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Impact of Fertility and Mowing on Crabgrass Quantity and Quality for Hay Production in Southeast Kansas

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Cover Page Footnote
We gratefully acknowledge the assistance of Farmers Coop of Columbus and Baxter Springs, KS, for providing the fertilizer and MoJo seed for the experiment.

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Summary
A crabgrass variety trial comparing Quick-N-Big and MoJo crabgrasses was conducted during the summer of 2020 at the K-State Research and Extension experiment station near Columbus, Kansas. The trial evaluated quantity and quality of forage produced under different nitrogen fertility scenarios and mowing management techniques. MoJo produced more biomass than Quick-N-Big. Addition of nitrogen fertilizer increased biomass production and forage protein content. Mowing was also found to enhance forage quality.

Introduction
Forage is a major component of the agronomic production system in southeast Kansas. Forage can be grazed or harvested as hay to supplement cattle feed during the winter. Crabgrass is a high yielding summer annual that complements cool season forages or can be used as a cover crop for summer forage. Productivity and quality of two crabgrass varieties were compared: MoJo and Quick-N-Big. MoJo is a blended seed variety with a large portion of the blend derived from Impact Crabgrass from the Samuel Roberts Noble Foundation. Quick-N-Big is a commonly planted variety that has been shown to grow successfully in southeast Kansas and was chosen as a comparison.

The second research goal was to determine how management practices affected production and quality of forage. The experiment was designed to simulate how management practices, including fertility and mowing, would increase or decrease forage production and quality for the two varieties. Producers have many different management approaches to forage production, ranging from no fertilizer, to different amounts and frequency of fertilization. The main difference between these management methods is whether the producer allows the forage to grow during the season or if the producer harvests the forage during the summer, putting the forage back in a vegetative state due to mowing. The treatments in the research trial were fertilizer rates, timing, and harvesting scenarios corresponding with common production choices.

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Experimental Procedures

Plots were established in a field at the Southeast Research and Extension Center near Columbus, KS. Plots were 60 × 10 ft and replicated 3 times in a Parsons silt loam soil. Prior to planting, the field was disked and field cultivated. A cultipacker was used to provide a firm seedbed. The seed was planted using a Brillion seeder that dropped the seed in front of packing wheels to a scant ¼ inch deep at a rate of 6 pounds per acre. Planting occurred on May 21, 2020, and plots were fertilized on June 19. Nitrogen (N) was broadcast by hand as urea at the rate of 100 lb N/acre as defined by the treatment. Treatments were the combination of mowing and fertilization (Table 1).

Treatments 2, 4, and 5 were completely mowed on August 20 after forage sampling. This simulated harvesting of the forage for hay and encouraged regrowth. The remaining treatments were allowed to grow without mowing until the final harvest in October.

Plots were sampled for biomass production and forage quality on August 20 and October 9, 2020, using a 3-ft Carter Harvester and samples were collected in bags. The entire sample was weighed for fresh weight determination on an area basis. Hand samples were taken from the plot sample to determine moisture, dry weight, and quality, and converted to an area basis based on total harvested weight. Forage mass was determined after drying samples at 120°F for 3 days. Samples were sent to SDK Labs, Hutchinson, KS, for quality analysis.

Weather during the growing season was recorded at the Mesonet station in Columbus, located 6 miles from the field (*https://mesonet.k-state.edu/weather/historical/*). Soil moisture was good at time of planting (5/21/2020). It rained shortly after planting and continued raining for several days. In total, 3.97 inches of rain were reported from 5/22/2020 to 5/30/2020, making soils very wet and muddy. However, after 5/31/2020, there were only 1.63 inches of rain for the next 61 days, causing soil moisture to be depleted and soils to dry out very quickly. Because of the lack of moisture, soil absorption of fertilizer and plant uptake may have been hampered. The original research plan was to harvest the plots every 30-45 days, but because of the dry weather, grass growth was slowed and harvest was delayed until August 20. Growing conditions were favorable after the first harvest, which allowed for a second harvest on October 9, 2020.

Results and Discussion

The MoJo seed was a coated seed and moved easily through the drill. It was heavier and flowed well. The Quick-N-Big seed was uncoated and required planting the field twice to obtain the desired planting population. With the drastic change in moisture conditions shortly after planting, weeds and other grasses became established in the grass plots. Barnyardgrass and pigweed were prominent in the MoJo stand. No herbicide or weed management program was implemented.

