Evaluation of CRP for Cellulosic Biomass Production

Ezra Aberle

The adoption of fertility management to pastures and non-legume hayland has been somewhat limited in this region. This study was conducted as a preliminary investigation to determine the potential of CRP for cellulosic biomass production through increased nitrogen (N) fertility management. The study was conducted in Foster County, ND. The site was CRP that had not been fertilized for many years. The site was a warm- and cool-season grass mixture. The nitrogen rates were 0 lbs., 50 lbs., and 100 lbs. N/acre broadcast as urea fertilizer on June 8, 2008, June 15, 2009, May 21, 2010, June 11, 2011, and May 22, 2012. Two biomass harvest timings were evaluated: 'Peak Standing' at the time of anthesis; and 'Killing Frost.' The 'Peak Standing" harvest was harvested on September 7, 2008, September 3, 2009, August 24, 2010, August 29, 2011, and August 15, 2012. The 'Killing Frost' harvest was harvested on October 31, 2008, October 23, 2009, November 1, 2010, September 30, 2011, and September 19, 2012. The 2012 growing season was significantly warmer and dryer than 2011. This led to an enhanced competitive advantage to the shallower rooted, sod-forming, cool-season grasses, Smooth Bromegrass and Kentucky bluegrass.

Yield in 2012 was significantly lower than 2011 due to reduced moisture in 2012 and reduced stand due to flooding in 2011. The proportion of Smooth Bromegrass in the stand has increased over time primarily in the no-added-nitrogen plots (data not shown). The proportion of Switchgrass in the stand was reduced in 2012 because of flooding and likewise the proportion of the more flood-tolerant grasses foxtail barley and Prairie Cordgrass increased in 2012. By harvesting these plots annually without additional fertilization, the early growth of the sod-forming Smooth Bromegrass gives it a competitive advantage over some of the more productive efficient-nitrogen-using, later-growing species. Prairie Cordgrass in the stand has increased over time primarily in the plots that are lower and wetter where this species has a competitive advantage over other species in the stand by being able to tolerate wet soils and spread under those conditions over time. Harvest timing alone did not have an effect on yield, however the proportion of Kentucky bluegrass in the stand was higher in the 'Peak Standing' harvest (at anthesis) than in the later Killing Frost harvest. By harvesting these plots earlier in the season the early growth of the sod-forming Kentucky bluegrass gives it a competitive advantage over some of the later-growing species which are more productive later in the season. Likewise the 'Killing Frost' treatment gave the later maturing, warm-season grasses like Switchgrass, Big Bluestem, and Prairie Cordgrass a competitive advantage to put on more biomass production after 'Peak Standing' harvest which resulted in higher production for the 'Killing Frost' harvest that year. As expected with most grass crops, yield was increased with nitrogen fertilizer levels. As mentioned earlier, by harvesting these plots annually without additional fertilization, the early growth of the sod-forming Smooth Bromegrass and Kentucky Bluegrass gives them a competitive advantage over some of the more productive efficient-nitrogen-using, later-growing species.

In conclusion, increasing N fertilization increased yield, however, exceeding 50 lbs of N with current yields, N prices, and grass hay prices is cost prohibitive. Harvest timing may have an impact on quality of the feedstock and stand longevity as the study progresses.