

Check and optimize your seed coating process
by analyzing the seed coverage



Seed Meets Technology - September 2023

Summary

1. Who we are and what we do

2. Check and optimize your seed coating process

2.1 Context

2.2 Our solution

3. Conclusion



1. Who we are and what we do

OPTOmachines – based in central France

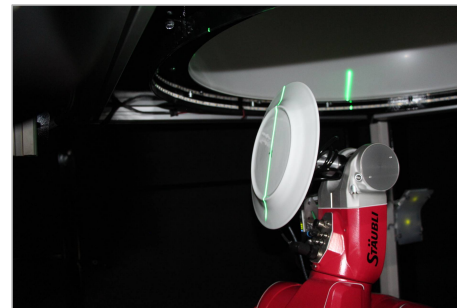
- **23 years of experience serving our customers tailored solutions**
- **Our core business:**
Design & manufacturing of optical inspection and measurement equipment by image processing for different industries
- **The team:**
Diversified, but complementary competences: metrology, measuring, optics, pattern recognition, photometry, image processing, mechanics, automation, robotics



1. Who we are and what we do

Activity based on innovation in 4 business lines in the 3 sectors:

- **Agronomics:** seed analysis equipment for laboratories or production lines
- **Industry:** special machines for inspecting & sorting for steel, plastic, aeronautic, food industries
- **Ceramics:** innovative machines for inspecting and sorting of ceramics
- **Highways services:** « Baliseur »: system for laying & retrieving traffic cones

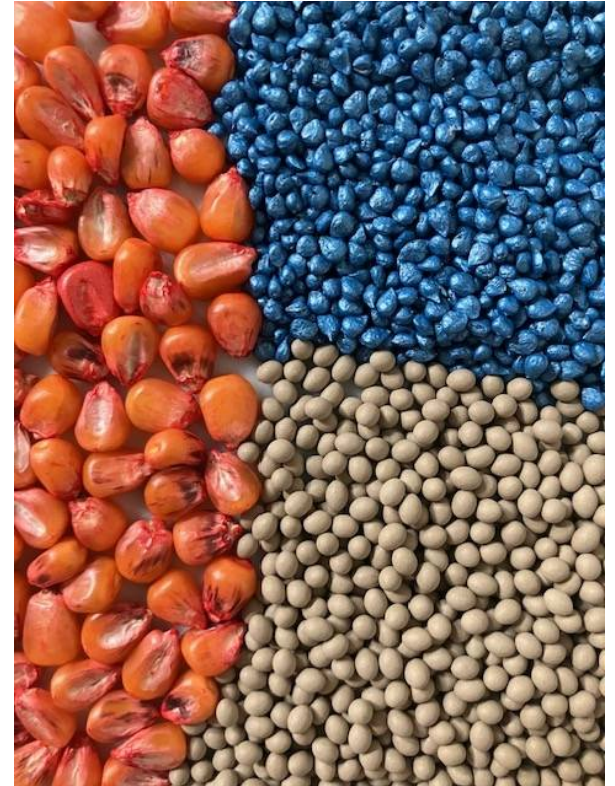


2. Check and optimize your seed coating process by analyzing the seed coverage

2.1. Context:

The use of seed treatments like seed priming, coating or pelleting enhances seed quality provides protection against pests and diseases and improves germination rates.

The efficiency of treatment processes like seed coating or seed pelleting can be evaluated by measuring the coverage in a non destructive way and quickly, by image processing.



2. Check and optimize your seed coating process by analyzing the seed coverage

2.2. Our solution:

The treatment process efficiency can be optimized by measuring the seed coverage.

Our equipment **OPTO Agrimetric** measures the seed coverage by computing color analysis and classification on seed samples.

Measuring the color is easily achievable. But: what is the color reference ?

