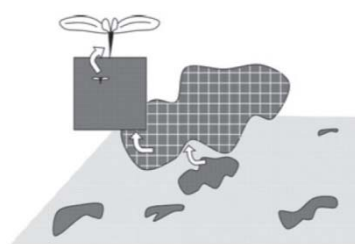
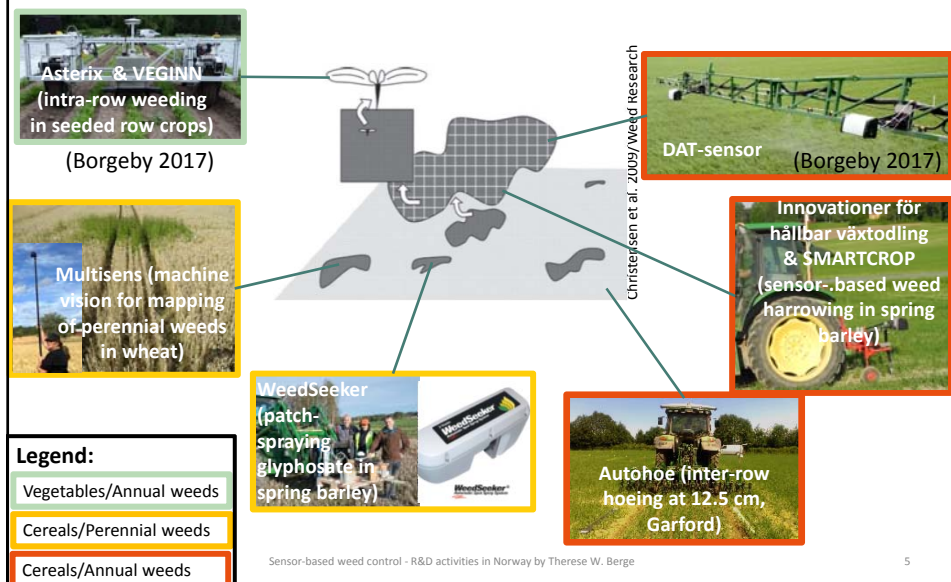


SENSOR-BASED WEED CONTROL – R&D ACTIVITIES IN NORWAY



Christensen et al. 2009/Weed Research

SENSOR-BASED WEED CONTROL – R&D ACTIVITIES IN NORWAY



DAT-SENSOR



Applicable to:

- Post-emergence patch spraying of herbicides
- Cereals (row distance 12.5 cm, crop 2-4 leaves to tillering stage)
- Summer- and winter annual weeds
- Seedlings of perennial weeds

Owned by:

Dimensions Agri Technologies AS, Norway

DAT-SENSOR



Photo: DAT AS

Developed by:

- Adigo AS (current version of machine vision)
- NIBIO (sensor-based spray threshold values)
- NLR (Norwegian Extension Service) and farmers (field trials)
- SINTEF ICT (previous version of machine vision)



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7

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Photo: Adigo AS

Example of image (ca. 20 cm x 30 cm)
captured by DAT-sensor

Machine vision:

- Proportion of image covered by cereals (C)
- Proportion of image covered by all weeds (W)
- > Relative weed cover (RWC)

$$RWC = \frac{W}{W + C}$$

- Mayweed -> Relative mayweed cover
- Grass weeds



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8

DAT-SENSOR



Example of image (ca. 20 cm x 30 cm)
captured by DAT-sensor

DAT-SENSOR

Evaluation of the machine vision algorithms:

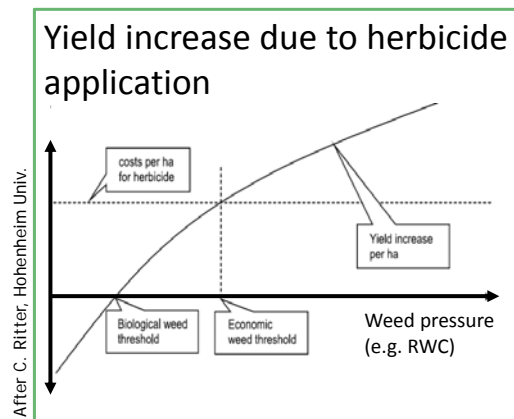
Percentage of weed leaf candidates correctly or incorrectly classified

