

Public Abstract

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Title: MANAGEMENT OF NITROGEN AND NITRIFICATION INHIBITORS FOR CORN AND WHEAT PRODUCTION ON CLAYPAN SOILS

Increasing cereal crop production, such as corn and wheat, to meet the food needs of a growing world population is an essential objective of agricultural research but environmental concerns over increasing intensification of crop production to meet those food needs using nitrogen (N) fertilizer are also a priority. Researchers are exploring many possible management practices to increase crop N use efficiency so that a larger proportion of the N fertilizer that is applied to farm fields is utilized by the crop to increase grain production.

Among these possible practices, is the use of different types of N fertilizer (e.g., urea ammonium nitrate solution (UAN), anhydrous ammonia (AA)), different fertilizer application rates and different timings of N fertilizer application including prior to plant emergence (pre-emergence) or during the growing season usually done to the side of the growing plant (sidedress). These fertilizers can also be mixed with chemical additives that facilitate N use by crops by reducing soil microbial processes that may cause environmental N loss. One such class of fertilizer additives is nitrification inhibitors (NI) which inhibit the soil-based process by which ammonium-N is converted to nitrate-N. Nitrate is a chemical form which is easily moved out of the crop rooting zone with drainage water and can also be converted to a gas which makes N less available to the plant and also may contaminate air and water resources. For increased use by farmers, NIs should have benefits (e.g., increased grain production or lower labor amount or timing) which outweigh the extra cost of the NI and its application.

Several NIs have long been commercially-available including nitrapyrin, but some new NIs are being developed such as KAS-771G77 which was tested in this research. Extensive research has been conducted on use of the nitrapyrin NI but less information is available on its use for corn and winter wheat production in poorly-drained soils such as found in the Claypan Soil Region of Missouri. Further research is needed to provide growers with information on the best management practices to utilize these NIs for corn and winter wheat production and to reduce possible N loss through increased crop N use efficiency.

Multiple field research experiments planted to corn and winter wheat were conducted from 2012 to 2016 in Northeast Missouri in poorly-drained claypan soils at the University of Missouri Greenley Memorial Research Center. This field-based research examined the use of two NIs (nitrapyrin and KAS-771G77) in conjunction with different application rates and application timings of UAN fertilizer solution and AA for its effects on soil N and corn and early or late-planted winter wheat production and N use efficiency. Results of these trials indicated that both pre-emergence or in-season sidedress applications of UAN fertilizer solution plus nitrapyrin can be effective for corn production, but the sidedress application may allow for a lower rate of UAN application (thereby decreasing the application costs) and may lower risk of N loss. Spring application of AA with KAS-771G77 produced the highest yields for early-planted wheat and fall application of AA with KAS-771G77 resulted in highest yields for late-planted wheat. Therefore, the effectiveness of the AA application with the NI was dependent on the timing of the application and when the winter wheat was planted in relation to that N fertilizer application. Use of NIs can provide growers with options to best manage N fertilizer applications in corn and winter wheat crops when risk of N loss is high due to climatic conditions or because of N fertilizer application timing or workload considerations.