

**ACCESSION NO:** 0176461 **SUBFILE:** CRIS  
**PROJ NO:** SD00327-G **AGENCY:** CSREES SD.  
**PROJ TYPE:** OTHER GRANTS **PROJ STATUS:** TERMINATED  
**CONTRACT/GRANT/AGREEMENT NO:** 97-38300-4534  
**START:** 15 SEP 1997 **TERM:** 31 MAR 2001 **FY:** 2000 **GRANT YR:** 1997  
**GRANT AMT:** \$73,200

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***EFFECTS OF GRAZING, COMPETITION AND CLIMATE ON TILLER SURVIVAL AND PRODUCTION***

**OBJECTIVES:** Determine the 1) effects of timing, frequency and severity of grazing on individual tiller survival and production, influence of competition on tiller response to grazing, influence of climatic variables on tiller responses to grazing.

**APPROACH:** Substudy 1: Season-long grazing by cattle will occur at a moderate stocking rate (SR) in spring 1997 on two western wheatgrass (WW) dominated, two shortgrass (SG) dominated and two WW-SG co-dominated pastures. Growth, plant development and utilization parameters will be recorded weekly on individual WW, buffalograss (BU) and blue grama (BG) tillers located in 14 plots. In 1998, daughter tillers from those tillers will be marked and survival, growth and development recorded weekly. Substudy 2: Same as substudy 1 except grazing will occur in 1998 and daughter tillers sampled in 1999. Substudy 3: Two short duration grazing (SDG) cells and 4 season-long (SL) pastures will be grazed in 1998 by cattle. SR will be light for one SDG cell and two SL pastures and heavy for one SDG cell and two SL pastures. Growth, plant development and utilization parameters will be recorded weekly for SL pastures and before and after grazing for 4 paddocks in each SDG cell. Daughter tiller data will be collected in 1999 using the same techniques as in substudies 1 and 2. Biomass and cover for all species and tiller density for WW, BU and BG will be collected each year for all substudies.

**PROGRESS:** 1997/09 TO 2001/03

Studies were implemented at the Cottonwood Research Station to evaluate factors affecting production and survival of 3 grass species. Individual marked western wheatgrass (WW), blue grama (BG) and buffalograss (BU) tillers were available for grazing in Year 1 (Y1), but protected in Year 2 (Y2) of each study. Weekly data collected (except in short duration systems where data were

collected prior to and after grazing a paddock) on parents in Y1 of each study included height, grazed status, survival, # leaves produced, and # leaves removed. In Y2 data collected biweekly on daughter tillers produced by Y1 parents included height, phenology, survival, and # leaves produced. Tiller density was unaffected ( $P>0.05$ ) by grazing system or stocking rate; year was significant. Density of WW tillers increased yearly from 1996-99 (299.6, 414.4, 479.2, 514.4/sq.m, resp.,  $P=0.0011$ ), BG density increased for 1998-99 (307.6 to 853.2/sq.m.,  $P=0.0004$ ), and BU density decreased from 1998-99 (984.0 to 340.0/sq.m.,  $P=0.0020$ ). Sufficient grazing occurred only on WW to allow analysis of grazing effects on only that species. Timing of grazing affected ( $P=0.001$ ) survival in all years. Early grazed tillers had lower survival (62.9%) than later grazing (77.7 and 97.6% for mid- and late-summer). The most severely grazed tillers had the lowest ( $P=0.001$ ) survival (70.5 vs. 86.3 and 84.3% for >38% vs. <15% and 15-38% biomass removed). While frequency of grazing had no effect ( $P>0.05$ ) on Y1 survival, if multiple grazings occur, short recovery periods (<28 d) reduce survival ( $P=0.001$ ) compared to long periods (75.4 vs. 91.6%, resp.). Surviving WW tillers produced more ( $P=0.001$ ) biomass (0.265 g/tiller) during Y1 than those which did not survive (0.154 g). Late grazed tillers produced more ( $P<0.002$ ) biomass (0.276 and 0.320 g/tiller, 1996 and 1998, resp.) than tillers grazed earlier (0.239 and 0.22 g for early and mid 1996; 0.223 and 0.239 for early and mid 1998). Multiple grazed tillers produced less biomass than single grazed tillers (0.221 vs. 0.263 g, resp.,  $P=0.001$  for 1996; 0.213 vs. 0.289 g, resp.,  $P=0.006$  for 1998). A higher percent of grazed WW tillers produced crown daughters than ungrazed tillers (78.3 vs. 70.6% in 1997,  $P=0.001$ ; 65.6 vs. 59.2% in 1999,  $P=0.015$ ). Surviving Y1 tillers produced more crown tillers in Y2 ( $P=0.001$ ) than tillers that died (76.7 vs. 61.95% for 1997; 66.7 vs. 46.5% for 1999). No differences ( $P>0.05$ ) in % of Y1 tillers producing crown tillers in Y2 were detected for timing, frequency, or intensity of grazing. Biomass of individual Y2 crown tillers was not affected ( $P>0.05$ ) by the grazing history of parents except intensity of grazing for 1996-97 ( $P=0.039$ ), where lightly grazed parents produced heavier daughters (0.24 g) than moderately- (0.21 g), heavily- (0.20 g), and un-grazed (0.22 g) parents. Total crown tiller biomass produced was different ( $P=0.041$ ) between grazed and ungrazed parents only for 1996-97 (0.31 vs. 0.29 g). Lightly grazed tillers in 1996 produced more ( $P=0.028$ ) total crown tiller biomass in 1997 (0.34 g) than did moderately- (0.30 g), heavily- (0.30 g) and un-grazed (0.29 g) tillers.

**IMPACT:** 1997/09 TO 2001/03

This work is important in the development of grazing strategies for rangelands of the Northern Great Plains. The true test of a grazing system lies in its effects on persistence of a species over time. Western wheatgrass relies primarily on vegetative reproduction (tillering), thus an understanding of grazing as it affects daughter crown tiller production is critical to our evaluation of grazing systems.

**PUBLICATIONS:** 1997/09 TO 2001/03

1. Johnson, P.S., L. Xu, R.A. Self, J. Comstock, and T. Fisher. 2000. Effects of

- grazing system and stocking rate on patterns of utilization of western wheatgrass, blue grama, and buffalograss: I. Probability of grazing. *Soc. Range Manage.* 53:50.
2. Johnson, P.S., L. Xu, R.A. Self, J. Comstock, and T. Fisher. 2000. Effects of grazing system and stocking rate on patterns of utilization of western wheatgrass, blue grama, and buffalograss: II. Intensity of grazing. *Soc. Range Manage.* 53:51.
  3. Johnson, P.S., L. Xu, T. Fisher, R. Self, J. Comstock. 2001. Effects of grazing on survival and aboveground biomass production of western wheatgrass tillers. *Soc. Range Manage.* 54:209.
  4. Johnson, P.S., L. Xu, T. Fisher, R. Self, J. Comstock. 2001. Effects of grazing history on persistence and production of western wheatgrass tillers. *Soc. Range Manage.* 54:208.
  5. Johnson, P.S., L. Xu, R.A. Self, J. Comstock, and T. Fisher. 2001. Effects of grazing system and stocking rate on patterns of utilization of western wheatgrass, blue grama, and buffalograss: I. Probability of grazing. *J. Range Manage.* (in preparation).
  6. Johnson, P.S., L. Xu, R.A. Self, J. Comstock, and T. Fisher. 2001. Effects of grazing system and stocking rate on patterns of utilization of western wheatgrass, blue grama, and buffalograss: II. Intensity of grazing. *J. Range Manage.* (in preparation).
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