Rules are made to be broken—or at least challenged—even on the farm. The “1.2 Rule” for nitrogen fertilizer application has guided countless agricultural researchers, consultants, extension agents, and farmers for decades. However, some researchers have begun to re-examine the evidence behind it as well as the history of the rule itself.

In an article published recently in *Agronomy Journal* (http://doi.org/10.2134/agronj2018.07.0479), agricultural economists and agronomists summarized the research that shows the ineffectiveness and harmfulness of the 1.2 Rule and yield-based nitrogen fertilizer management, how the rule came to be, and where the research should go next.

The 1.2 Rule was and is still used as a simple rule of thumb to recommend nitrogen fertilizer application rates. In its simplest form, a farmer following the rule takes his or her field’s “potential” yield (in bushels per acre) and multiplies that by 1.2 to get the recommended nitrogen fertilizer application rate (in pounds per acre). There are intricacies involved, such as if soybeans had been grown on the field recently, but largely, the rule is straightforward.

While a Ph.D. student at the University of Illinois Department of Agricultural and Consumer Economics, Divina G.P. Rodriguez dove into the origins of the rule as first author on the article, ultimately finding that two papers in 1966 and 1973 by agronomist George Stanford likely established the rule. Rodriguez is now a researcher at the Norwegian Institute of Bioeconomic Research.

“I started my research on the history of fertilizer recommendations by contacting the authors of the *Illinois Agronomy Handbook, 1999–2000* to see if they knew its origins,” she explains. “They pointed me to other work, and then I chanced upon the Stanford papers. I immediately showed them to my adviser David Bullock at the University of Illinois, and we both thought they might be where the 1.2 formula started.”

After those two papers, the rule quickly pervaded the culture and common thinking around nitrogen management, making its way—in the form of catchy slogans like “1.2 is the best you can do”—onto even pocket knives handed out by agricultural organizations (see photo below). It became a rule of thumb, frequently stated and rarely understood, Bullock says.

“So, nitrogen fertilizer is becoming a bigger deal as the 20th century goes on, and people who work with farmers, such as those in extension, wanted to be able to recommend something to them,” he says. “They saw this 1.2 Rule as a great thing to recommend to help farmers.”

Stanford’s basis for his rule was that nitrogen recommendations needed to be data extensive, rather than data intensive, the researchers explain. This served as a way for the 1.2 Rule to

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**Key Points**

- An old and widely accepted yield-based N fertilizer management “ballpark” recommendation was evaluated.
- While this rule (the 1.2 Rule) served an important function at the time of its inception, it may have harmed agriculture in a number of ways.
- The future of nitrogen recommendations is the opposite of the 1.2 Rule approach—farmers’ decisions need to be made using more data, not less.
become a sweeping recommendation for farmers everywhere, rather than gathering lots of data at the farm level. There were some valid reasons for this at the time, the researchers add. Field-specific trials were costly and time consuming and not as feasible as they are now.

Decades after the rule became commonplace, many began to realize that a blanket rule for nitrogen management had serious consequences for both farmers and the environment. Farmers are putting nitrogen on their fields that costs money but doesn’t increase yield, with the excess fertilizer running into bodies of water.

“Globally, under- or overuse of fertilizer presents either lost agricultural production or environmental degradation,” Rodriguez says. “In the past decades, most land grant universities and soil-testing laboratories provided nitrogen recommendations based on Stanford’s 1.2 Rule, and many still continue to do so. We examined and critiqued the origins of the rule but also analyzed its application, both to judge its appropriateness and to examine how better fertilizer recommendations might be made.”

In trying to get at the origins of the 1.2 Rule, Rodriguez and Bullock obtained the original data Stanford used in his papers and found many issues with the conclusions. Among other issues, they found that the field trial data used in the study was old (from the early 1950s), and some of the data were left out of the papers’ reported results, which proclaimed the 1.2 Rule. Also, the findings were being extrapolated to locations outside the study area, from the American Deep South to the Midwest.

“While Stanford was using the technology and theory available to him at the time, it just wasn’t empirical research,” Bullock says. “By the 1980s, people started getting skeptical and doing research on the rule and started finding there was no relation between yield potential and nitrogen application rate. Many, many papers found that and started taking more empirical approaches.”

The future of nitrogen recommendations is—ironically, Bullock says—the opposite of the 1.2 Rule approach; farmers’ decisions need to be made using more data, not less. He and his team, and several other researchers across the world are performing field trials right on a farmer’s farm since they are now cheaper and easier.

“We get the data right from the field we are interested in, and new precision technology has opened up many new and easy ways to get data,” he explains. “The farmers participate in the trials and are a big part of the research, and it’s interesting, fun, and rewarding for everyone involved. I think that there is a win–win possibility here, and those are hard to find in this world.”

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Photos on opposite page courtesy of Haiying Tao (field image) and David Bullock (pocket knife with the “1.2 Rule” slogan).