MoJo out-performed Quick-N-Big by 23% dry matter in the unfertilized plots and by 59% or greater in the other treatments (Figure 1) at the first sampling on August 20, 2020. The MoJo rebounded quickly from the initial harvest and weeds and other grasses did not return. In the treatments with no fertilizer (1 and 2), the MoJo produced an additional 1500 pounds of forage dry matter per acre while the Quick-N-Big only produced an additional 466 pounds of forage at the second sampling on October 9. In treatments 4 and 5, MoJo produced twice as much forage as the Quick-N-Big.

A key component of this trial was to show how management affects the quality of the grasses. Ideally, crude protein (CP) levels in hay should fall between 9% for dry cows and 12% for lactating cows. Crude protein values across all treatments and varieties varied from 6.9% to 10.0% at the August 20 sampling date, as the grass was well past maturity at the time of harvest (Figure 2). Fertilized plots did have slightly higher CP% than the control plots except for treatment 4 of the MoJo. That may be due to other weeds and grasses in the MoJo plot. Crude protein values fell from 7% and 8% in August to 4% CP in October in the unfertilized, unmowed plots (Treatment 1; Figure 2). Conversely, the unfertilized, mowed plots (Treatment 2) had crude protein values that remained around 7% at the October sampling date. Similarly, the fertilized plots that were mowed (Treatments 4 and 5) had higher crude protein values in October than the fertilized plot that was not mowed (Treatment 3). Protein values for treatment 4 and 5 ranged from 10 to 12.9% in October, compared to approximately 7% crude protein in both varieties in treatment 3. This demonstrates that putting the plant back to a vegetative state, creating new tissue, by mowing enhances protein production in the forage.

Crude protein was greater in most of the fertilized plots at both sampling times than in the unfertilized treatments, confirming that adding nitrogen does affect protein value of the forage. There were two notable exceptions to this. The MoJo plots in August had low crude protein, potentially due to higher weeds contaminating the plots. The fertilized, unmowed treatment 3 also had crude protein percent much lower than the other two fertilized plots, and more similar to the unfertilized but mowed treatment 2. Treatment 5 that received additional N after the first harvest in August showed a protein value 2% higher than treatment 4.

Total digestible nutrients (TDN) is a measure of the energy content in the feed, and ranges from 40-50% for low quality hay to 50–60% for higher quality hay. Total digestible nutrients in the MoJo variety was higher than the Quick-N-Big variety for all treatments and all sampling times except the fertilized, mowed plots sampled on October 9 (Figure 3). The TDN values with the MoJo treatments ranged from 51% to 56%, while Quick-N-Big TDN values ranged from 47% to 49% at the August 20 sampling time. Mowed plots showed slightly greater TDN than in the unmowed plots. Fertility did not strongly influence TDN.

Recommendations

If crabgrass is used for summer grazing, once it matures it needs to return to a vegetative state to maintain the forage quality. If not, the forage will fail to meet the animal's nutritional requirements and the need for additional supplements will increase production costs. After crabgrass reaches maturity, it will continue to increase in forage accumulation, but protein values will decrease unless it is harvested and returned to a vegetative state. Though forage may be plentiful for an animal to eat, livestock fed on forage that is 6% CP or less will not gain even at a rate of 1 lb/day. Mowing encourages new growth and increases CP and TDN. Nitrogen application will also enhance dry matter production and protein value of the forage to help meet the animal's nutritional needs.

