

# Precision Agriculture Adoption

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# Overview

- Adoption around the world
- Farmers' experience
- Adoption benefits
- Adoption constraints
- Adoption trends
- References

# Yield monitors estimates In America

Country	Estimated Number	Year of Estimate	Yield Monitors per Million Acres
USA	30.000 *	2000	136
Argentina	1.000	2003	17
Brazil	100	2002	1
Chile	12	2000	8
Uruguay	4	2000	3

\* Daberkow estimates that in 2003, the number of yield monitors in the USA will be up to 45.000

# Yield monitors estimates Outside America

<b>Country</b>	<b>Estimated Number</b>	<b>Year of Estimate</b>	<b>Yield Monitors per Million Acres</b>
U.K.	400	2000	43
Denmark	400	2000	100
France	50	2000	2
Germany	4250	2003	212
Netherlands	6	2000	11
Sweden	150	2000	48
Belgium	6	2000	7
Spain	5	2003	<1
Portugal	4	2003	3
Greece	2	2005	1
Australia	800	2000	17
South Africa	15	2000	1

Source: Griffin, et al., 2004. Purdue University, USA

# Crops And Precision Agriculture

In the U.S.A. crops harvested with yield monitor

<u>Crop</u>	<u>1996</u>	<u>2000</u>	<u>2003</u> *
● Corn	15.6%	34.2%	46%
● Soybean	13.3%	25.4%	36%
● Wheat	5.9%	9.1%	15%
● Cotton	NA	1.3%	NA

- ✓ Only about 1/3 of the combine harvesters use GPS..
- ✓ The 1st yield monitor for cotton was launched in 1998

\* Estimates by Daberkow

# Geo-referenced soil map

In the U.S.A., acres on which soil mapping was used:

<u>Crop</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>
● Corn	18.6%	23.8%	25%	25%
● Soybean	14.4%	16.7%	18.5%	11%*
● Wheat	6.6%	NA	12.2%	NA
● Cotton	3.1	1.3%	NA	NA

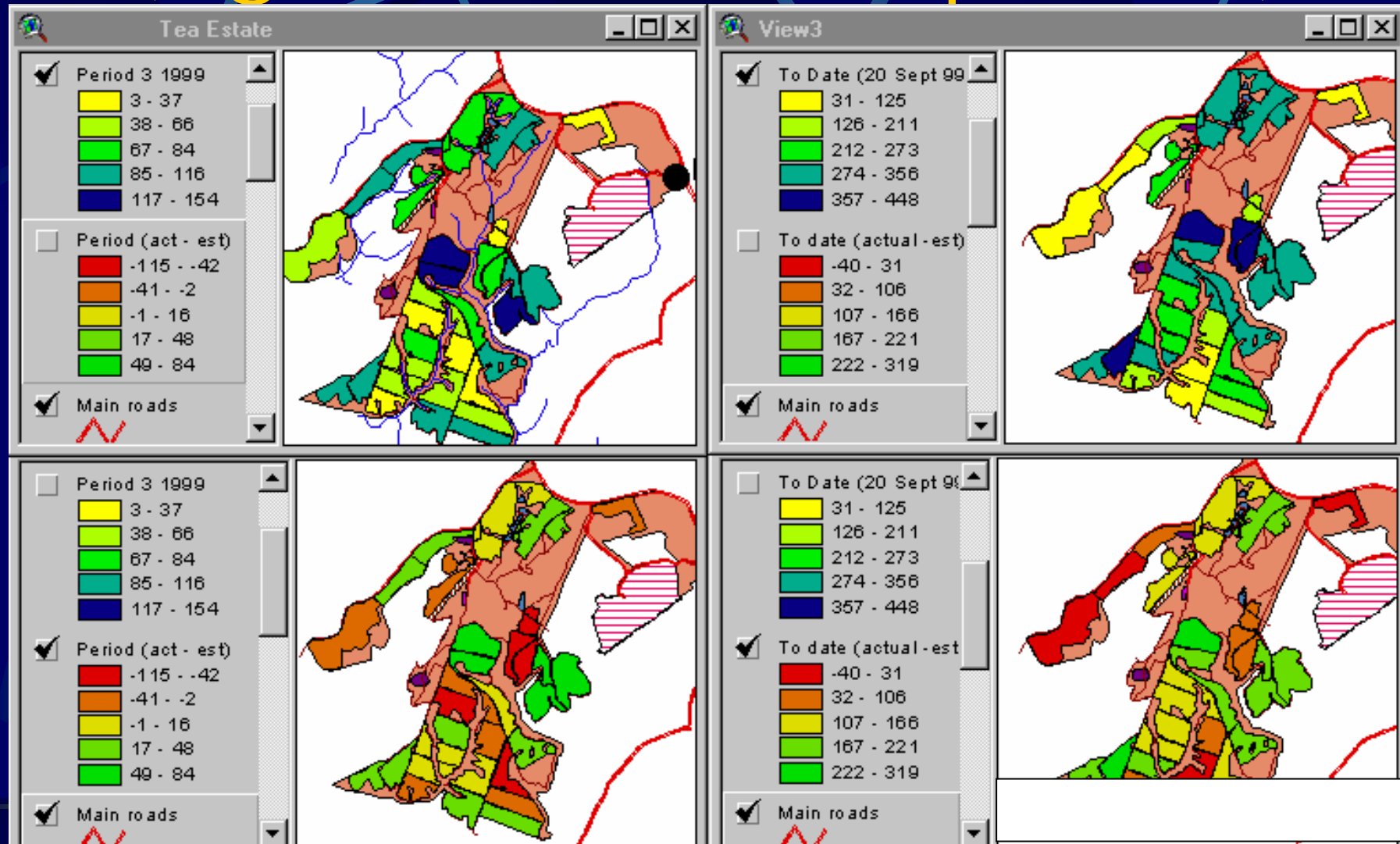
\* For soybean in 2001, there was no data. The number stands for 2002



Is Precision Ag Only for  
the Developed World and  
Arable Crops?



