



# LSP *Myth Buster* #55

An ongoing Land Stewardship Project series on ag myths and ways of debunking them.

Updated: May 2019

## → **Myth: Every Acre is a Potential Nitrogen-Fueled Superstar**

→ **Fact:** Farmers know that their fields do not conform to a single, uniform blanket of productivity. Everything from soil type and topography to rotation history and accessibility of field equipment to that odd corner can trigger yield variability from one acre to the next. And when yield varies, so does the efficiency with which inputs such as nitrogen fertilizer are taken up by plants and used. That's important, because a field or a portion of a field that is not utilizing fertilizer efficiently is seeing a fair amount going to waste as it's either emitted into the atmosphere or washed through the soil profile by water. That imposes a cost on a farmer's bottom line as well as the environment. Nitrogen that escapes Midwestern farm fields pollutes water in the region, and is a major cause of the hypoxic dead zone in the Gulf of Mexico. In addition, lost nitrogen can be a potent greenhouse gas.

One strategy farmers use to deal with yield variability is to apply more nitrogen fertilizer on those consistently poor performing parcels as a way to bring yields all across a farm to one uniform level. But a recent breakthrough study of Midwestern crop farms shows that such an approach is probably a waste of money, as well as bad for the environment. This study has implications not only for how fertilizer management is carried out, but also how land overall is best utilized.

### **Overachievers vs. Slackers**

The study, which was led by researchers at Michigan State University, used satellite imagery combined with other data to estimate the proportion of nitrogen fertilizer that was removed during harvest of corn on some 70 million acres in 10 Midwestern states, including Minnesota, Iowa, Wisconsin, and the Dakotas. The nitrogen that was not removed by harvesting the plants was considered "surplus," and thus lost into the environment. If a field or a part of a field produced low yields, then less nitrogen fertilizer was taken up by the corn plants and hauled off the land during harvest.

Cornfields were examined over an eight-year period, and the data was validated by comparing the

satellite information to 10 years of yield information collected by sensors mounted on combines from more than 1,000 farms. It's the first time yield variability has been quantified to such a micro-scale.

The resulting paper, which was published in the April 8, 2019, edition of *Scientific Reports*, created three categories: "stable high yield," "stable low yield," and "unstable yield." It turns out that across the Corn Belt, on average 48 percent of the subfield areas analyzed for the study were stable, high-yielders — year-in and year-out they crank out good corn harvests. The unstable acres — they can yield high one year, low the next — accounted for 28 percent of the cropped land. Around 26 percent of the land was the crop equivalent of the runt of the litter — consistently low yields, no matter what the circumstances.

That means a quarter of the land studied is leaking nitrogen fertilizer on a consistent basis, and adding more to prop up yields is not working, and in fact is only making the problem worse.

The study found that these consistently low yielding areas contribute around 44 percent of the nitrogen lost. Lost nitrogen from the 10 states studied annually totals nearly \$1 billion of wasted fertilizer and 6.8 million metric tons of greenhouse gas emissions, estimate the researchers. The study's authors argue that research like this reinforces the need to implement "precision agriculture" systems when producing row crops. Such systems rely on a combination of satellite data, yield monitor results, soil tests, and other information to fine-tune how much fertilizer is applied to each acre. Such technology could be particularly useful on those acres that are "unstable" yielders.

But Dr. Bruno Basso, the lead author of the study, makes it clear that no amount of fertilizer micro-managing is going to make those consistently low-yielding areas consistently viable crop producers. In a Michigan State press release, he said this study makes the case for leaving those dud acres unfarmed. He maintains that with good nutrient management the consistently high yielding acres, even the unstable ones, can more than make up for the lost corn

*Continued on next page...*

...Continued from previous page

production on that 26 percent of low-yielding land. He suggests planting such marginal land to “conservation grasses” or “perennial bioenergy crops.”

Basso and his colleagues make a good point, and this kind of research could help identify areas that would benefit from the restoration of prairie and wetland habitats, for example. This data also bolsters the argument for reforming crop insurance so that it does not provide so many incentives for tilling marginal acres.

### Valuing Acres Differently

But here’s another idea: make those marginal acres into livestock production areas. Managed rotational grazing has been shown to protect water quality, improve wildlife habitat, and even build soil carbon, all while producing income for farmers without a major investment in equipment. In fact, before changes in the crop insurance program made it more economically viable to grow row crops on marginal acres, those were the parts of the farm that were often grazed.

In recent years, numerous farming operations that are adapting managed rotational grazing have chosen to take their own “low-yielding” acres out of crop production and make them places where they produce livestock. Granted, many crop farmers today do not have livestock to graze, but increasingly we’re seeing situations where cattle, sheep and other animals can be “borrowed” temporarily to graze pasture or even land that’s been cover cropped.

Lightweight, portable fencing systems make it possible to reintroduce livestock onto farms, and the Sustainable Farming Association of Minnesota has worked with the Minnesota Department of Agriculture and the Natural Resources Conservation Service to develop an “exchange” where livestock farmers and crop producers can connect ([www.mda.state.mn.us/cropland-grazing-exchange-1](http://www.mda.state.mn.us/cropland-grazing-exchange-1)).

Ultimately, good grazing management can help get us out of the rut of valuing an acre of land based solely on its corn suitability rating. Given the right tools, management, and incentives, one farmer’s underperformer can be another’s superstar.

### More Information

- The *Science Reports* paper, “Yield stability analysis reveals sources of large-scale nitrogen from the US Midwest,” is available at [www.nature.com/srep](http://www.nature.com/srep).
- For more on viable ways of integrating livestock into cropping systems, see the Land Stewardship Project’s Soil Builders web page: [www.landstewardshipproject.org/lspsoilbuilders](http://www.landstewardshipproject.org/lspsoilbuilders).

### More Myth Busters

More Land Stewardship Project *Myth Busters* on a variety of topics are available at [www.landstewardshipproject.org/about/libraryresources/mythbusters](http://www.landstewardshipproject.org/about/libraryresources/mythbusters).