Test set		Correct (%)	Misclassified (%)	
			Crop as weed	Weed as crop
Spring cereals	A (n=14 003)	84.0	5.1	10.9
	B (n= 23 185)	79.2	14.0	6.7
Winter wheat*	A (n=9 587)	91.0	4.4	4.5
	B (n= 39 535)	91.7	7.1	1.1

Kaspersen et al. 2010/3rd Precision Crop Protection Conference

*Images taken in autumn

DAT-SENSOR



Machine vision and weed/crop competition:

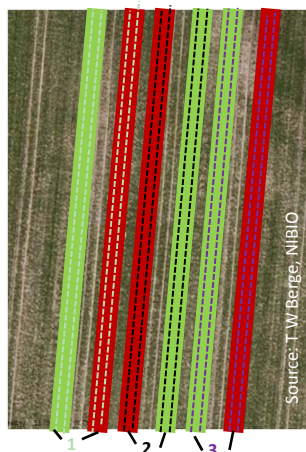
- Cereals are relatively competitive against weeds
- Cereal tolerates a relatively high pressure of the weeds
- Herbicide application below a certain weed pressure cause crop yield losses
- Threshold values



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11

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- Uniform application
- Patch spraying

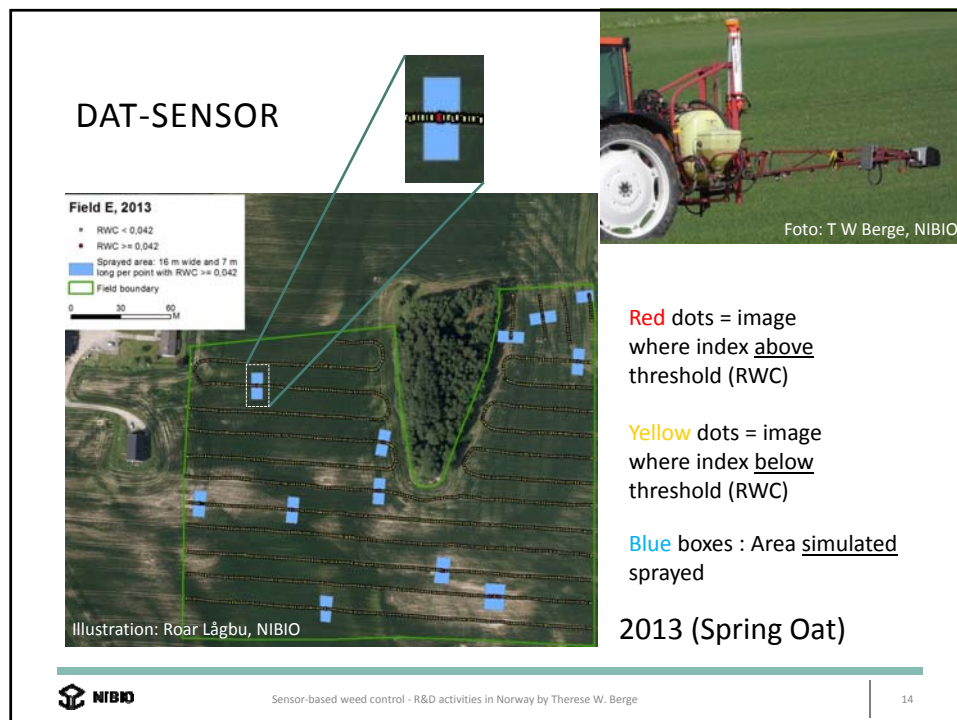
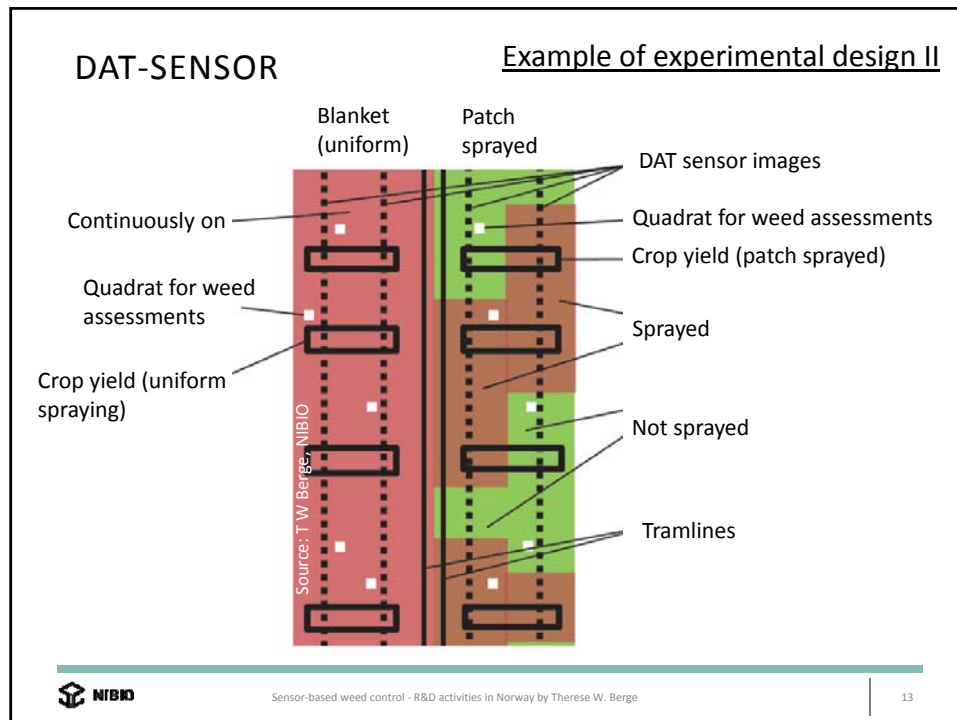
Example of experimental design I