Main principles:

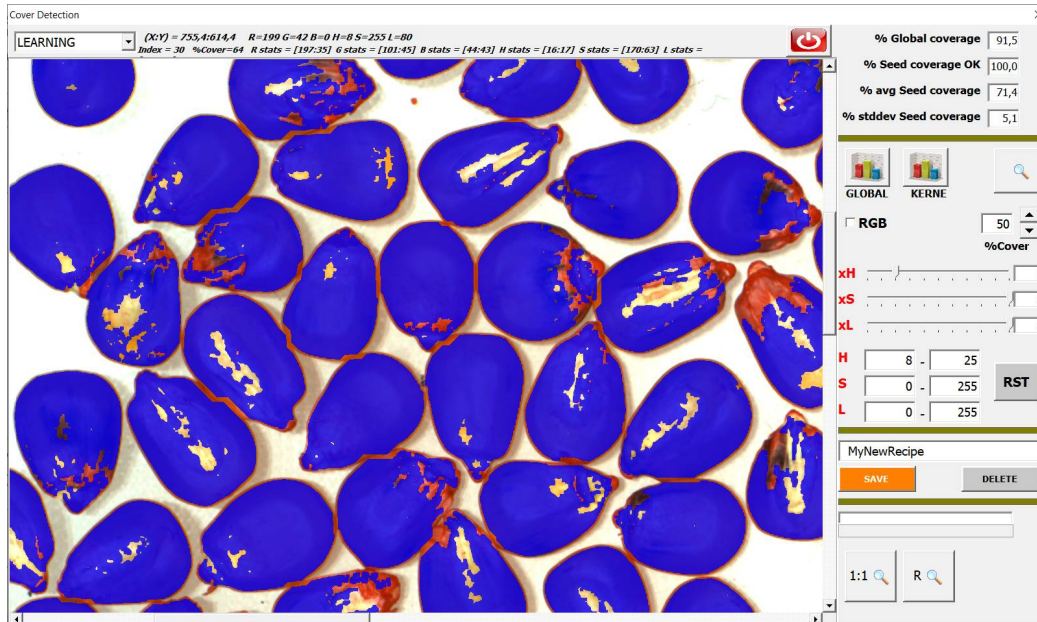
- 1) Automatic color parameters are computed with the help of a **learning procedure** based on the analysis of a reference seeds sample, i.e. seeds with a reference coverage.
- 2) Automatic parameters are applied to new samples in order to measure seeds coverage with the same standard as the related reference.



2. Check and optimize your seed coating process by analyzing the seed coverage

Measurements :

- **Global percentage of coverage:** Overall coverage surface / Overall seeds surface

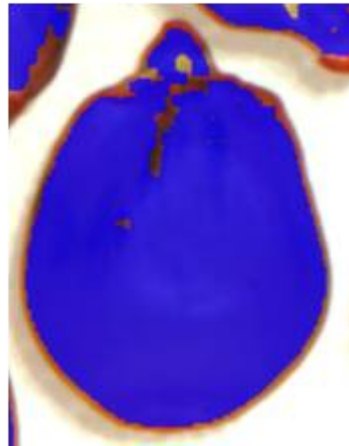


2. Check and optimize your seed coating process by analyzing the seed coverage

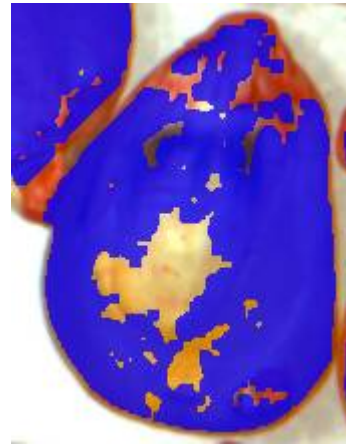
Measurements :

- **Global percentage of coverage:** Overall coverage surface / Overall seeds surface
- **Percentage of “good” seed coverage:** quantity of seeds with good coverage

Good : > 90 %



No good : < 90 %



2. Check and optimize your seed coating process by analyzing the seed coverage

Measurements :