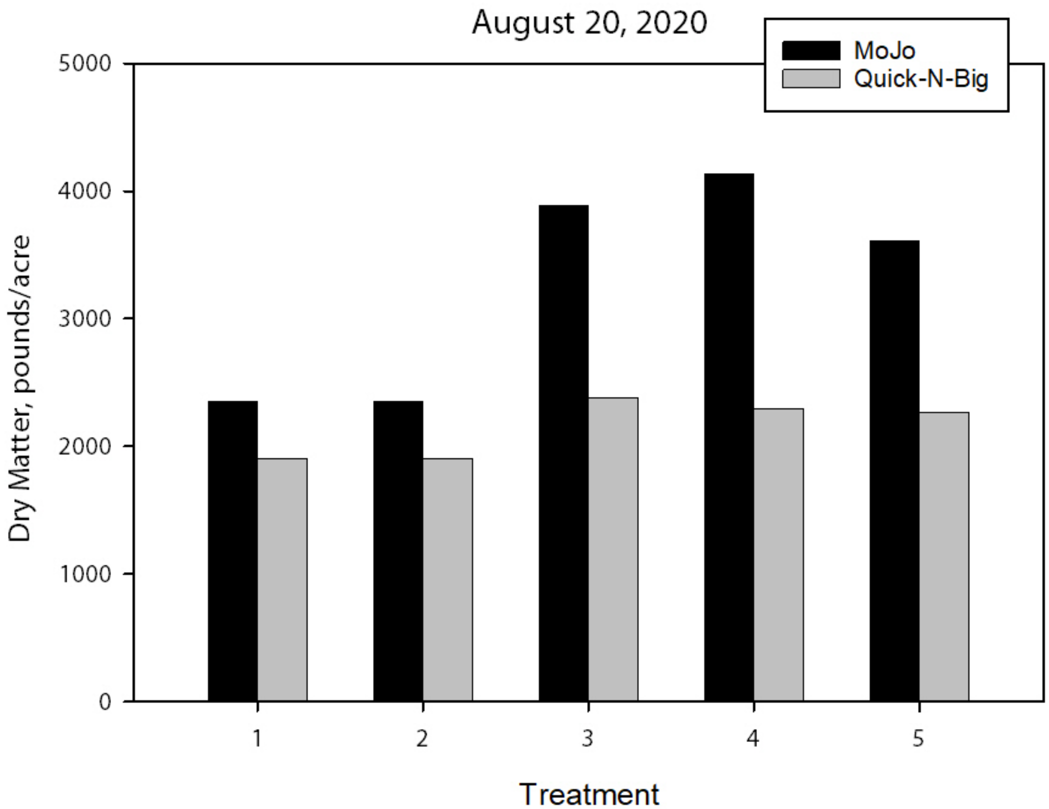
MoJo crabgrass out-performed Quick-N-Big in total dry matter production in both the August and October harvest. MoJo recovered faster after mowing than Quick-N-Big.

Acknowledgments

We gratefully acknowledge the assistance of Farmers Coop of Columbus and Baxter Springs, KS, for providing the fertilizer and MoJo seed for the experiment.

Table 1. Fertility and mowing treatments

Treatment	Mowing		Fertilizer (June 19)	Fertilizer (August 21)
1		October 21	None	None
2	August 21	October 21	None	None
3		October 21	100 lb N	None
4	August 21	October 21	100 lb N	None
5	August 21	October 21	100 lb N	100 lb N