# Tea estate yield maps (kg of made tea per ha)



Source: S. Blackmore



# PF applied to dates in Arabia

## ● Fields

- Well established groves (each tree numbered)

## ● Yield mapping

- Record harvest from each tree

## ● Fertilizer

- Applied by hand, according to treatment maps

## ● Technology

- Low support

## ● Special considerations

- Labour shortages
- Operator safety (15m trees!)



# Date harvesting by hand

Person

Crown

Dates being lowered

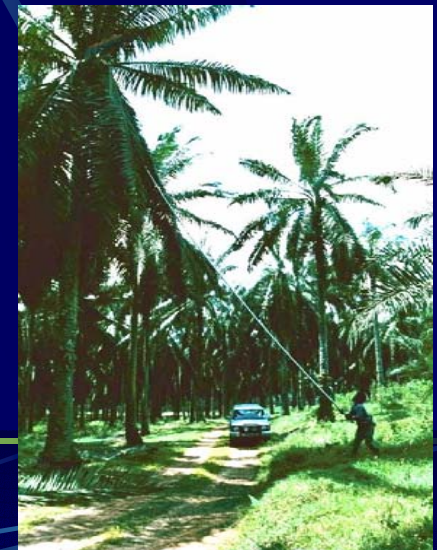
Source: S. Blackmore





# PF for other tree crops

- Each tree uniquely located
- Harvested by hand
- Weighed by block
- Quality graded on farm?
  - Oranges in Brazil and Florida
  - Oil palm in Malaysia
  - Christmas trees in Denmark



# PF applied to Sugar in Australia, Brazil & Mauritius

- Fields
  - Highly structured small blocks
- Yield mapping
  - Hand cutting moving to mechanical harvesters
- Fertilizer application
  - By hand, using maps, increasingly mechanized
- Technology
  - Medium support
- Special considerations
  - Reducing the cost of production, Mechanization
  - De-rocking, no burning after 2006 in Brazil

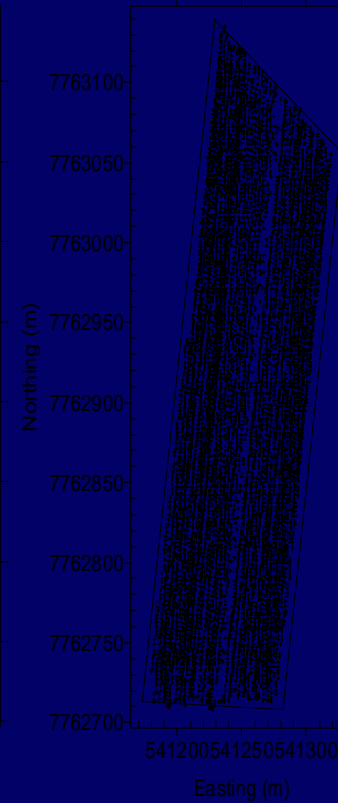
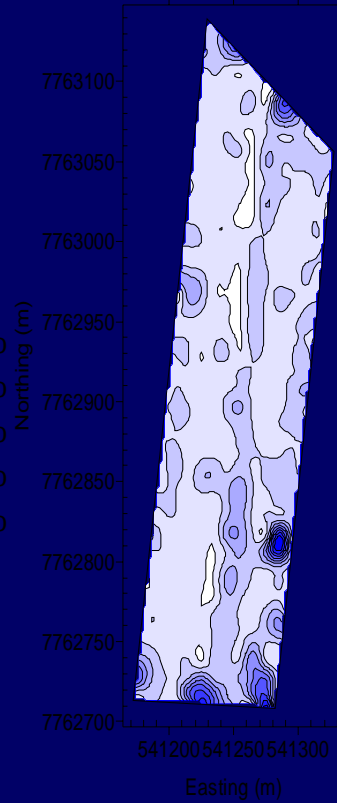
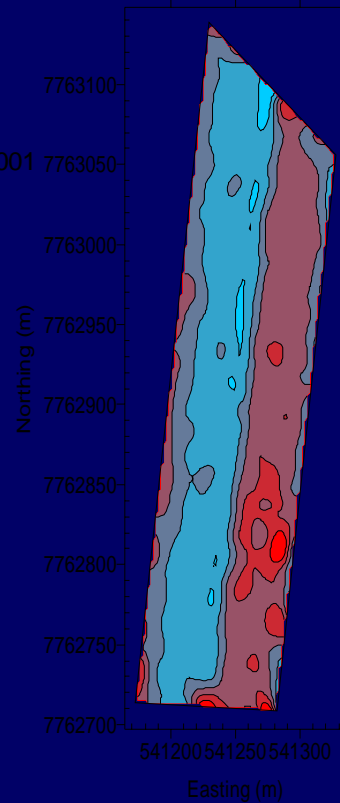


# Yield mapping sugar cane harvester



Sugar cane Av. yield, Std Dev and (non zero) Points  
Albion\_2643 field, Medine SE 2001

