johnson**, W. H. Horton, A. J. Palazzo, and S. A. Young. 1997. Registration of 'CD-II' crested wheatgrass. *Crop Science* 37: 1023.
- Athar, M., and **D. A. Johnson**. 1997. Effect of drought on the growth and survival of *Rhizobium meliloti* strains from Pakistan and Nepal. *Journal of Arid Environments* 35: 335-340.
- Asay, K.H., and **D. A. Johnson**. 1997. Genotype X competition level interactions in crested wheatgrass (*Agropyron desertorum* Poaceae: Triticeae). *International Journal of Plant Science* 158: 851-855.
- Jones, T. A., D. C. Nielson, D. G. Ogle, **D. A. Johnson**, and S.A. Young. 1998. Registration of Sand Hollow squirreltail germplasm. *Crop Science* 38: 286.
- Arredondo, J. T., and **D. A. Johnson**. 1998. Clipping effects on root architecture and morphology of 3 range grasses. *Journal of Range Management* 51: 207-214.
- Jensen, K. B., K. H. Asay, **D. A. Johnson**, W. H. Horton, A. J. Palazzo, and N. J. Chatterton. 1998. Registration of RWR-Tetra-1 tetraploid Russian wildrye germplasm. *Crop Science* 38: 1405.
- Asay, K. H., **D. A. Johnson**, and A. J. Palazzo. 1998. Parent-progeny relationships for carbon isotope discrimination and related characters in crested wheatgrass. *International Journal of Plant Science* 159: 821-825.
- Arredondo, J. T., T. A. Jones, and **D. A. Johnson**. 1998. Seedling growth of Intermountain perennial and weedy annual grasses. *Journal of Range Management* 51: 584-589.
- Jones, T. A., and **D. A. Johnson**. 1998. Invited synthesis paper: Integrating genetic concepts into planning rangeland seedings. *Journal of Range Management* 51: 594-606.
- Asay, K. H., **D. A. Johnson**, and M. D. Rumbaugh. 1999. Genotype x competition level interactions in alfalfa (*Medicago sativa* L.). *International Journal of Plant Science* 160: 129-134.
- Asay, K. H., K. B. Jensen, W. H. Horton, **D. A. Johnson**, N. J. Chatterton, and S. A. Young. 1999. Registration of 'RoadCrest' crested wheatgrass. *Crop Science* 39: 1535.
- Arredondo, J. T., and **D. A. Johnson**. 1999. Root architecture and biomass allocation of three range grasses in response to non-uniform supply of nutrients and shoot defoliation. *New Phytologist* 143: 373-385.