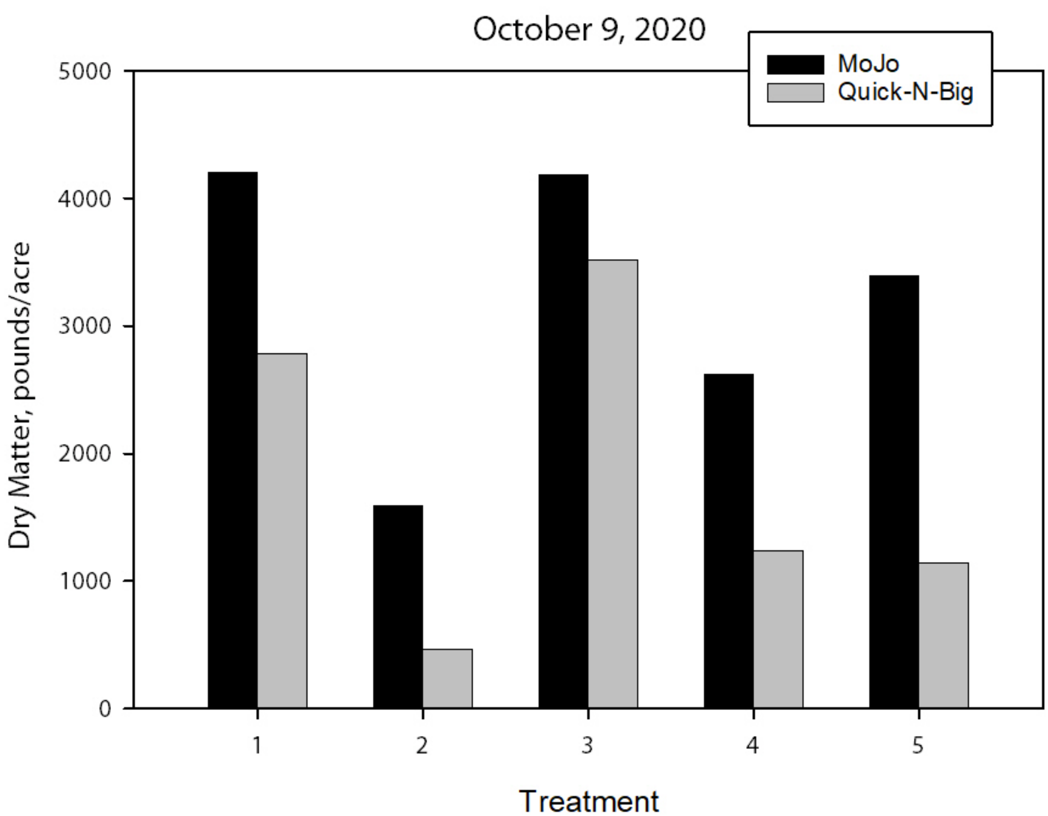
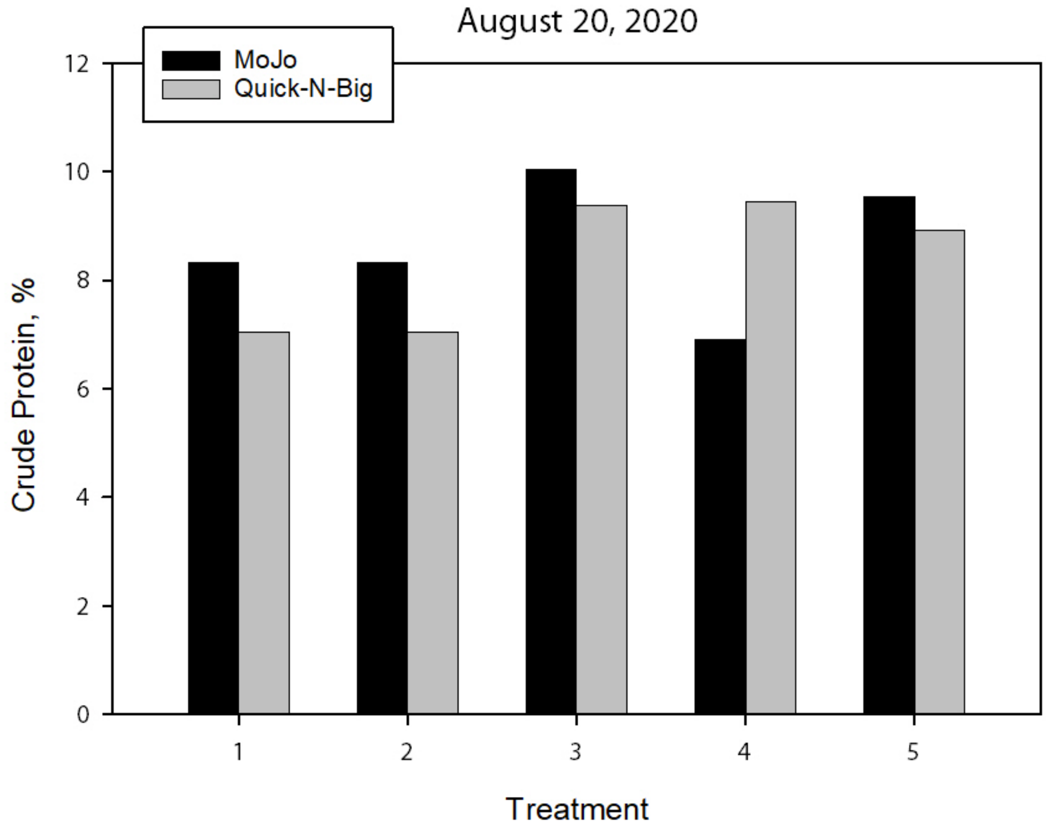


Figure 1. Dry matter production for MoJo (black bars) and Quick-N-Big (grey bars) crabgrass harvested August 21 (upper) and October 9 (lower). Averages are given for treatments as outlined in Table 1.



