

THE USE OF INFORMATION TECHNOLOGY IN DANISH AGRICULTURE

By Bruce Erickson

Denmark is an industrious farming area where productivity is high, and information plays a key role in continuing to build productivity and efficiency. Danish agriculturalists are utilizing a variety of ways to turn information into intellect, through the application of spatially intense information, databases, decision tools, and other methods. This article is based on a visit by a group from the Danish Agricultural Advisory Service (DAAS) to the Site-Specific Management Center on May 23.

DAAS is a farmer owned non-profit organization that has about 3300 employees, about 400 working in crop production technologies from a national center and 56 local centers. Besides working with farmers to help them with their crop nutrient needs, the local centers offer advice on crop production, animal husbandry, environmental issues, machinery, farm accounting, and variety trials. The national center supports the local centers with specialists in specific disciplines, software development, education and training, statistical analyses, and many other activities.

Denmark covers an area less than half the size of Indiana, and 62% of the land is agricultural. Farm sizes are small, averaging 55 hectares (about 140 acres), but 300 hectares is not an uncommon size for some of the larger farming operations. With the relatively cool climate, cereal crops such as barley and wheat thrive. The Danes utilize most of their crop output to produce meat and dairy products, with 24 million hogs slaughtered annually, similar to Iowa's production, and about a half a million dairy cows, half of Wisconsin's.

Denmark's farming past included heavy use of pesticides and fertilizers, with the goal of maximizing yields and incomes. Farming today is much different, where yield and income is important but tempered by environmental restrictions such as treatment frequencies, fertilizer budgets, and specific restrictions on the use of nitrogen.

Every farmer in Denmark must submit every year a fertilizer account detailing amounts of animal manures, fertilizers purchased, and the like. The DAAS advisors compared it to submitting an income tax return. The general goal of nitrogen fertilization is that it be 75% efficient—that most of the nitrogen is utilized by the crop, not lost to the environment where it could potentially cause harm. And while a 75% efficiency rate might seem reasonable to a non-agriculturalist, this is a very high expectation compared to the estimated efficiencies that might be expected by a Midwest corn farmer. If a Danish farmer exceeds nitrogen quotas, they are initially fined about \$0.50 per pound nitrogen over-applied per acre. Fines are double or more for repeat violations and when applications exceed



Danish farmers must comply with strict nitrogen accounting.

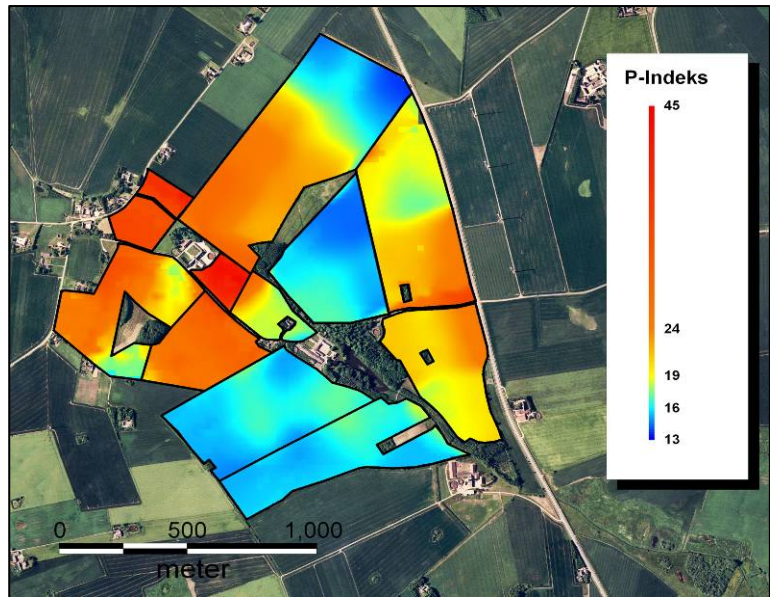


quotas by larger amounts.

In addition there are cross compliance requirements with EU farm subsidy programs. Farm program payments may be reduced or in extreme cases eliminated for farms that do not comply with nitrogen regulations. The DAAS advisors said that with farm payments averaging around \$140/acre (\$350/ha), farmers do not want to risk losing them.

Economists have predicted that strict nitrogen limits would encourage adoption of variable rate nitrogen technology because it would be important to make the best use of the small amount of nitrogen allowed, but the DAAS advisors said that they have not observed this response in Denmark. They indicated that allowable N rates are so far below optimum that applying a little more N here and a little less has little effect on yields or profits.

Nitrogen recommendations in Denmark are based on crop needs, then adjusted for manures, cover crops, soils, previous crops, annual rainfall, and also a compulsory reduction, currently 10%. With so many cows and hogs and the manure they produce in the relatively small area of Denmark, the impact of nutrients in the environment is closely monitored. The European Union Water Framework Directive demands “good organic and chemical conditions in surface water.” Phosphorus indexing is used to measure the potential for phosphorus transport from fields.



An indexing tool is used to assess the potential for phosphorus transfer from agricultural areas.

One of the key tools used by DAAS is the Danish Field Information Database, internet hosting of detailed field information from over 30,000 Danish farms, including yield map information, soil sampling, and spatial data such as electromagnetic conductivity. Traceability is important in Europe, and this database is a key part of that effort. This comprehensive database covers about 70% of the cultivated area of Denmark.

Another key effort of DAAS is in working to better utilize spatially intensive information in its efforts to assist farmers. Grid soil testing is commonly done in 1 hectare grids, but there is little use of combine yield monitor data or remote sensing information. EM-38 electromagnetic soil information has been collected in the past, but the Danes have had difficulty utilizing this information in such a way that consistently improves site-specific decision-making, such as the creation of soil management zones. The Danes are very interested in models and algorithms to support nitrogen, liming and other applications.



In 2002, the Purdue Site-Specific Management Center participated in a survey of Danish farmers who had used precision agricultural practices. The surveys focused on the farmer's use of equipment and software, internet and e-mail use, data handling, information sources, desired information and services, and a number of other factors. A corresponding survey was conducted in the Eastern Corn Belt, USA. The survey results showed more similarities than differences in practicing precision agriculture between the two countries, with the majority of respondents indicating that they had made some changes to their management practices due to precision technologies. Time requirements and high cost of data handling were cited as the main problems. Survey respondents found soil maps to be more valuable than yield maps in management decisions. About 80% of the respondents would like to store the PA data themselves. The majority of the respondents indicated that they have changed their management practices due to PA, but not substantially.

Conclusions:

Continued contacts with Danish researchers and farm advisory service would be useful for both sides. The Danish experience with strict limits on nitrogen application may provide useful lessons for US producers just entering into a time of more stringent fertilizer use regulation.

For more information about DAAS or the Danish farmer survey, please see:

The Danish Agricultural Advisory Service, available at:

<http://www.lr.dk/applikationer/kate/viskategori.asp?ID=lr0030000200>

Fountas, S. Blackmore, S. Ess, D. Hawkins, S. Blumhoff, G. Lowenberg-Deboer, J. Sorensen, C.G. Farmer experience with precision agriculture in Denmark and the US Eastern Corn Belt. *Precision Agriculture*. 2005 Apr. v. 6, no. 2. Available at <http://www.springerlink.com/> (select Browse Publications on main page, go to Precision Agriculture).

