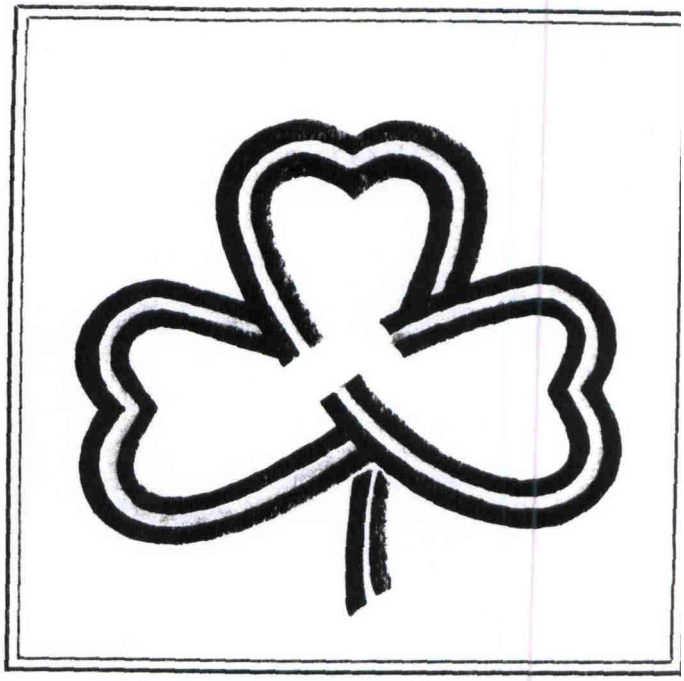
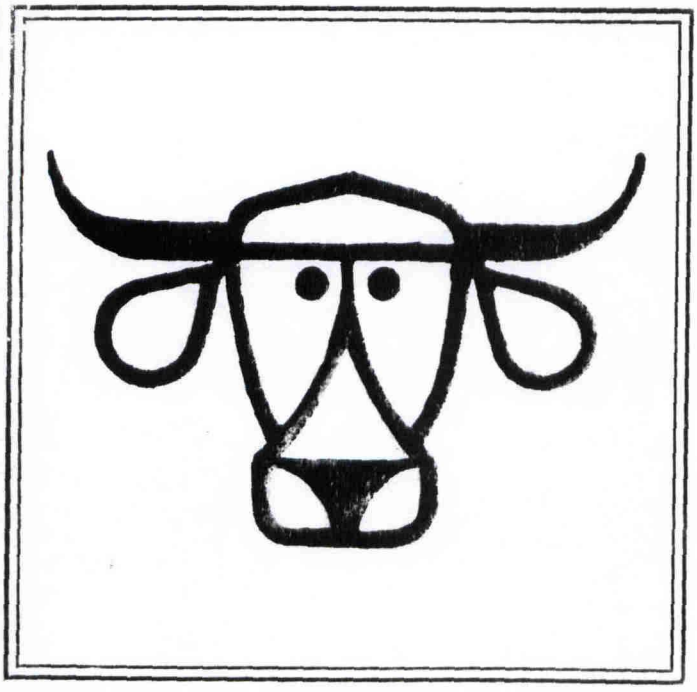
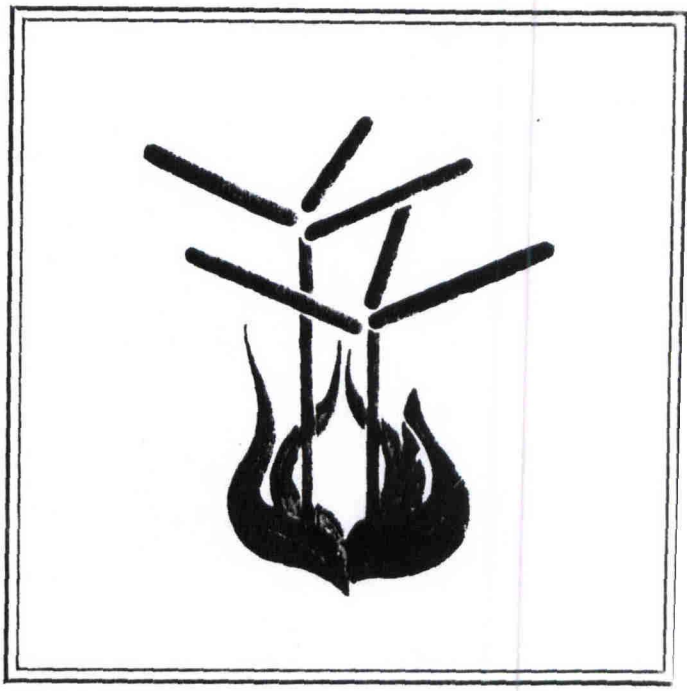
PUBLICATIONS

