Pl@nteInfo – USING THE INTERNET FOR CUSTOM TAILORED CROP INFORMATION

www.planteinfo.dk/information/publikationer/efita97/

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Abstract: Pl@nteInfo (*www.planteinfo.dk*) is an information system for crop production which uses the Internet to supply farmers and agricultural advisors with just-in-time information about risks for diseases, pests, drought etc. The information can be selected on national or regional level, and in some cases it can be tailored to fit the particular situation of the farm by allowing the user to submit farm-specific data.

Keywords: Internet, risk, advise, crop, disease, pest, decision support, model

1 Introduction

The Internet and its graphical user interface, the World Wide Web (WWW), has reached a level of distribution and use, which makes it unnecessary to argue for the enormous possibilities connected with these technologies. One of the most commonly cited advantages of the WWW is the access to information on a *global scale*. Indeed, the amount of world wide accessible information is literally exploding. However, when the initial fascination of being able to select information from a distant computer has faded out, most Internet users will probably mainly want information of *local* interest.

Another commonly cited advantage of the WWW is the access to *up-to-date* information. Unfortunately, a bit of Internet surfing will reveal that a substantial part of the Web sites are glossy, electronic brochures with the intention to describe something (a product, a company, an organisation etc.). With these static Web-brochures, the Internet is used as yet another medium to promote something for somebody. Even when Web pages are meant to describe dynamic phenomena, they are often not kept updated, or they remain 'under construction'.

Actually, it is an advantage of the Internet, which has not yet been sufficiently acknowledged, that it can be used to give *local* and *up-to-date* information. Naturally, local information on the Internet is

only interesting, if the information is not available locally already – possibly because it is under influence by non-local factors. An obvious example is the most recent local weather forecast.

This advantage of the Internet makes it very interesting for agriculture, since most non-trivial agricultural problems require skills from different disciplines, up-to-date information from different sources, together with knowledge of the local conditions now and in the past. Consider for example the complex problem of how to protect a crop against an observed disease with minimal environmental impact. In order to determine the optimal fungicide, dosage and time of treatment, a lot of information from different sources must be processed: Knowledge about the physiology of the crop and the morphology, epidemiology and aetiology of the disease must be available; the current infection level must be predicted from an uncertain field monitoring; the disease progress must be predicted under different treatment strategies and under influence by the future weather; the possible treatment regimes must be recognised, together with the prices, availability and efficacy of fungicides, legal and security regulations, environmental impact etc.

In order to take all (or some of) these pieces of information into account in the decision making, farmers and agricultural advisors use computer-based decision support systems (DSSs), like the Danish crop protection DSS, PC-Plant Protection (Murali, 1991; Secher *et al.* 1995). The required field-specific and dynamic information will typically have to be provided by the user, while most of the other information is embedded in the DSS or an associated farm management system. These pieces of information are not static, though: The list of approved fungicides may be changed by the emergence of new products and the removal of old, the legal regulations may change, improved knowledge may evolve, like for fungicide efficacy, crop susceptibility etc. Also, the disease and crop models may be improved. Since it is expensive to update a computer-based DSS, this is done quite infrequently (like annually), and consequently parts of the information in the DSSs are not up-to-date.

The Internet is a very well suited tool to ensure that the decision support is always based on the most up-to-date information available: The most current information (weather, approved fungicides, prices, legislation etc.) can be collected at the time of enquiry from the various sources and used as input data. Future development may result in DSSs, where this information collection is done automatically by the system. Furthermore, the DSS could be assembled from modules built and maintained by the different institutions with the proper domain expertise. For example the Internet can be used to collect the most recent disease model and combine it with the most recent crop model and maybe other models (like microclimate, fungicide effect, environmental impact, ...). Such systems we call Collaborative Information Systems (CISs) (Jensen et al., 1996a).

2 Pl@nteInfo

The Danish WWW-based information system for crop production, Pl@nteInfo, can be viewed as a modest (so far) example of a CIS, where information from different sources are collected and used to give information which is up-to-date and tailored to the local conditions of the user. Pl@nteInfo (*www.planteinfo.dk*) is being developed in a collaboration between the Danish Institute of Plant and Soil Science (DIPS), and the Danish Agricultural Advisory Centre (DAAC) (Jensen et al., 1996b).

During the growing season of 1996 Pl@nteInfo has supplied farmers and advisors with daily updated information about:

- Calculated risks of diseases and pests based on weather data
- Field recordings of diseases and pests
- Agricultural weather information

For some of the subjects, the information has been presented graphically on geographical maps of Denmark with colours indicating the risk levels. By clicking on an the map users can obtain regional

information, as illustrated in figure 1. Apparently Pl@nteInfo is the first information system in the world with such facilities.