Field size; 9.11  
Type; Sugar cane  
Variety; R570  
Date sown; Dec 1995  
Date harvested; 13/7/2001  
Methods;  
1) Gridded on 10m  
2) Averaged over 10m  
3) Spline smoothed  
Units; t/ha

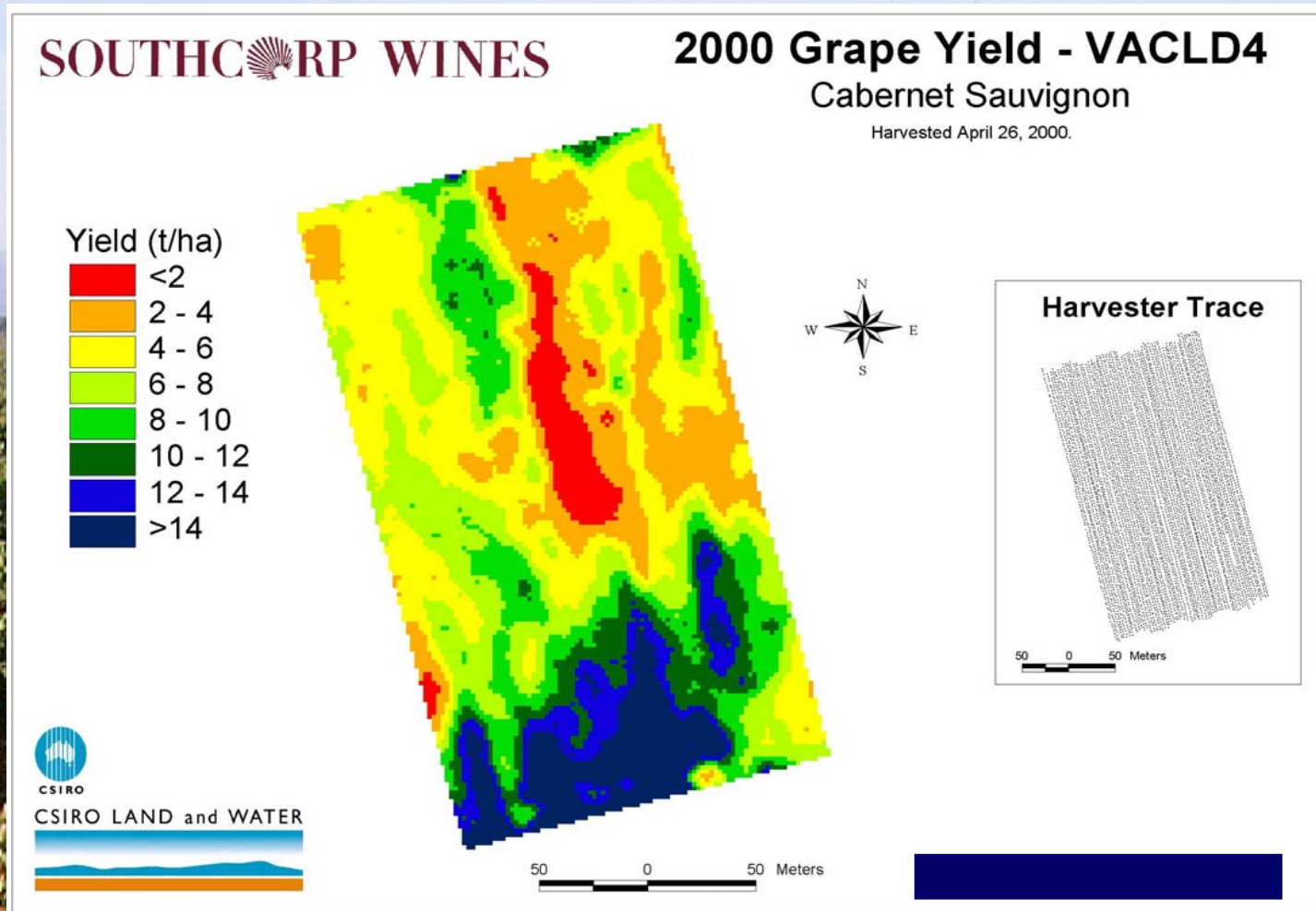


C:\Sugar\Medine\Albion\_2643\2001\Yield\ALB2643\_Y\_2001.F

Source: S. Blackmore



# Precision viticulture



Source: S. Blackmore

# Reasons for different adoption patterns around the world

- Auto-guidance popular in Australia, as their soils are vulnerable to compaction and have not freezing and thawing to counteract that compaction
- Grid soil sampling is popular in the U.S. and Canada, mostly because soil analysis is cheaper there
- VRT in Europe has focused on nitrogen, due to environmental rules
- ....



# Hypothesis for adoption of yield monitors in Europe

- Northern Europeans are used to intense crop management in comparison to US farmers with more extensive management. Will yield monitoring be another management tool for Europeans?
- What will be the role for Advisory Services in Europe in comparison to commercial advisors in the USA?
- Will European farmers be willing to spend time in the office analysing the yield data, in comparison to their US counterparts that prefer the outdoor lifestyle?