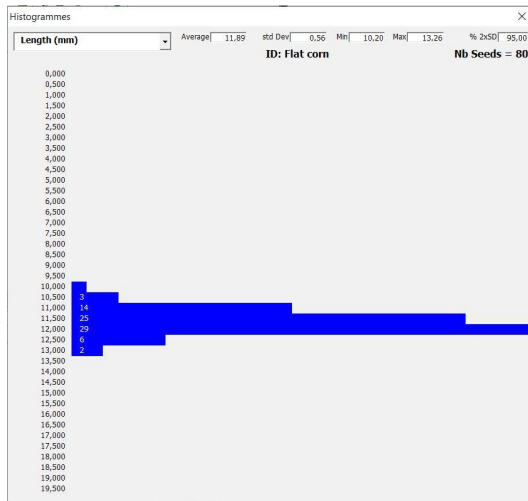
- **Global percentage of coverage:** Overall coverage surface / Overall seeds surface
- **Percentage of “good” seed coverage:** quantity of seeds with good coverage
- **Percentage of average seed coverage:** average of individual seeds coverage percentage

$$\Rightarrow \bar{\Sigma} \text{ (seed \%)}$$

2. Check and optimize your seed coating process by analyzing the seed coverage

Measurements :

- **Global percentage of coverage:** Overall coverage surface / Overall seeds surface
- **Percentage of “good” seed coverage:** quantity of seeds with good coverage
- **Percentage of average seed coverage:** average of seed coverage
- **Percentage of standard deviation of seed coverage:** indication of heterogeneity



2. Check and optimize your seed coating process by analyzing the seed coverage

Measurements :

- **Global percentage of coverage:** Overall coverage surface / Overall seeds surface
- **Percentage of “good” seed coverage:** quantity of seeds with good coverage
- **Percentage of average seed coverage:** average of seed coverage
- **Percentage of standard deviation of seed coverage:** indication of heterogeneity
- **Thousand Seed Weight**

OPTOAGRI2-TSW Measurement 2.7 - © 10 2018

Type of seeds :
Corn

Ref. of batch :
1

Total Nb seeds : 290
Total weight : 76,75

T.S.W : 264,66
Nb meas : 1

T.S.W corrected :
Humidity :

Number of seeds to reach : **Mass to reach :**

Compute

Measure

Measure finished: Ready for measurement.

Taring

Mass : 76,75
Nb seeds : 290

QUIT Init DB

09/01/2019-17:36:38 *** Analyse: Corn ** ID: 1 ** Mass: 76,75 g ** Cmpnt: 290 ** PMG:264,66 g ** tc: 2,2 s