- Jensen, K. B., K. H. Asay, **D. A. Johnson**, and B. J. Li. 2000. Characterization of Siberian wheatgrass germplasm (*Agropyron fragile*) from Kazakhstan. (Poaceae: Triticeae). *Journal of Range Management* 53: 347-352.
- Gu, Anlin, Yi Jin, and **D. A. Johnson**. 2000. Ecogeographical distribution and utilization of perennial Triticeae rhizomatous species. *Grasslands of China* 6: 21-25.
- Angell, R., T. Svejcar, J. Bates, N. Z. Saliendra, and **D. A. Johnson**. 2001. Bowen ratio and closed chamber carbon dioxide flux measurements over sagebrush steppe vegetation. *Agricultural and Forest Meteorology* 108: 153-161.
- Jensen, K. B., **D. A. Johnson**, K. H. Asay, and K. C. Olson. 2002. Seasonal-accumulated growth and forage quality of range grasses for fall and winter grazing. *Canadian Journal of Plant Science* 82: 329-336.
- Jensen, K. B., K. H. Asay, **D. A. Johnson**, and B. L. Waldron. 2002. Carbon isotope discrimination in orchardgrass and ryegrasses at four irrigation levels. *Crop Science* 42: 1498-1503.
- Asay, K. H., K. B. Jensen, B. L. Waldron, G. Han, **D. A. Johnson**, and T. A. Monaco. 2002. Forage quality of tall fescue across an irrigation gradient. *Agronomy Journal* 94: 1337-1343.
- Gilmanov, T. G., **D. A. Johnson**, and N. Z. Saliendra. 2003. Growing season CO₂ fluxes in a sagebrush-steppe ecosystem in Idaho: Bowen ratio/energy balance measurements and modeling. *Basic and Applied Ecology* 4: 167-183.
- Monaco, T. A., **D. A. Johnson**, J. M. Norton, T. A. Jones, K. J. Connors, J. B. Norton, and M. B. Redinbaugh. 2003. Contrasting responses of Intermountain West grasses to soil nitrogen. *Journal of Range Management* 56: 282-290.
- Jensen, K. B., B. L. Waldron, K. H. Asay, **D. A. Johnson**, and T. A. Monaco. 2003. Forage nutritional characteristics of orchardgrass and perennial ryegrass at five irrigation levels. *Agronomy Journal* 95: 668-675.
- Wylie, B. K., **D. A. Johnson**, E. Laca, N. Z. Saliendra, T. G. Gilmanov, B. C. Reed, L. L. Tieszen, and B. B. Worstell. 2003. Calibration of remotely sensed, coarse resolution NDVI to CO₂ fluxes in a sagebrush-steppe ecosystem. *Remote Sensing of the Environment* 85: 243-255.
- Johnson, D. A.**, N. Z. Saliendra, J. W. Walker, and J. R. Hendrickson. 2003. Bowen ratio versus canopy chamber CO₂ fluxes on sagebrush rangeland. *Journal of Range Management* 56: 517-523.

- Johnson, D. A.**, K. H. Asay, and K. B. Jensen. 2003. Carbon isotope discrimination and yield in 14 cool-season grasses. *Journal of Range Management* 56: 654-659.
- Monaco, T. A., C. T. MacKown, **D. A. Johnson**, T.A. Jones, J.M. Norton, J.B. Norton, and M.G. Redinbaugh. 2003. Nitrogen effects on seed germination and seedling growth. *Journal of Range Management* 56: 646-653.
- Peel, M. D., K. H. Asay, **D. A. Johnson**, and B. L. Waldron. 2004. Forage production of sainfoin across an irrigation gradient. *Crop Science* 44: 614-619.
- Shewmaker, G. E., **D. A. Johnson**, H. F. Mayland, S. A. Martin, and S. B. Hansen. 2004. Elemental uptake in relation to root characteristics of tall fescue. *Communications of Soil Science and Plant Analysis* 35: 1339-1355.
- Norton, J. B., T. A. Monaco, J. M. Norton, **D. A. Johnson**, and T. A. Jones. 2004. Soil morphology and organic matter dynamics under cheatgrass and sagebrush-steppe plant communities. *Journal of Arid Environments* 57: 445-466.
- Jensen, K. B., K. H. Asay, **D. A. Johnson**, and B. L. Waldron. 2004. Carbon isotope discrimination of tall fescue cultivars across an irrigation gradient. *Canadian Journal of Plant Science* 84: 157-162.
- Gilmanov, T. G., **D. A. Johnson**, N. Z. Saliendra, K. Akshalov, and B. K. Wylie. 2004. Gross primary productivity of the true steppe in Central Asia in relation to NDVI: Scaling up CO₂ fluxes. *Environmental Management* 33: S492-S508.
- Wylie, B. K., T. G. Gilmanov, **D. A. Johnson**, N. Z. Saliendra, K. Akshalov, L. L. Tieszen, B. C. Reed, and E. Laca. 2004. Intra-seasonal mapping of CO₂ flux in rangelands of northern Kazakhstan at one-kilometer resolution. *Environmental Management* 33: S482-S491.
- Jones, T. A., D. C. Nielson, S. R. Larson, **D. A. Johnson**, T. A. Monaco, S. L. Caicco, D. G. Ogle, and S. A. Young. 2004. Registration of Fish Creek bottlebrush squirreltail germplasm. *Crop Science* 44: 1879-1880.
- Jones, T. A., D. C. Nielson, S. R. Larson, **D. A. Johnson**, T. A. Monaco, S. L. Caicco, D. G. Ogle, S. A. Young, and J. R. Carlson. 2004. Registration of Toe Jam Creek bottlebrush squirreltail germplasm. *Crop Science* 44: 1880-1881.
- Gilmanov, T. G., **D. A. Johnson**, N. Z. Saliendra, T. J. Svejcar, R. F. Angell, and K. L. Clawson. 2004. Winter CO₂ fluxes above sagebrush-steppe ecosystems in Idaho and Oregon. *Agricultural and Forest Meteorology* 126: 73-88.
- Jensen, K. B., S. R. Larson, B. L. Waldron, and **D. A. Johnson**. 2005. Characterization of hybrids from induced X natural tetraploids of Russian wildrye. *Crop Science* 45: 1305-1311.