1980

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, The Texas A&M University System, College Station, Texas







Forage Research in Texas

Departmental Technical Report No. 80-6
Department of Soil and Crop Sciences

Project: H 1623 - H 6320
Workers: F. M. Rouquette, Jr.[1] T. C. Keisling, B. J. Camp[2], and K. L. Smith

PM - 0035

TOTAL ALKALOID AND NITRATE CONTENT OF DROUGHT-STRESSED PEARL MILLET

SUMMARY

During the prolonged drought conditions of 1978, cattle throughout the East Texas area abruptly refused to graze many fields of commercial pearl millet hybrids. Forage was sampled from a pasture on an upland site in which plants exhibited visual drought stress, and from a bottomland site in which plants did not show drought stress symptoms. Chemical analyses were conducted for total alkaloids and nitrate. Two management treatments, shredding and irrigation, were used in an effort to increase palatability of the drought-stressed pearl millet. Total alkaloid concentration of non-drought-stressed forage, which was readily consumed, ranged from 10 to 20 ppm throughout the August sampling period. Drought-stressed forage, which was not consumed, had total alkaloid concentrations of 180 to 460 ppm. Drought-stressed plants contained 3% nitrate compared to non-drought-stressed plants that contained only 1% nitrate. Since regrowth forage did not have improved palatability and since nitrate levels may be high in drought-stressed pearl millet harvested for hay, the best management decision may be to remove the animals and delay further forage utilization either for grazing or for hay until adequate rainfall reduces the drought symptoms and the related nitrate content.

OBJECTIVES

This study was undertaken to characterize the occurrence of the lack of palatability with pearl millet, investigate some plant factors associated with reduced palatability, and verify that drought was involved in the development of the palatability problem with pearl millet.

PROCEDURES

Hybrid pearl millet was drilled on 10-inch centers at a seeding rate of 15 pounds/acre on June 2 on both an upland Darco soil and bottomland containing both Thenas and Nahatche soils. Fertilizer was applied preplant at the rate of 75-75-75 lbs/ac of N-P_2O_5-K_2O, and post-planting at the rate

---

[1]Formerly Assistant Professor, Soils, Overton

[2]Professor, Toxicology, Veterinary Physiology & Pharmacology, Texas A&M University

of 100-0-0 lbs/ac N-P_2O_5-K_2O. Three separate areas on the Darco soil were individually irrigated with 2-inches of water on August 7 and again on August 16. All fields received .7 inch water as rainfall on August 6. Approximately one-half acre in a 4-acre paddock was shredded to promote new growth. Forage for chemical analysis was cut to a 2-inch height from both irrigated and non-irrigated sites on the Darco soil, and also from the bottomland paddock. Mature F-1 (Brahman x Hereford) cows, weighing about 1100 pounds, were placed on both areas when the pearl millet was approximately 18 inches in height. Although extreme palatability differences were apparent, the cattle were not removed from either area. Total alkaloid content was measured as phenylethylamine alkaloids, and nitrate was determined with a specific ion electrode.

RESULTS

The difference in alkaloid content between drought-stressed and non-drought-stressed pearl millet was large ($P<.01$)(Fig. 1). While the alkaloid content of the non-drought-stressed plants was found to be consistent and low, the alkaloid content of the drought-stressed plants fluctuated with the occurrence of the .7 inch rain. With continued drought after the .7 inch rain, the alkaloid content increased from 20 to 460 ppm.