# Farmers' Experience.. In Denmark and Cornbelt, USA

Two surveys conducted in Denmark and the Eastern Cornbelt in the USA, in 2002, targeted farmers practicing Precision Ag

- 63 respondents in DK, 135 in the USA

Respondents' Average Age:

43 (DK)  
46 (USA)

Respondents' Cultivating Area:

422 ha (DK)  
790 ha (USA)

Farmers' Average Age:

52 (DK – 2000 statistics)  
57 (USA – 1997 statistics)

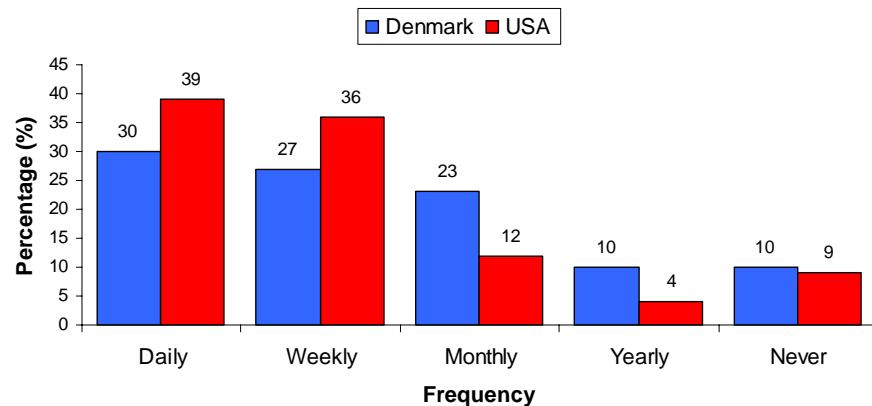
Farmers' Average Cultivating Area :

50 ha (DK – 2000 statistics)  
190 ha (USA – 1997 statistics)

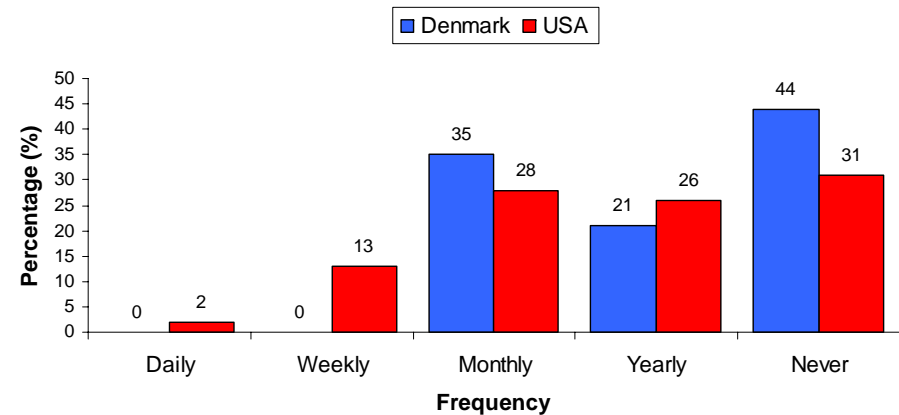
- ✓ *Respondents a decade younger than the average farmer*
- ✓ *Farmers who cultivate large farms tend to practice PF*

# Farmers' Experience.. In Denmark and Cornbelt, USA

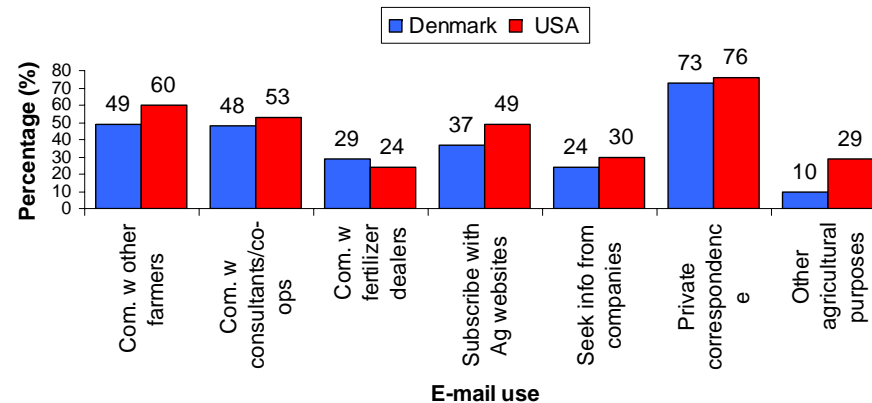
### Internet Use for Agricultural Purposes