- Li, Y. L., **D. A. Johnson**, Y. Z. Su, J. Y. Cui, and T. H. Zhang. 2005. Specific leaf area and leaf dry matter content of plants growing in sand dunes. *Botanical Bulletin of Academia Sinica* 46: 127-134.
- Monaco, T. A., **D. A. Johnson**, and J. E. Creech. 2005. Morphological and physiological plasticity of *Isatis tinctoria*: Responses to contrasting light, soil-nitrogen, and water. *Weed Research* 45: 1-7.
- Jensen, K. B., K. H. Asay, **D. A. Johnson**, S. R. Larson, B. L. Waldron, and A. J. Palazzo. 2006. Registration of 'Bozoisky-II' Russian wildrye. *Crop Science* 46: 986.
- Wolf, A., K. Akshalov, N. Saliendra, **D. A. Johnson**, and E. A. Laca. 2006. Inverse estimation of $V_{c_{max}}$, leaf area index, and the Ball-Berry parameter from carbon and energy fluxes. *Journal of Geophysical Research-Atmospheres* 111: D08S08
doi:10.1029/2005JD005927 (1-18).
- Johnson, D. A.**, D. P. Sheehy, D. Miller, and D. Damiran. 2006. Mongolian rangelands in transition. *Secheresse* 17(1-2): 133-141.
- Sheehy, D. P., D. Miller, and **D. A. Johnson**. 2006. Transformation of traditional pastoral livestock systems in the Tibetan Steppe. *Secheresse* 17(1-2): 142-151.
- Gilmanov, T. G., T. J. Svejcar, **D. A. Johnson**, R. F. Angell, N. Z. Saliendra, and B. K. Wylie. 2006. Long-term dynamics of production, respiration, and net CO₂ exchange in two sagebrush-steppe ecosystems. *Rangeland Ecology and Management* 59: 585-599.
- Shewmaker, G. E., **D. A. Johnson**, and H. F. Mayland. 2008. Mg and K effects on cation uptake and dry matter accumulation in tall fescue (*Festuca arundinacea*). *Plant and Soil* 302: 283-295.
- Wolf, A., N. Saliendra, K. Akshalov, **D. A. Johnson**, and E. Laca. 2008. Effects of different eddy covariance correction schemes on energy balance closure and comparisons with the modified Bowen ratio system. *Agricultural and Forest Meteorology* 148: 942-952.
- Bhattarai, K., **D. A. Johnson**, T. A. Jones, K. J. Connors, and D. R. Gardner. 2008. Physiological and morphological characterization of basalt milkvetch (*Astragalus filipes*): Basis for plant improvement. *Rangeland Ecology and Management* 61: 444-455.
- Svejcar, T., R. Angell, J. Bradford, W. Dugas, W. Emmerich, A. B. Frank, T. Gilmanov, M. Haferkamp, **D. A. Johnson**, H. Mayeux, P. Mielnick, J. Morgan, N. Z. Saliendra, G. E. Schuman, P. L. Sims, and K. Snyder. 2008. Carbon fluxes on North American rangelands. *Rangeland Ecology and Management* 61: (accepted 4/15/08).
- Johnson, D. A.**, T. A. Jones, K. J. Connors, K. Bhattarai, B. S. Bushman, and K. B. Jensen. 2008. Notice of release of NBR-1 germplasm basalt milkvetch. *Native Plants Journal* 9: 127-132.

