An attempt to use image analysis to capture growth dynamics in mixed crops stands

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Background

Demand for organically grown winter oilseed rape.

Problems with pests, nutrient supply and weeds

Growing winter oilseed rape in a living mulch of white clover

- To reduce the problems with pests
- To reduce the need for separate green manure crops
- To introduce a "friendly" weed competitor

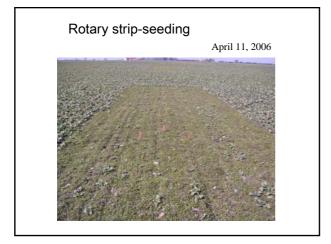
Hypotheses on rape part of the project (short)

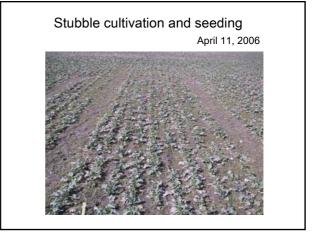
- Larger yields, N-yields
- Rotary strip seeding reduces variation
- "Brushing" increases rape biomass and yield
- Exist a LAI shifting point among species (image analysis)



Conventional ploughing and seed-bed preparation April 11, 2006



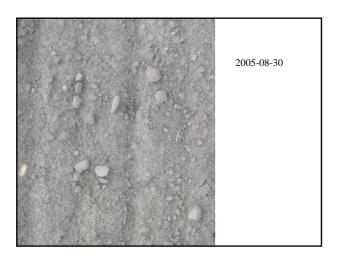


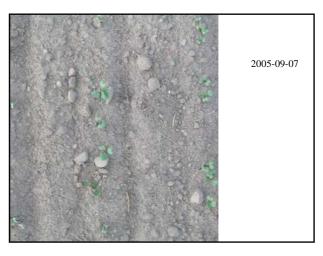


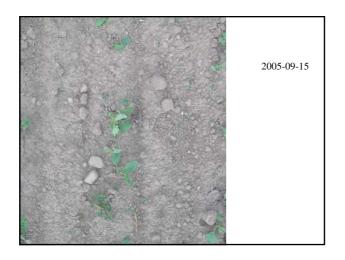
We would like to use image analysis to separate:

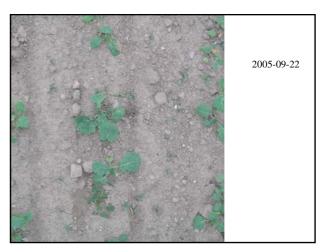
- · Bare soil and plant debris
- Rape
- · White clover
- Weeds

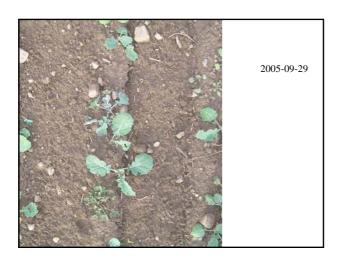
Bonesmo, H. Et al. 2004. Evaluating an image analysis system for mapping white clover pastures. Acta Agric. Scand., Sect.B, Soil and Plant Sci. 54: 76-82



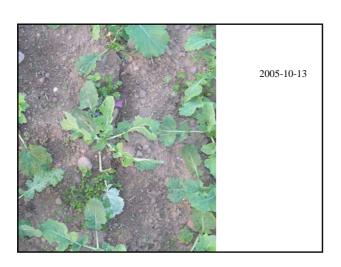


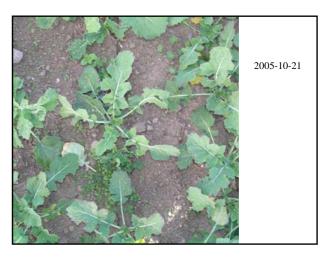














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Frame:

I(x,y) = R(x,y) + G(x,y) + B(x,y)/3

R, G, B = red, green, blue Converts to grey. 0 = black, 255 = white, >170 = 1 = frame

Bare soil, plant debris:

 $I_{RG}(x,y) = g(x,y)/(r(x,y) + 1)$

r, g = red, green divided by image intensity, I.

Threshold I_{RG} , default 0,6. Reducing I_{RG} means less bare soil

Model assumption:

Clover coverage – clover leaves are larger and more circular than grass leaves.

Step 1

Transform to grey image by carrying out a PCA-analysis and retaining the first component.

Step 2

The edges are computed using the Sobel method with a user defined gradient threshold.

Clover = open areas, grass = many edges.

Step 3

Eroding (when many edges) and dilating (when few edges) the combined (with binary soil image) edge analysis

User defined number of erosions.

The resulting area may also include weeds.

Step 4

Separate clover from weeds by using thresholds for smallest and largest weed area, respectively

Conclusions - image analysis

- · Frame easily separated
- Bare soil and plant debris can be separated from living plants (few tests)
- Plant form is not a suitable parameter to to use when trying to separate rape from dicot weeds and white clover