### Internet Use for PF purposes

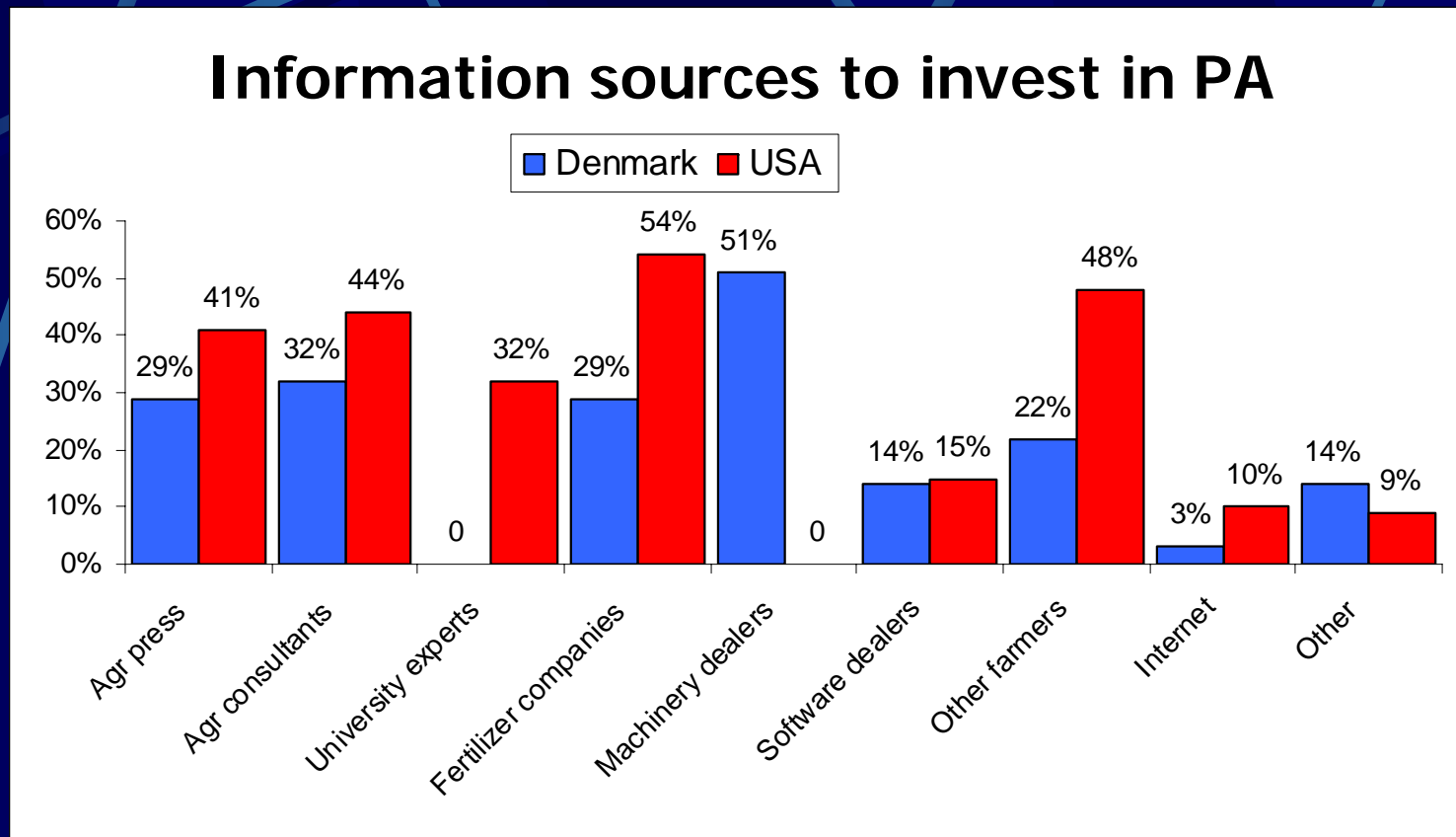


### E-mail Use



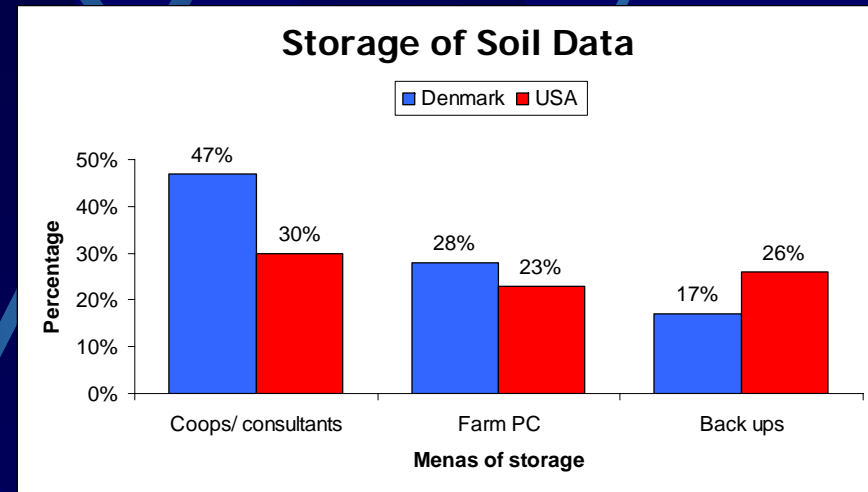
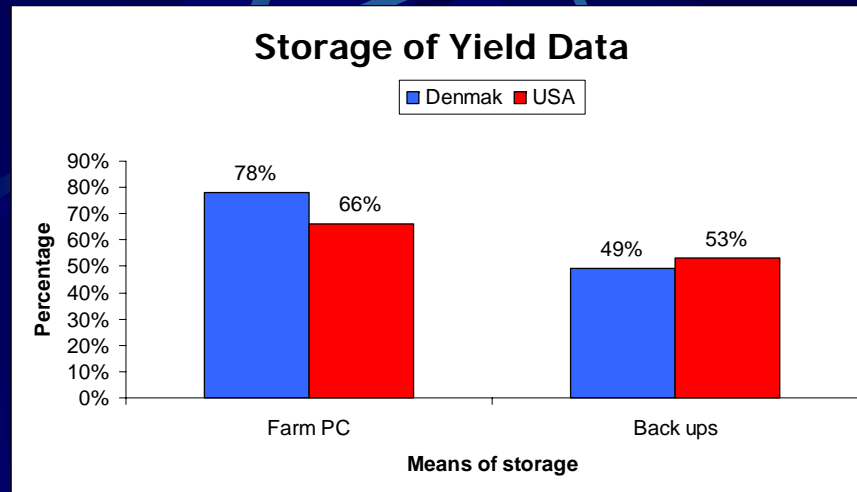
✓ 90% in DK & 87% in USA have used Internet and e-mail for agricultural purposes, but a small number for PF