- Jensen, K. B., A. J. Palazzo, B. L. Waldron, J. G. Robins, B. S. Bushman, **D. A. Johnson**, and D. G. Ogle. 2008. Improved establishment characteristics of 'Vavilov II' Siberian wheatgrass. *Journal of Plant Registrations* 3: 61-64.
- Perez-Quezada, J. F., N. Z. Saliendra, K. Akshalov, **D. A. Johnson**, and E. A. Laca. 2009. Land-use influences carbon fluxes in northern Kazakhstan. *Rangeland Ecology and Management* 62: (accepted 11/10/08).
- MacKown, C. T., T. A. Jones, **D. A. Johnson**, T. A. Monaco, and M. G. Redinbaugh. 2009. Seedling N uptake by perennial and invasive annual grasses of the Intermountain West: Effects of N form. *Soil Science Society of America Journal* (accepted 3/28/09).
- Polley, H. W., W. Emmerich, J. A. Bradford, P. L. Sims, **D. A. Johnson**, N. Z. Saliendra, T. Svejcar, R. Angell, A. B. Frank, R. L. Phillips, K. Snyder, and J. A. Morgan. 2009. Physiological and environmental regulation of inter-annual variability in CO₂ exchange on rangelands in the western USA. *Global Change Biology* 15: (accepted 4/27/09).
- Arredondo, J. T., and **D. A. Johnson**. 2009. Root responses to short-lived pulses of soil nutrients and shoot defoliation in seedlings of three rangeland grasses. *Rangeland Ecology and Management* 62: (accepted 5/29/09).
- Gilmanov, T.G., et al. 2009. Productivity, respiration, and light-response parameters of world grassland and agro-ecosystems derived from flux-tower measurements. *Rangeland Ecology and Management* 62: (accepted 7/12/09).

Other Publications:

- Johnson, D. A.**, M. M. Caldwell, and L. L. Tieszen. 1973. Photosynthesis in relation to leaf water potential in three alpine plant species. p. 205-210. In: Bliss, L. C. and F. E. Wielgolaski (eds.). *Primary Production and Production Processes, Tundra Biome*. Univ. of Alberta Press, Edmonton, Alberta, Canada.
- Caldwell, M. M., **D. A. Johnson**, M. Fareed, L. L. Tieszen, R. T. Moore, and J. Ehleringer. 1973. Gas exchange of alpine tundra species. U.S. IBP Tundra Biome Report 73-16. Tundra Biome Center, Univ. of Alaska, Fairbanks. 40 pp. (Technical Report)
- Johnson, D. A.** 1973. Field measurements of photosynthesis and leaf growth rates of three alpine plant species. Utah State University. 25 pp. (M.S. Thesis)
- Caldwell, M. M. and **D. A. Johnson**. 1974. Gas exchange and water relations of tundra species - 1973 data. U.S. Tundra Biome Report 74-16. Tundra Biome Center, Univ. of Alaska, Fairbanks. 14 pp. (Technical Report)
- Johnson, D. A.** 1975. Gas exchange and water relations of two alpine and two arctic tundra plant species. Utah State University. 122 pp. (Ph.D. Dissertation)