2. Check and optimize your seed coating process by analyzing the seed coverage

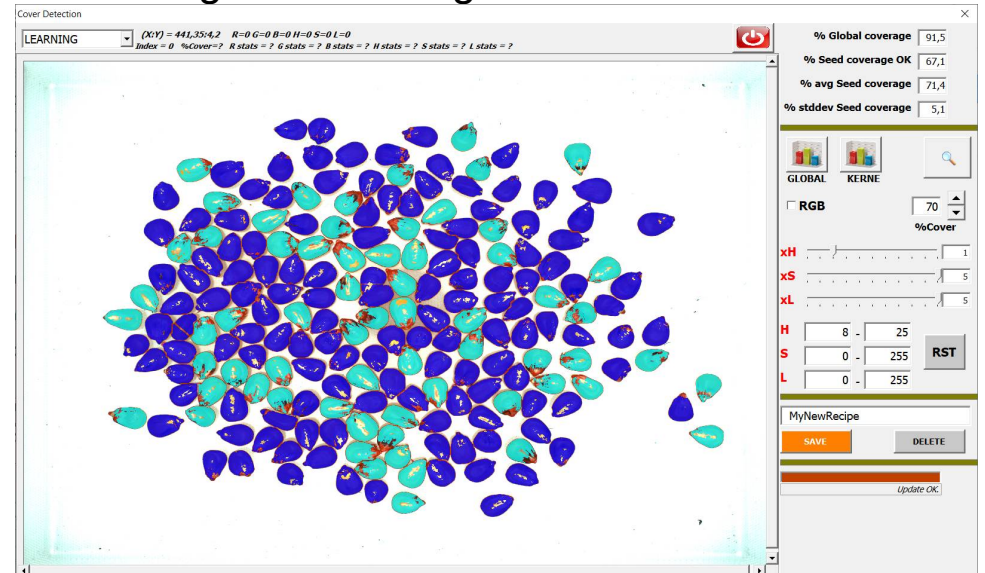
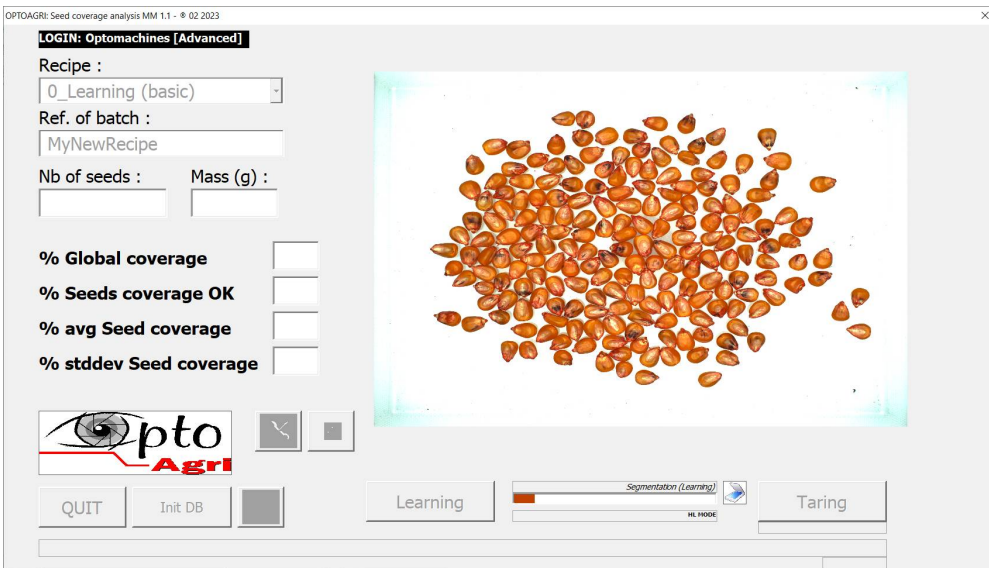
2 learning procedures :

1) BASIC LEARNING: Automatic color parameters are computed from a reference sample. The reference sample should be carefully selected, and coverage must be significant.

2) ADVANCED LEARNING: done on two samples. The first one is the reference sample and the second one is a non covered sample (raw seeds). Automated color parameters derived from the first sample are applied to the validation (non covered) sample. Results on the validation samples are used for computing the limit values.

2. Check and optimize your seed coating process by analyzing the seed coverage

1) BASIC LEARNING: Automatic color parameters are computed from a reference sample. The reference sample should be carefully selected, and coverage must be significant.