# Farmers' Experience.. In Denmark and Cornbelt, USA



- ✓ *Machinery dealers, ag consultants, ag press in Denmark*
- ✓ *Fertilizer companies, farmers, ag consultants, ag press in the USA*

# Farmers' Experience.. In Denmark and Cornbelt, USA



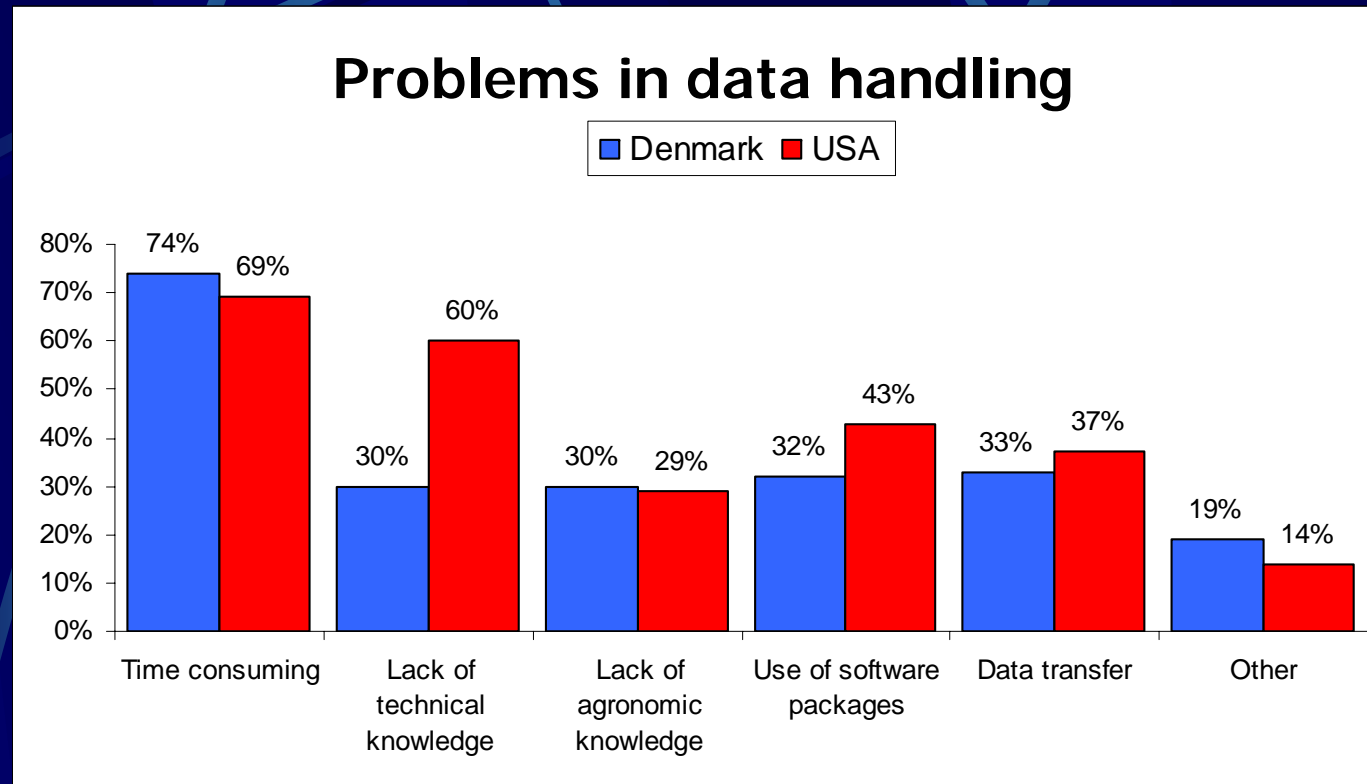
## Data Ownership

*Farm PC:*  
81% (DK)  
78% (USA)

Common Web  
Database (USA)  
88% : No

- ✓ *Low percentage of making back-ups.*
- ✓ *Farmers do not trust other sources to store their data*