- Caldwell, M. M., **D. A. Johnson**, and M. Fareed. 1978. Constraints on tundra productivity: photosynthetic capacity in relation to solar radiation utilization and water stress in arctic and alpine tundras. p. 323-342. In: Tieszen, L. L. (ed.). *Vegetation and Production Ecology of an Alaskan Arctic Tundra*. Springer-Verlag, New York. (Book Chapter)
- Asay, K. H., **D. A. Johnson**, and D. R. Dewey. 1978. Breeding grasses for western range. *Utah Science* 39:3-5. (Popular Publication)
- Johnson, D. A.** and K. H. Asay. 1978. Screening for drought resistance in range plants. *Utah Science* 39:11-13. (Popular Publication)
- Rumbaugh, M. D. and **D. A. Johnson**. 1979. Nitrogen fixation and seedling development of subterranean vetch. *Clovers and Special Purpose Legumes Research* 12:48-54. (Technical Report)
- Johnson, D. A.** (editor). 1979. *Special Management Needs of Alpine Ecosystems*. Soc. Range Manage. Range Sci. Series No. 5. Denver, CO. 100 pp. (Book)
- Johnson, D. A.** 1980. Improvement of perennial herbaceous plants for drought-stressed western rangelands. p. 419-433. In: Turner, N. C., and P. J. Kramer (eds.). *Adaptation of Plants to Water and High Temperature Stress*. Wiley-Interscience, New York. (Book Chapter)
- Johnson, D. A.** 1980. Improved plant traits for high altitude disturbances. p. 173-184. In: Jackson, C. L., and M. A. Schuster (eds.). *Proceedings: High-Altitude Revegetation Workshop No. 4*. Infor. Series No. 42. Colo. Water Resour. Res. Inst., Colorado State Univ., Fort Collins. (Proceedings)
- Rumbaugh, M. D., **D. A. Johnson**, and G. A. Van Epps. 1981. Forage diversity increases yield and quality. *Utah Science* 42:114-117. 1981. (Popular Publication)
- Johnson, D. A.**, M. D. Rumbaugh, and G. A. Van Epps. 1983. Forage quantity and quality contributions from a grass-legume-shrub planting on a semiarid rangeland. p. 472-475. In: Smith, J. A., and V. W. Hays. (eds.). *Proceedings of the XIV International Grassland Congress*. Lexington, KY. Westview Press, Boulder, CO. (Proceedings)
- Johnson, D. A.** 1983. Wheat's waxy bloom fights off drought. *Crops and Soils* 36:12-13. (Popular Article)
- Johnson, D. A.** 1986. Seed and seedling relations of crested wheatgrass: A review. p. 65-90. In: Johnson, K. L. (ed.). *Crested Wheatgrass: Its Values, Problems, and Myths*. Utah State University, Logan, UT. (Proceedings)
- Johnson, D. A.** 1986. Improved rangeland species: A physiological perspective. p. 444-446. In: Joss, P. J., P. W. Lynch, and D. B. Williams (eds.). *Rangelands: A Resource Under Siege*, Australian Academy of Science, Canberra. (Proceedings)

