A new study from Colorado State University (CSU) shows how combining the strategies of zone management and active remote crop sensing for variable-rate nitrogen management can increase nitrogen use efficiency in irrigated corn while potentially raising yield.

The clearest and most consistent benefit of combining zone management based on soil properties with in-season remote sensing is the noticeable increase in nitrogen use efficiency, says lead author Louis Longchamps, postdoctoral research associate at the Precision Agricultural Laboratory (PAL) in the Department of Soil and Crop Sciences at CSU, who measured the benefits of combining the two management approaches.

“Our results demonstrate that combining both soil and crop information to determine nitrogen application rate and placement would be more effective at increasing nitrogen use compared with using only crop or only soil information—the research team studied center-pivot irrigated corn from 2010–2012.

Four different modes of fertilizer management were compared in the study: Traditional uniform rate of nitrogen throughout the field, variable rate by zone management to account for soil production potential, variable rate by remote sensing to monitor in-season plant health, and variable rate by using the combined approach of zone management and remote sensing.

Zone management

For the zone management approach, fields were divided into high-, medium-, and low-performance sub-regions using bare soil imagery, field topography, and the farmer’s experience about the field to determine spatial variability, a technique that was developed by Khosla and his research team more than a decade ago.

“The idea is to break up the field and come up with the areas where you have the best productivity and areas where you have the lowest productivity, and some intermediate zones,” Longchamps says. “And then, manage accordingly.”

Bare soil imagery was used to determine a variety of soil qualities, including bulk density, texture, compaction, organic matter, and moisture content. Elevation maps, meanwhile, were used to correlate grain yields with topography to indicate where water was pooling in the field.

“We created an elevation map to find out where the water flows and where the water pools, and we found out this was well correlated with the yield,” Longchamps points out.

Farmers also provided important information based on their personal experience and knowledge, he says, including useful facts on the land’s previous management, history of land use, tillage, pests and weeds, and other observations. In one quick meeting with the farmer, the researchers were able to glean a substantial amount of valuable information in addition to the bare soil imagery and topography maps.