# Farmers' Experience.. In Denmark and Cornbelt, USA

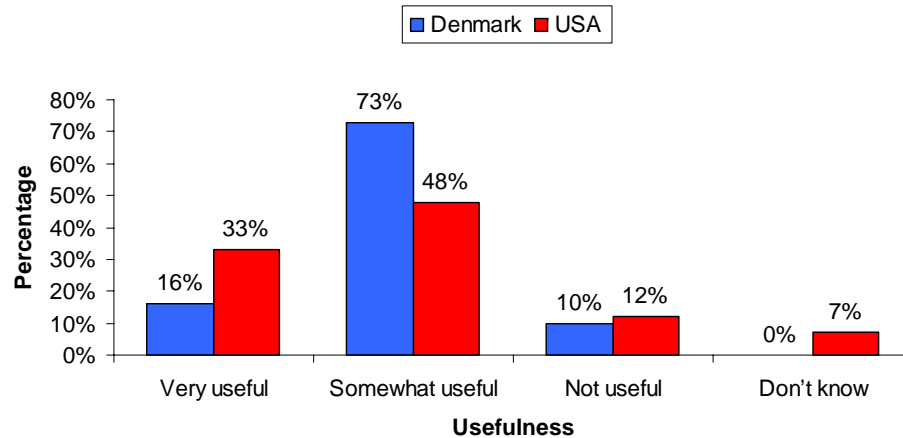


• *57% very costly in the USA*

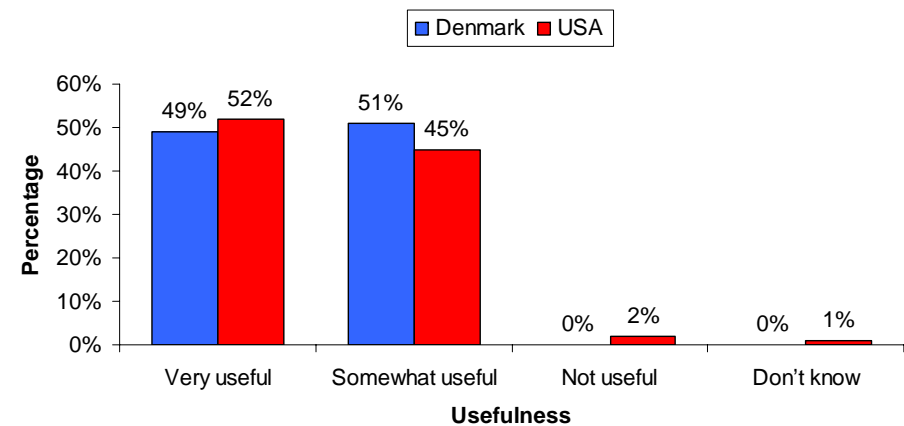
✓ *Time consumption, lack of technical knowledge, and cost are the most important impediments in the implementation of PA*

# Farmers' Experience.. In Denmark and Cornbelt, USA

### Value of Yield Maps



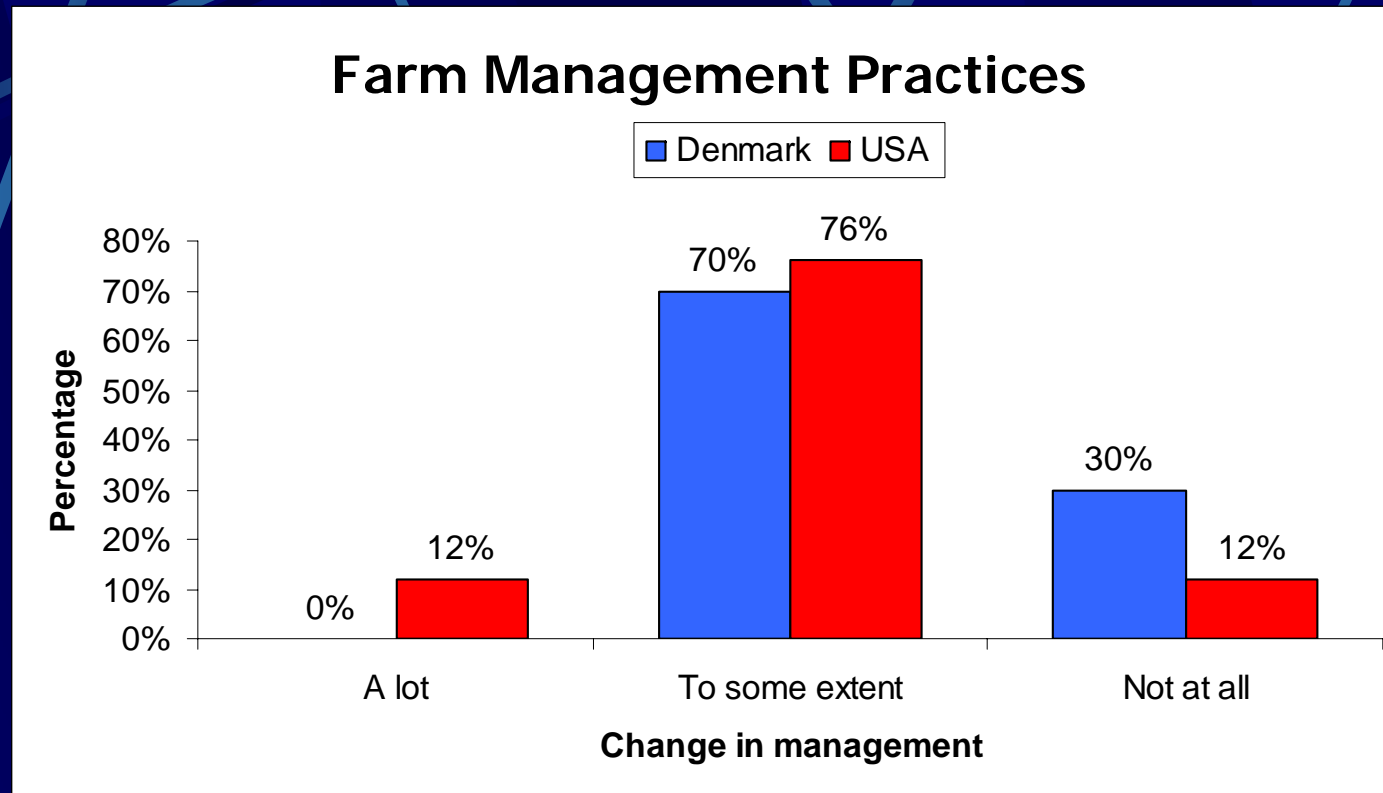
### Value of Soil Maps



✓ *Soil maps are currently more valuable to make management decisions than yield maps*