- Johnson, D. A.,** and K. H. Asay. 1987. Selection procedures for improving seedling establishment in cool-season range grasses. p. 131-137. In: Frasier, G. W. and R. A. Evans (eds.) Proceedings of Symposium "Seed and Seedbed Ecology of Rangeland Plants." USDA-ARS Publ. Series. (Proceedings)
- Asay, K. H., and **D. A. Johnson.** 1987. Breeding for improved seedling establishment in cool-season range grasses. p. 173-176. In: Frasier, G. W. and R. A. Evans (eds.) Proceedings of Symposium "Seed and Seedbed Ecology of Rangeland Plants." USDA-ARS Publ. Series. (Proceedings)
- Asay, K. H., and **D. A. Johnson.** 1989. Genetic variances in crested wheatgrass-alfalfa mixtures. p. 357-358. In: XVI International Grassland Congress, Nice, France. October 4-11, 1989. (Proceedings)
- Myers, R. L., C. B. Rumburg, and **D. A. Johnson.** 1989. The federal budget process. Rangelands 11:247-250. (Popular Article)
- Ford, T. M. J., **D. A. Johnson,** M. D. Rumbaugh, and B. Z. Richardson. 1989. Sweetvetch: A native legume for rangeland revegetation. Utah Science 50:73-77. (Popular Article)
- Clark, D. H., **D. A. Johnson,** and J. J. Read. 1990. Analysis of carbon isotopic composition in leaf samples with near infrared reflectance spectroscopy. p. 501-504. In: Proceedings of the III International Conference on Near Infrared Reflectance Spectroscopy. Brussels, Belgium. (Proceedings)
- Johnson, D. A.,** J. J. Read, and K. H. Asay. 1991. Carbon isotope discrimination in crested wheatgrass: Relationship to physiological characteristics. p. 273-275. In: Proceedings of the IV International Rangeland Congress. Montpellier, France. (Proceedings)
- Johnson, D.A.** 1991. Functioning and productivity of rangeland ecosystems. p. 1076. In: Proceedings of the IV International Rangeland Congress. Montpellier, France. (Proceedings)
- Johnson, D. A.,** K. H. Asay, and J. J. Read. 1993. Genotypic and environmental variation for carbon isotope discrimination in crested wheatgrass, a perennial forage grass. p. 269-280. In: J. R. Ehleringer, A. E. Hall, and G. D. Farquhar (eds.). Stable Isotopes and Plant Carbon-Water Relations. Academic Press, San Diego. (Book Chapter)
- Johnson, D. A.,** and K. H. Asay. 1994. Selection for enhanced seedling establishment in cool-season range grasses. p. 337-341. In: S. B. Monsen and S. G. Kitchen (eds.). Proceedings--Ecology and Management of Annual Rangelands. Gen. Tech. Report INT-GTR-313. USDA-FS Intermountain Research Station, Ogden, Utah. (Proceedings)
- Johnson, D. A.** 1995. Possible germplasm evaluation procedures for water-limited, overgrazed environments in Patagonia. p. 88-97. In: L. Montes and G.E. Oliva (eds.). Proceedings of the International Workshop on Plant Genetic Resources, Desertification and

Sustainability in Patagonia. Instituto Nacional de Tecnologia Agropecuaria, Rio Gallegos, Argentina. (Proceedings)

Frank, A. B., S. Bittman, and **D. A. Johnson**. 1996. Water relations of cool-season grasses. p. 127-164. *In*: L. E. Moser, D. R. Buxton, and M. D. Casler (eds.). Cool-Season Forage Grasses. Amer. Soc. Agron., Madison, WI. (Book Chapter)

Johnson, D. A., T. A. Gilmanov, N. Z. Saliendra, and J. W. Walker. 1999. Carbon dioxide fluxes on control and burned sites on sagebrush-steppe rangeland in the western USA. p. 746-747. *In*: Eldridge, D. and D. Freudenberger (eds.), People and Rangelands Building the Future, Proceedings of the VIth International Rangeland Congress, Townsville, Australia. (Proceedings)

Svejcar, A. J., W. Dugas, H. Mayeux, **D. A. Johnson**, A. B. Frank, T. G. Gilmanov, R. F. Angell, J. A. Morgan, P. L. Sims, and J. A. Bradford. 2002. The USDA-ARS CO₂ Flux Network: Variation in rangeland CO₂ flux across years and ecosystems. p. 37-38. 25th Conference on Agricultural and Forest Meteorology, 20-24 May 2002, Norfolk, Virginia. American Meteorological Society, Boston, Mass. (Proceedings)

Hipps, L. E., S. Ivans, S. Ivans, **D. A. Johnson**, and N. Z. Saliendra. 2002. Eddy covariance and Bowen ratio estimates of water vapor and CO₂ fluxes over crested wheatgrass. p. 39-40. 25th Conference on Agricultural and Forest Meteorology, 20-24 May 2002, Norfolk, Virginia. American Meteorological Society, Boston, Mass. (Proceedings)

Johnson, D. A., N. Z. Saliendra, and T. G. Gilmanov. 2002. Annual CO₂ fluxes above a sagebrush-steppe ecosystem in eastern Idaho. p. 47-48. 25th Conference on Agricultural and Forest Meteorology, 20-24 May 2002, Norfolk, Virginia. American Meteorological Society, Boston, Mass. (Proceedings)