Regrowth forage on the shredded area was no more readily accepted than the uncut forage. Therefore, the management practice of cutting drought-stressed pearl millet for hay will not relieve the palatability problem in pearl millet regrowth forage.

Forage from the three areas receiving supplemental water via sprinkler irrigation showed a significant ($P<.01$) decrease in total alkaloid content (Fig. 2). A 46-fold difference in alkaloid concentration between the irrigated vs non-irrigated pearl millet was found.

Percentage nitrate was approximately 3% in drought-stressed plants and about 1% in non-drought-stressed plants (Fig. 3). Although the .7 inch rain caused a slight reduction in nitrate concentration, percent nitrate of the drought-stressed pearl millet remained relatively constant at 3%. Thus, in pearl millet, there may be a direct relationship between alkaloid level and nitrate concentration. We have speculated that the lack of palatability in pearl millet across East Texas may have prevented a high incidence of nitrate toxicity.

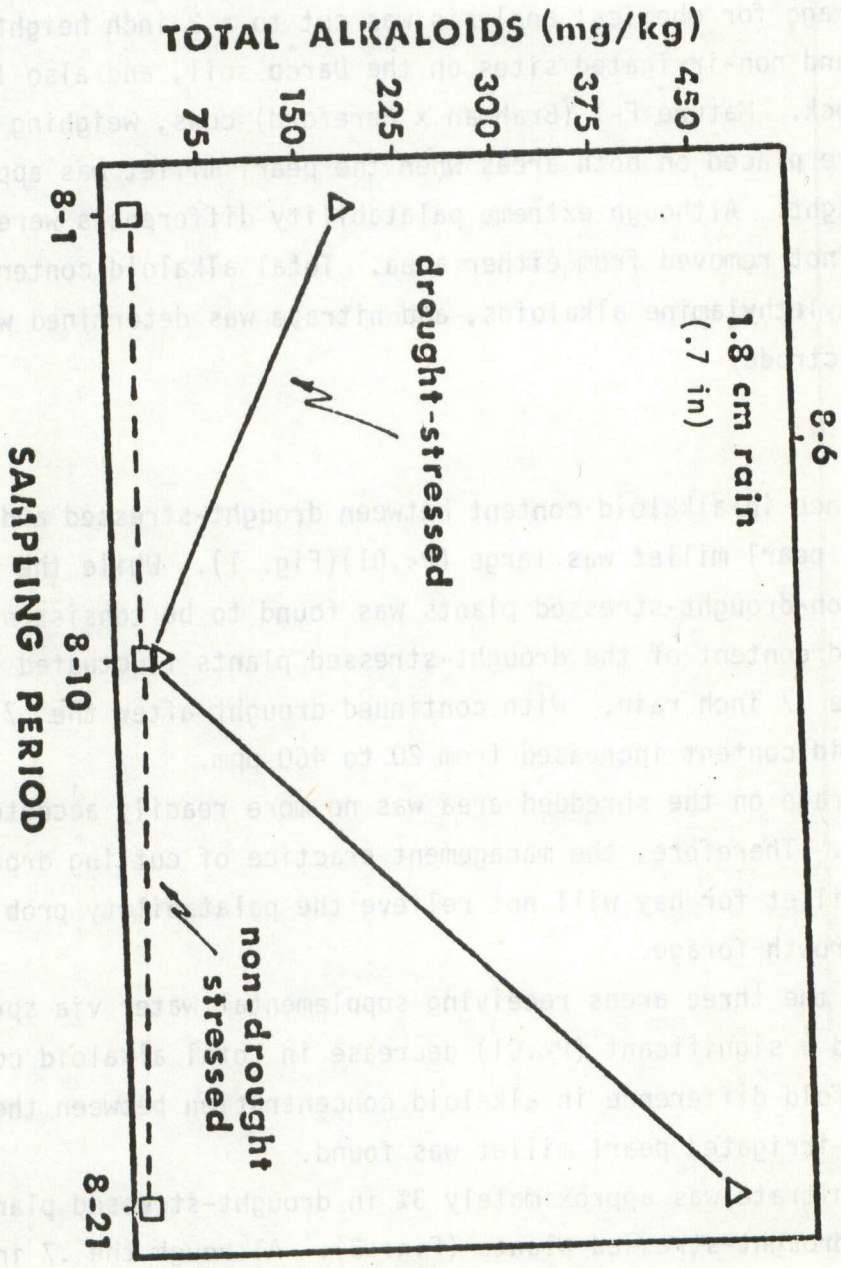


Figure 1. Total alkaloid concentration in mg/kg (ppm) of pearl millet growing on drought-stressed and non-drought-stressed soils.

