

THIS ARTICLE IS ABOUT...

RIGHT SOURCE	RIGHT RATE	RIGHT TIME	RIGHT PLACE
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**Split Applications
Target Plant Needs**

- Split applications of nitrogen help growers match crop requirements with nutrient supply.
- Split application can increase nitrogen efficiency by more effectively matching nutrient supply with plant need.

Split Fertilizer Application Helps Optimize Nutrient Management

Split nitrogen (N) fertilizer applications can play an important role in a nutrient management strategy that is productive, profitable and environmentally responsible. Dividing total nitrogen application into two or more treatments can help growers enhance nutrient efficiency, promote optimum yields and mitigate the loss of nutrients.

By more specifically synchronizing nitrogen supply with a plant's ability to utilize nutrients, split application can be an important component of 4R Nutrient Stewardship — **right source, right rate, right time and right place.**



Depending on soil type, climate, agronomic practices and other factors, nitrogen fertilizer can be vulnerable to loss. Denitrification, leaching and volatilization impose costs that include lost productivity and negative environmental impact. Split-applying nitrogen fertilizer is one way to confront these challenges. When a crop's total nitrogen requirement is supplied with a single pre-plant or at-planting application, most of the N must "wait" for the target crop's future needs and that means the window for potential loss remains open longer.



By postponing a portion of the N treatment until the crop is better able to utilize the nutrient, plants take up the nitrogen more quickly and efficiently. That means growers get more from their fertilizer investment and fertilizer losses that can contribute to environmental concerns are lessened.

Enhanced Nitrogen Efficiency With Split Applications

Agriculture faces the daunting challenge of meeting food, forage and

fiber needs in a manner that is both environmentally and economically sustainable while striving to increase productivity with more efficient use of resources. Fertilizer is an integral part of this quest and the adoption of research-based best management practices (BMPs), such as split fertilizer application, reward farmers and consumers alike. To “split-apply” nitrogen, growers make two or more fertilizer applications during the growing season rather than providing all of the crop’s N requirements with a single treatment prior to, or at, planting.

“When all of the nitrogen is supplied ahead of crop growth, more of that nitrogen is susceptible to denitrification, leaching or volatilization,” explains Kansas State University Agronomist and Professor Emeritus Gary Kilgore. “Different growing environments pose different potential nitrogen loss conditions — nitrogen leaching beyond the root zone, for instance, is most likely in lighter textured soils not inhibited by a clay layer — but almost all growers face the possibility of losing some of the nitrogen they apply.

“When you split your N application and put a portion on later, almost all of that second application will be taken up by the plant. Plant roots are more developed and better able to access the N and the plant’s nitrogen requirement is increasing so uptake is much more efficient,” adds Kilgore who is also a Kansas Soybean Director, a Kansas Grain Sorghum Commissioner and executive secretary of the Kansas Forage and Grasslands Council.

Consider Split Application Crop-by-Crop

Split application offers efficacy benefits on a wide range of crops

and forages but its management must be considered on a crop-by-crop basis. The timing of post-planting nitrogen applications is especially critical. The target species must be immature and growing to provide time for the nitrogen to be absorbed and metabolized in order to have the most efficient yield or quality impact. In the case of corn, for instance, all of the nitrogen should be delivered to the plant before ears are set. In wheat, the second application of N generally is best made 10 days to two weeks prior to the jointing stage when leaf tissue elongates to form a stem and the plant’s nitrogen requirement increases as it begins its reproductive phase.

All crops, however, have different nutrient requirements. Because of a need for continuous, in-season production, forages especially benefit from split-applying nitrogen. For bermudagrass in particular, split application is vital. While nutrients like phosphorus are taken up as needed by the plant, nitrogen will be “spent” much more quickly and, therefore, won’t carryover. The result of a single application at the beginning of the growing season is substantial early-season production with dwindling productivity henceforth. For a forage crop like bermudagrass to sustain prolonged high productivity at a high quality level, N applications must be made throughout the growing season to equalize yield and maintain protein and total digestible nutrients (TDN).

Source and Placement Important

As in all fertilization strategies, source, rate, time and place should be the foundation of split fertilization decisions. Although various forms of nitrogen — granular, liquid and anhydrous — can be utilized in a split application scenario, their

placement is critical. Anhydrous, for example, can be used on row crops but should be injected into the soil and, therefore, protected from loss. Urea spread over the top for the second in-season application is vulnerable to surface volatilization.

Just like the crops they nourish, different N sources have different characteristics. Ammonium forms are less likely to emit greenhouse gases (GHG) and are less vulnerable to denitrification than are nitrate fertilizers. Preferably, urea-containing fertilizers should be applied when soil incorporation by rainfall or irrigation is likely within 24-48 hours, or incorporated by tillage. This is especially important in environments favorable to ammonia volatilization.

In addition to protecting crop productivity and fertilizer investment, farmers have a broader stake in limiting nitrogen losses. Excess nitrate in the soil under warm, wet or waterlogged conditions can result in emissions of nitrous oxide, a greenhouse gas whose global warming potential far exceeds that of carbon dioxide. For more information on limiting the global warming impact of fertilizer use, refer to this resource from the International Plant Nutrition Institute.

Better Yields, Less N Loss

Joe Smith of Independence, Kansas, has been a split application proponent for several years. A retired county Extension agent, Smith participates in his family’s farming operation at McCune, Kansas.

“For us, it makes for a more efficient use of nitrogen,” he says. “We get a lot of denitrification in our area and if we don’t use the nitrogen, we lose it. By putting nitrogen on when the plant can fully utilize it, we get better efficiency and we see better yields.

“When that corn plant is about 10-12 inches tall, it’s at a stage that it’s really ready to charge. It’s really ready to take advantage of the nitrogen and it’s going to use it up.”

The first split application is applied, in the form of anhydrous, as close to planting as possible in order to minimize N losses. A starter is used through the planter and the application at 10-12 inches provides the final boost for optimum yields.

Use Research-Based Recommendations

Split application should not exceed total test-based nitrogen recommendations. While split-applying N can enhance efficiency, it does not change what the plant needs and should not be used to exceed recommendations. Those recommendations should always be based on reasonable yield goals derived

and developed from research applicable to a given growing locale.

The downside for split applications is that wet conditions may prevent timely treatment. Also, dry conditions can prevent fertilizer from reaching crop roots and extra fuel costs from additional trip through the field must be considered. Some farmers may find that controlled-release fertilizer products offer a viable alternative to a split application.

Split fertilizer application can be an important part of a successful nutrient management program and can help growers achieve 4R Nutrient Stewardship — **right source, right rate, right time and right place**. Farmers should consult local or regional agronomic research to identify the BMPs involved with split application as well as its specific use and benefits for the crops they grow.

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The information presented here is mostly general and conceptual. For more specific information regarding safe rates of in-furrow fertilization for specific crops and conditions, one should refer to university extension resources, and/or consult a knowledgeable and experienced crop advisor or industry professional. Also, an Excel decision support tool is available online. Visit the IPNI website www.ipni.net/toolbox.