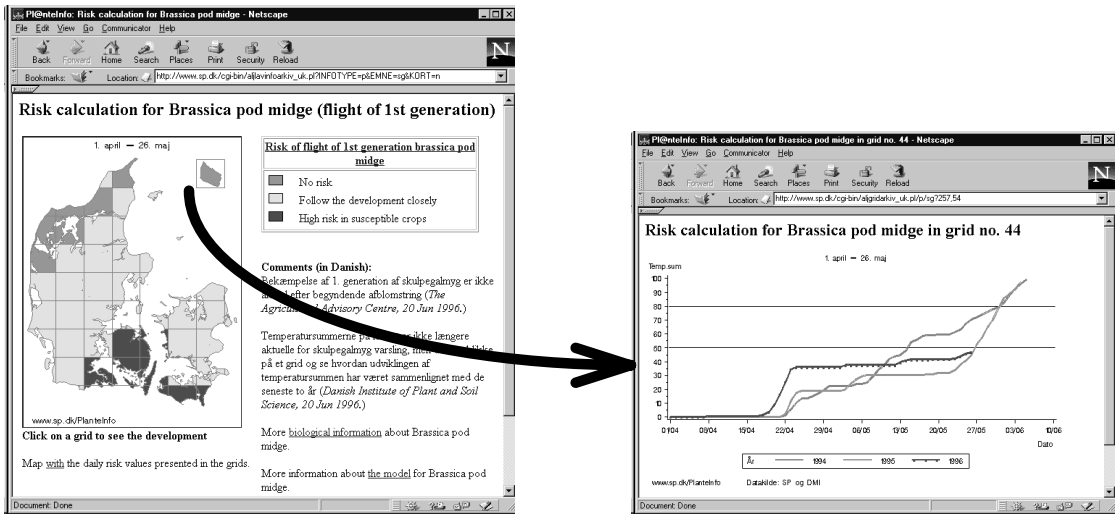

Figure 1. Example of pest risk information in Pl@nteInfo. A click on the map of Denmark (left screen) results in regional information of the development of the risk index (right screen).

Pl@nteInfo contains examples of integration of information from different sources into the same Web-page. The geographical maps with daily calculated risk indices for various diseases and pests were produced by DIPS, and they were accompanied by textual interpretations of the situation from DAAC in the same WWW document (e.g. the left screen of figure 1). Since the information from the two autonomous sources were updated independently, a program was used. When executed on request from a user, the program collected the latest versions of the two pieces of information, combined them into the proper WWW document, and displayed the resulting document on the user's screen.

3 Pl@nteInfo in 1997

For the growing season of 1997 Pl@nteInfo has been improved with new facilities. A new design with a menu frame will make it easier to navigate within the web-site, and the front page will give agronomic information of current interest. Furthermore, Pl@nteInfo contains facilities for *custom tailored information*, where users can submit local field and weather recordings in order to tailor the information to their local conditions. These facilities include:

- Predictions of crop development stages
- Local irrigation need
- Local nitrogen fertilisation need

In order to calculate for example the field specific nitrogen fertilisation need, the farmer submits information about date and results of an analysis of the mineral nitrogen content in the field, the soil type, the crop, the expected yield, and the organic nitrogen applied from fertiliser or ploughed in crop remains for the past five seasons. The calculation can be printed out and used as legal documentation for a higher fertilisation need than stated by the Danish authorities.

Since the 1996 version of Pl@nteInfo, the technical procedures for the daily updating of the information in Pl@nteInfo has been improved towards the ideas behind CIS. This is part of a development leading to a more open and distributed system architecture, where for example the plant pathologists responsible for the disease risk models can maintain their models without central administration. The programs to produce maps and diagrams of risk indices are no longer produced in

advance. Now, the user activates a SAS program on the server, which collects the proper data from a database and process the data to produce the requested Web pages. For information on dynamic SAS applications on WWW, see the Web pages *www.sas.com/rnd/web/dispatch/* from SAS Institute.

As a result of the open system architecture and the dynamic data processing, the information presented in Pl@nteInfo will always be based on the best available models and the most recent information input.

The programs for presenting results with geographical maps and expert comments have been made general. This has made it easy to export the concept for a similar service in Sweden. Pl@nteInfo uses weather data from the Swedish Meteorological and Hydrological Institute together with Swedish or Danish disease or pest models and expert interpretations from the Swedish agricultural advisory service to produce daily updated information about frit flies, Septoria spp. and potato late blight.

4 Conclusion

During its first season Pl@nteInfo has proven to be a very useful information system. But equally important, Pl@nteInfo demonstrates some of the most significant advantages of the Internet as a medium for distributing information:

1. The information can be *custom tailored* based on input data from the user.
2. The information can be processed from input data from different *independent sources*.
3. Information from different sources can be *integrated* automatically into the same Web page.
4. The Internet facilitates *collaboration* between institutes of different expertise or similar institutes in different countries.

The utilisation of these advantages should lead to much more sophisticated information systems, where the information is based on the best models and the latest data available. This in turn should lead to more precise advises or background information for the users, which in the case of Pl@nteInfo should result in a more environmental use of chemicals and resources on the farms.

Future work in Pl@nteInfo will deal with facilities where the processing capacity of both server and client computers are used. In this way, a client can activate the preparation and collection of dynamic information from a range of server computers, and then use it as input for a DSS on the client computer. The technical problems of automatic information collection has yet to be solved.

5 References

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