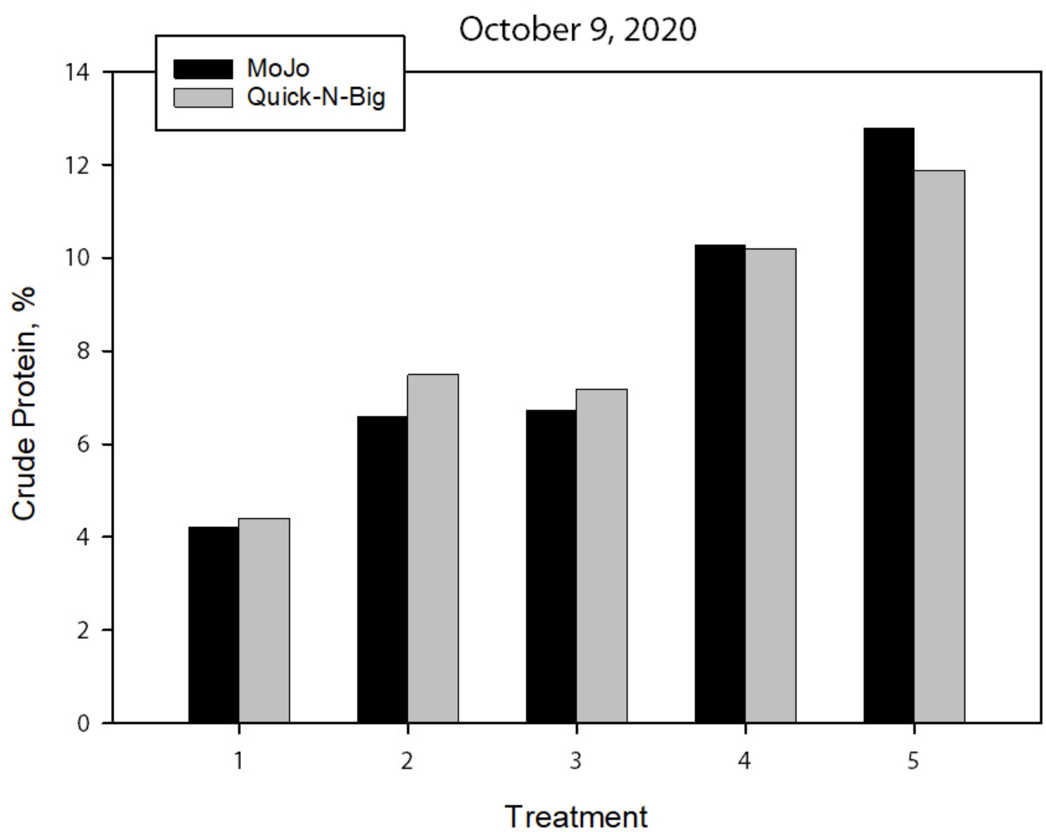
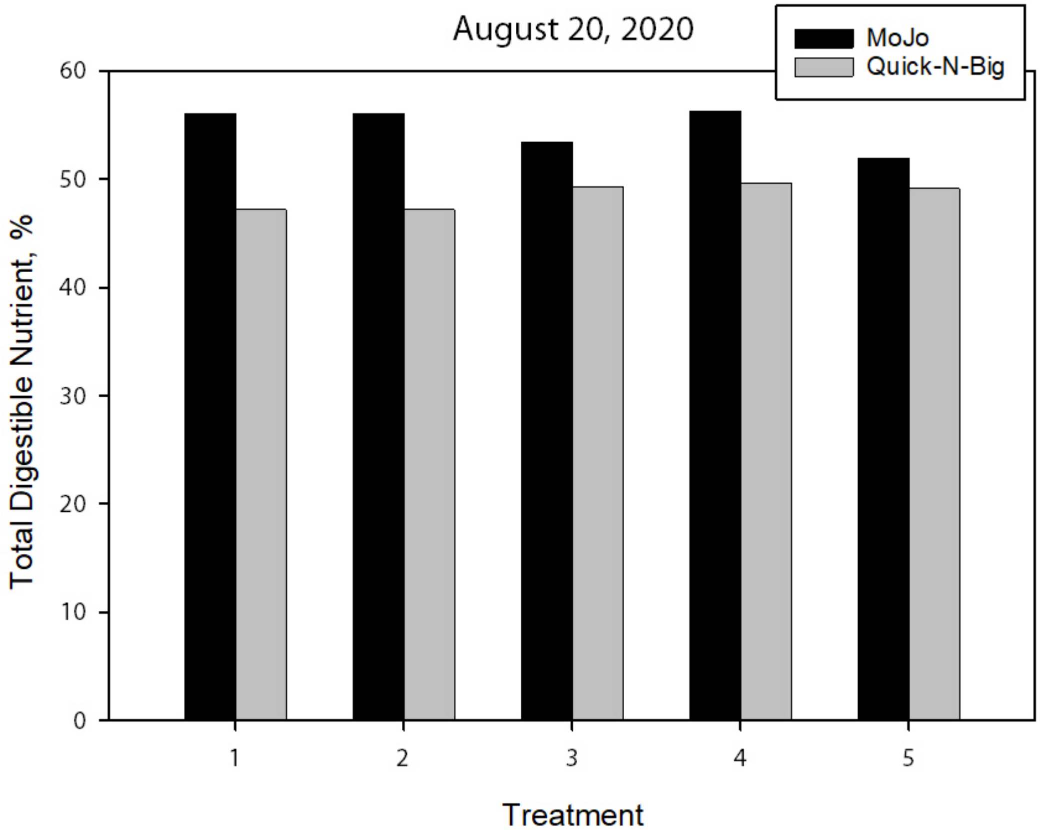