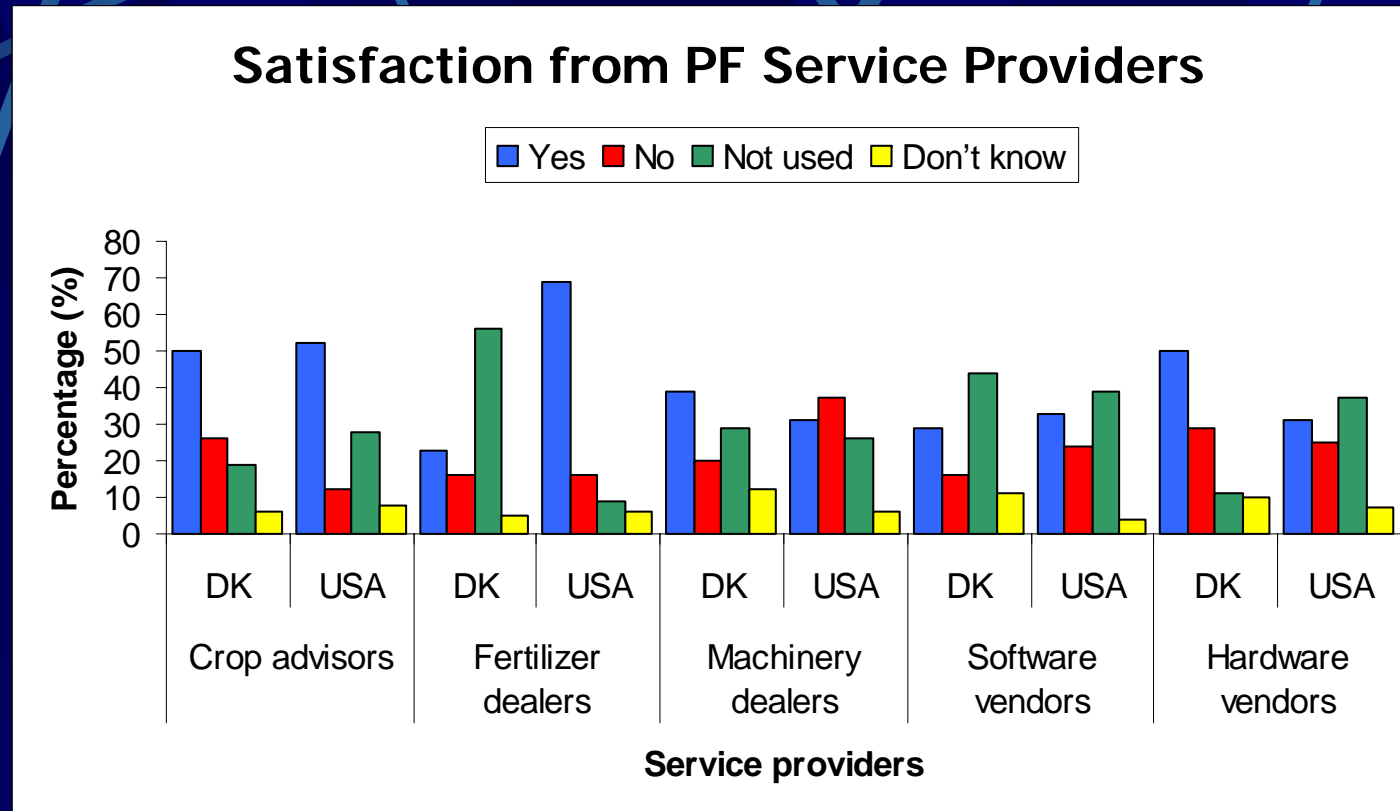


# Farmers' Experience.. In Denmark and Cornbelt, USA



- ✓ *Respondents have changed farm management practices, but not substantially*

# Farmers' Experience.. In Denmark and Cornbelt, USA



- ✓ *Higher satisfaction from crop advisors & fertilizer dealers (USA)*
- ✓ *The majority has not used software & hardware vendors*

# PA constraints

- Precision Ag is information-intensive management practice
- Data analysis the major problem
  - Farmers are not willing to spend time in the office analysing the data
  - There is not a “cook-book” on how to analyse the data
- “Closed-looped” approaches to make farm management decisions is not acceptable by farmers
- PA Farm management is more of an “ART” than “Science”

# PA benefits

- Software and Hardware prices continually falling, while their capacity increasing
- The public acceptance on IT is broadening, e.g. GPS in cars, sensors in everyday life
- Environmental incentives to reduce inputs, e.g. new CAP in the E.U.
- New Technologies in Agriculture may look more “fancy” for the new generation of farmers

# The potential of PA

- The Role of Advisory/Extension Service
  - Initially to understand the reasons why farmers don't adopt PA
  - Then, the advisors should target on these reasons, trying to give practical and profitable solutions
- Still, need to educate agronomists to work with PA and help farmers using and analysing PA data

# References

- Griffin, T.W., J. Lowenberg-Deboer, D.M. Lambert, J. Peone, T. Payne, and S.G. Daberkow, 2004. Adoption, Profitability, and Making Better Use of Precision Farming Data. Staff Paper #04-06. Department of Agricultural Economics, Purdue University
- Lowenberg-Deboer, J., 2003. Is the US falling behind in yield monitor adoption? Site-Specific Management Center, Purdue University. Newsletter, August 2003.
- S. Fountas, D. Ess, C.G. Sorensen, S. Hawkins, H.H. Pedersen, S. Blackmore, J. Lowenberg-Deboer, 2005. Farmer experience with Precision Agriculture in Denmark and US Eastern Corn Belt. Precision Agriculture. In Press.