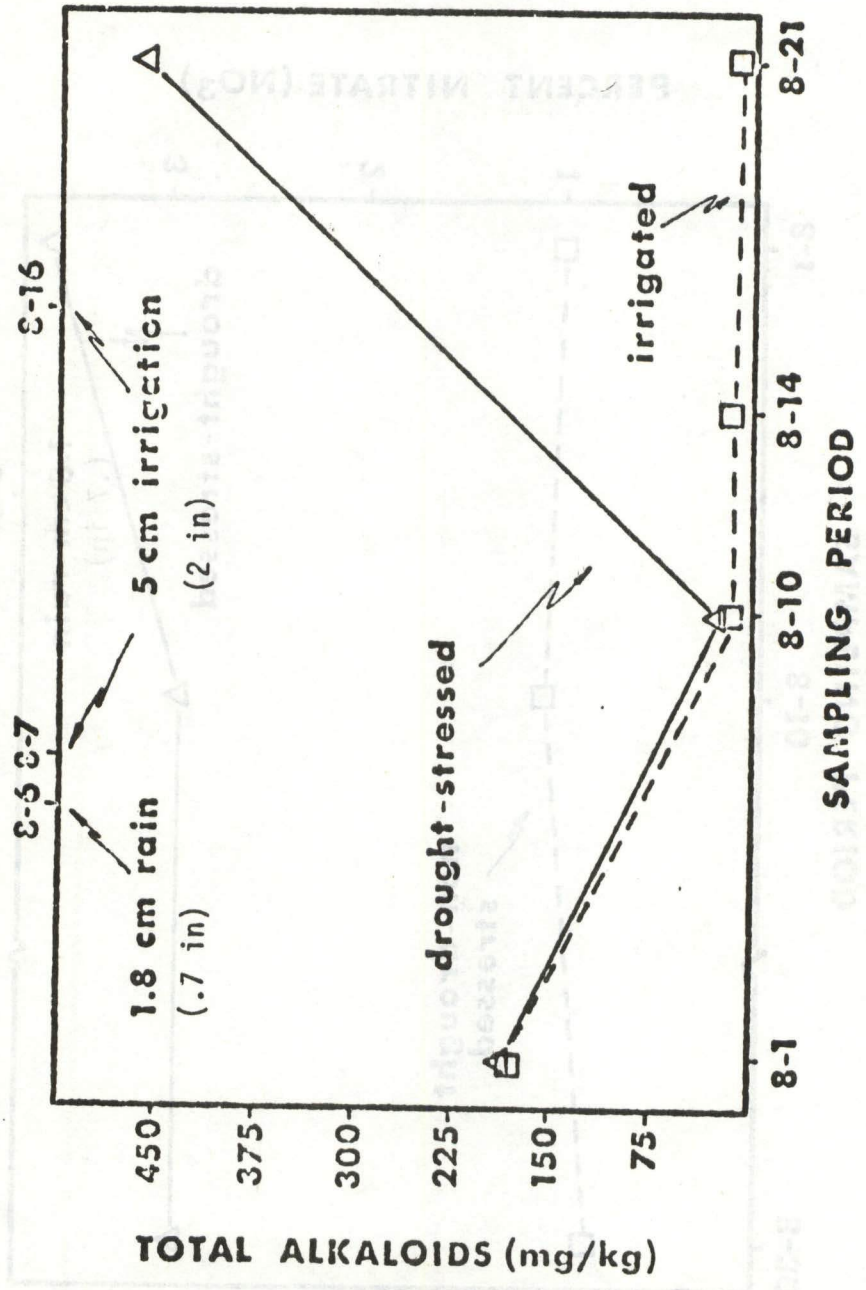


Figure 2. Total alkaloid concentration in mg/kg (ppm) of irrigated and non-irrigated pearl millet growing on drought-stressed soil.