Figure 2. Crude protein percent for MoJo (black bars) and Quick-N-Big (grey bars) crabgrass harvested August 21 (upper) and October 9 (lower). Averages are given for treatments as outlined in Table 1.



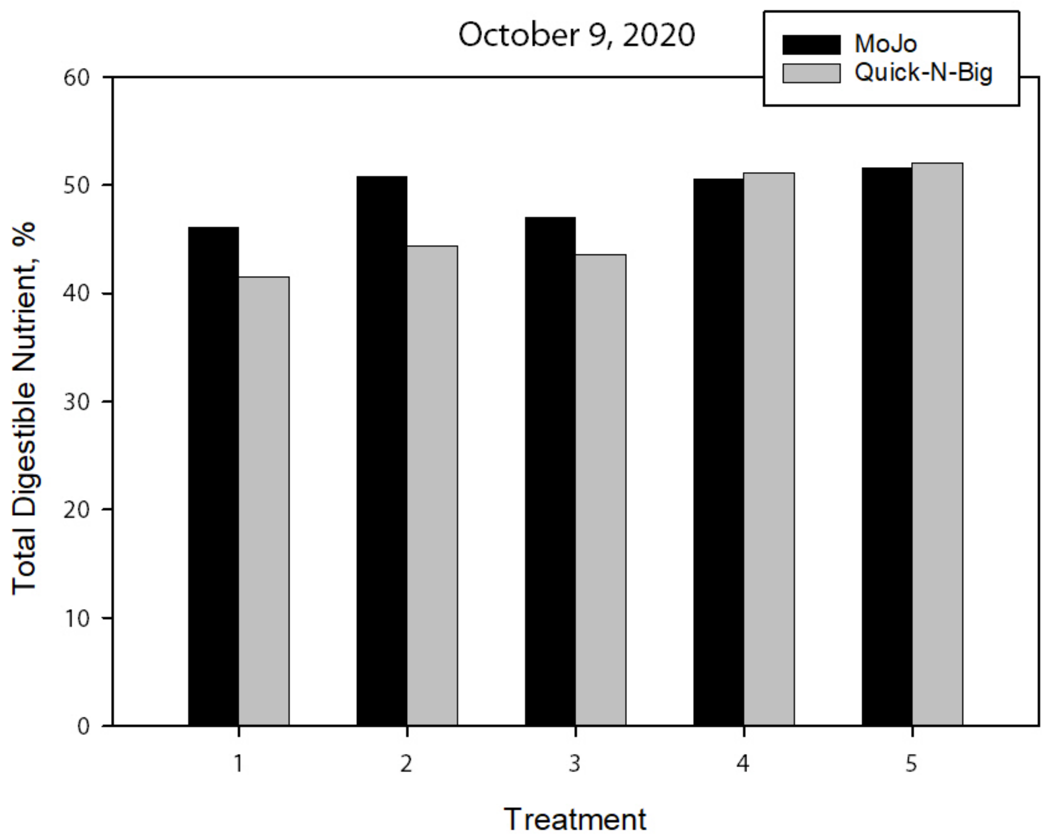


Figure 3. Total digestible nutrients percent for MoJo (black bars) and Quick-N-Big (grey bars) crabgrass harvested August 21 (upper) and October 9 (lower). Averages are given for treatments as outlined in Table 1.