- Testing three different threshold values for patch spraying
- Compares uniform and patch spraying (paired t-tests)
 - Crop yield
 - Weed control level
 - Crop quality parameters



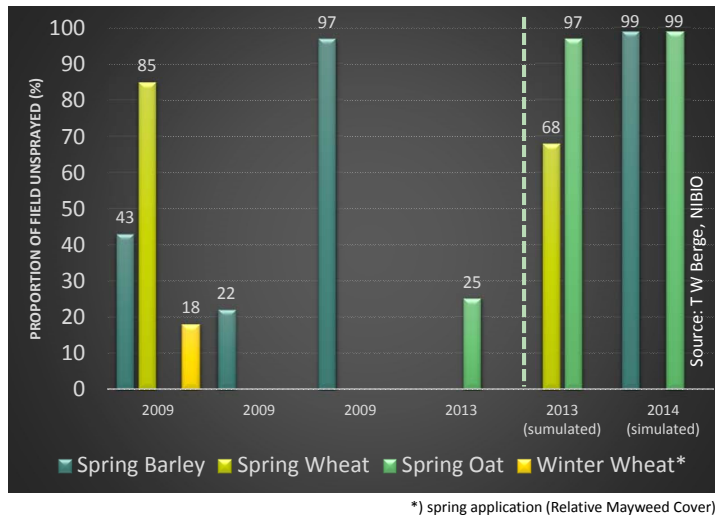
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12



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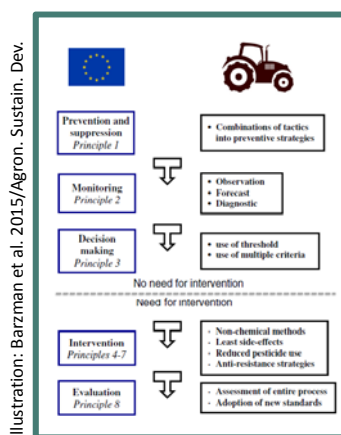
Herbicide savings



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15

PATCH SPRAYING AND EU IPM DIRECTIVE



- ANNEX III of Framework Directive 2009/128/EC
- Principle 6:

"The professional user should keep the use of pesticides and other forms of intervention to levels that are necessary, e.g. by reduced doses, reduced application frequency or **partial applications**, considering that the level of risk in vegetation is acceptable and they do not increase the risk for **development of resistance** in populations of harmful organisms."
- IPM is mandatory since 2015 in Norway



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16

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Source of video: <http://www.dimensionsagri.no/>

ACKNOWLEDGEMENT

- **Dimensions Agri Technologies AS**, www.dimensionsagri.no
- **Adigo AS**, www.adigo.no
- **Norsk Landbruksrådgiving (NLR)**, www.nlr.no
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- **Other farmers** in Tønsberg, Hedmark and Ås
- **SINTEF**, www.sintef.no
- Jan Netland, Marit Helgheim, Kjell Wærnhus, Roar Lågbu, Samuel Habte, Audun Korsæth, Haldor Fykse et al., **NIBIO**