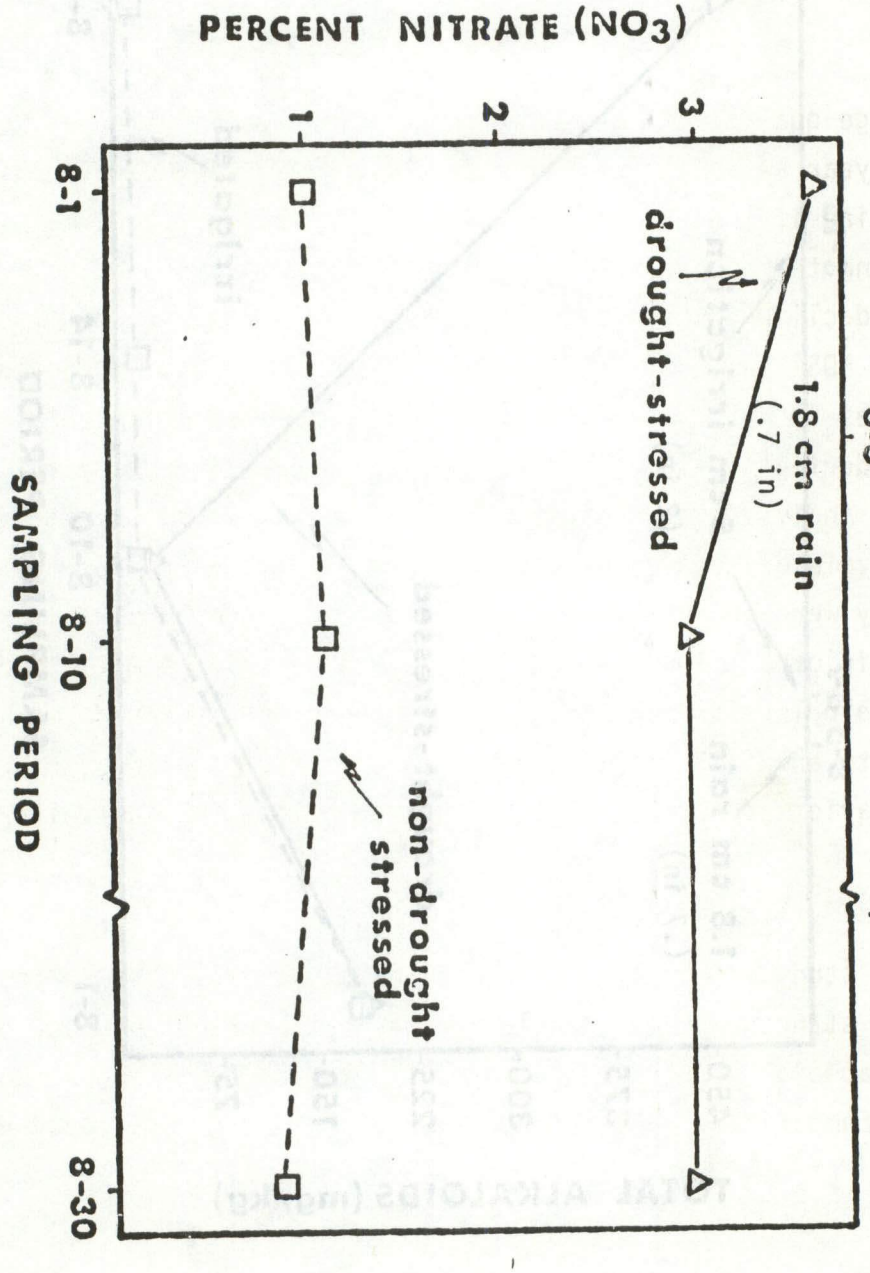


Figure 3. Percent nitrate of drought-stressed and non-drought-stressed pearl millet.