Gilmanov, T. G., **D. A. Johnson**, N. Z. Saliendra, A. J. Svejcar, and R. F. Angell. 2002. CO₂ losses during the cold period above sagebrush-steppe ecosystems in Idaho and Oregon. p. 51-52. 25th Conference on Agricultural and Forest Meteorology, 20-24 May 2002, Norfolk, Virginia. American Meteorological Society, Boston, Mass. (Proceedings)

Mayeux, H., W. A. Dugas, T. Svejcar, **D. A. Johnson**, A. Frank, R. Angell, J. Morgan, P. Sims, B. Emmerich, and M. Haferkamp. 2002. Rangeland CO₂ fluxes: Implications of results from the USDA-ARS Flux Network. p. 53-54. 25th Conference on Agricultural and Forest Meteorology, 20-24 May 2002, Norfolk, Virginia. American Meteorological Society, Boston, Mass. (Proceedings)

Johnson, D. A. 2002. Improved forages for rangelands and pasturelands of the western U.S.A. Possibilities for their use in southern Chile. p. 15-32. *In*: O. Strauch and A. Cardenas (eds.) Manejo y Mejoramiento de las Praderas en la Zona Austral de Chile. Serie Actas INIA No. 19, Instituto de Investigaciones Agropecuarias, Punta Arenas, Chile. (Proceedings)

- Jigjidsuren, S., and **D. A. Johnson**. 2003. Forage Plants in Mongolia. Admon Publishing CO., Ulaanbaatar, Mongolia. 563 pp. (Book)
- Monaco, T. A., J. B. Norton, **D. A. Johnson**, T. A. Jones, and J. M. Norton. 2004. Soil nitrogen controls on grass seedling tiller recruitment. p. 47-50. In: A.L. Hild, N.L. Shaw, S.E. Meyer, D.T. Booth, and E.D. McArthur (compilers). Seed and Soil Dynamics in Shrubland Ecosystems: Proceedings. RMRS-P-31, USDA-FS Rocky Mountain Res. Sta., Fort Collins, Colo. (Proceedings)
- Norton, J. B., T. A. Monaco, J. M. Norton, **D. A. Johnson**, and T. A. Jones. 2004. Cheatgrass invasion alters soil morphology and organic matter dynamics in big sagebrush-steppe rangelands. p. 57-63. In: A. L. Hild, N. L. Shaw, S. E. Meyer, D. T. Booth, and E. D. McArthur (compilers). Seed and Soil Dynamics in Shrubland Ecosystems: Proceedings. RMRS-P-31, USDA-FS Rocky Mountain Res. Sta., Fort Collins, Colo. (Proceedings)
- Johnson, D. A.**, S. Jigjidsuren, D. P. Sheehy, M. E. Majerus, S. R. Winslow, and L. K. Holzworth. 2006. Collection and evaluation of forage germplasm indigenous to Mongolia. p. 50-61. In: D. J. Bedunah, E. D. McArthur, and M. Fernandez-Gimenez (compilers). Rangelands of Central Asia: Proceedings of the Conference on Transformations, Issues, and Future Challenges. RMRS-P-39, USDA-FS Rocky Mountain Res. Sta., Fort Collins, Colo. (Proceedings)
- Wylie, B. K., T. G. Gilmanov, **D. A. Johnson**, N. Z. Saliendra, L. L. Tieszen, R. A. F. Doyle, and E. A. Laca. 2006. Scaling-up of CO₂ fluxes to assess carbon sequestration in rangelands of Central Asia. p. 111-119. Rangelands of Central Asia: Proceedings of the Conference on Transformations, Issues, and Future Challenges. RMRS-P-39, USDA-FS Rocky Mountain Res. Sta., Fort Collins, Colo. (Proceedings)
- Johnson, D. A.**, S. Jigjidsuren, and A. Gu. 2008. Collection and domestication of rangeland plants with emphasis on Mongolia and China. p. 437-442. In: Multifunctional Grasslands in a Changing World. Vol. II. Guangdong People's Publishing House, Guangzhou, China. (Proceedings)