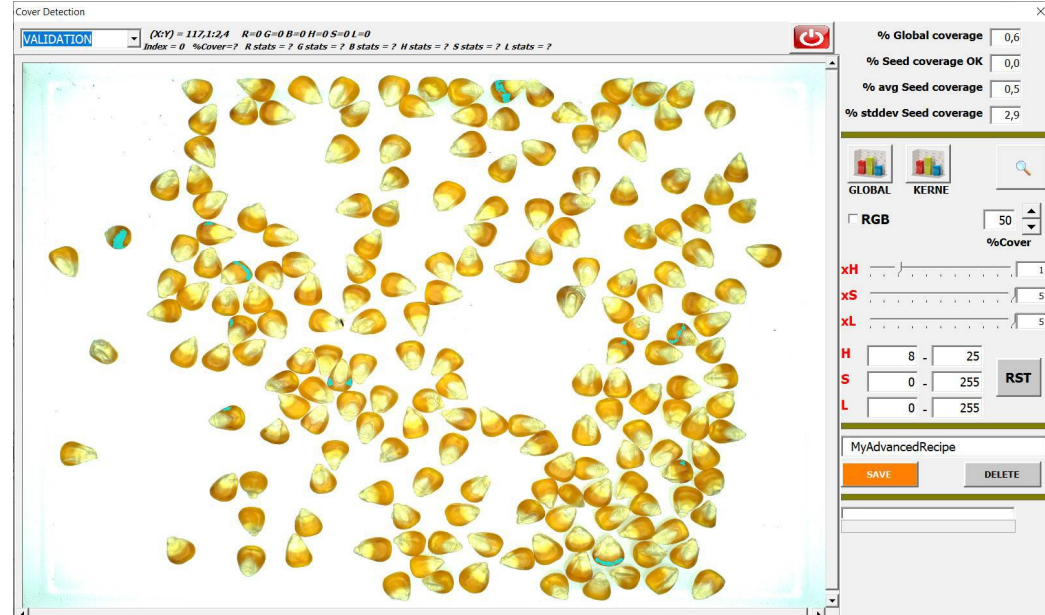
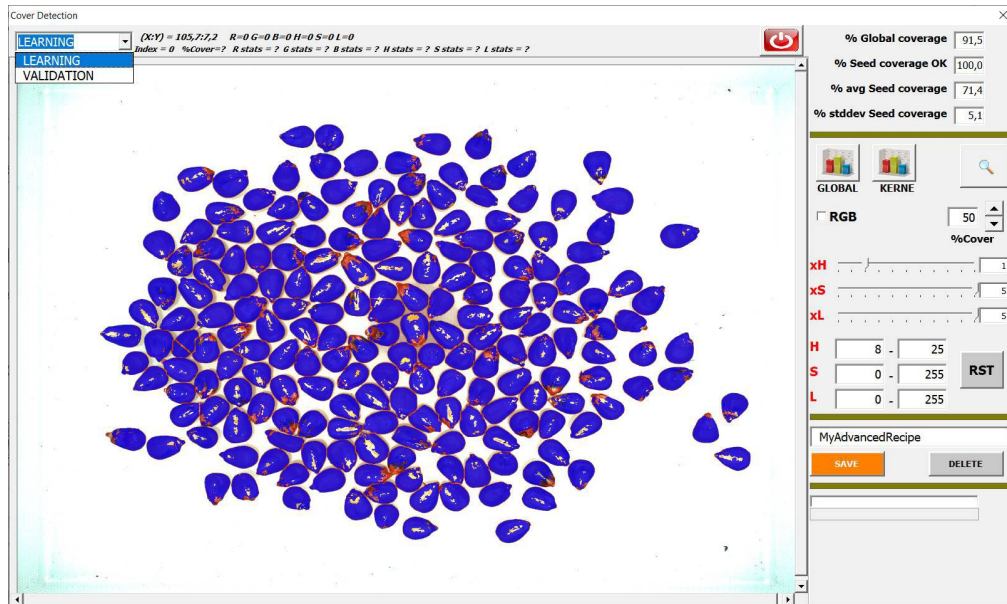


Dark blue means that the coverage ratio (i.e. Coverage surface/Seed surface) is equal to or above the « %Cover » threshold. Light blue means that the coverage ratio is lower than the « %Cover » threshold.

2. Check and optimize your seed coating process by analyzing the seed coverage

2) ADVANCED LEARNING:

The advanced learning follows the same rule as the basic procedure, except that a second image is taken from a validation sample (non covered). After the reference acquisition, the operator is asked to fill the machine again with a new sample which will be used to evaluate the performance of the recipe.



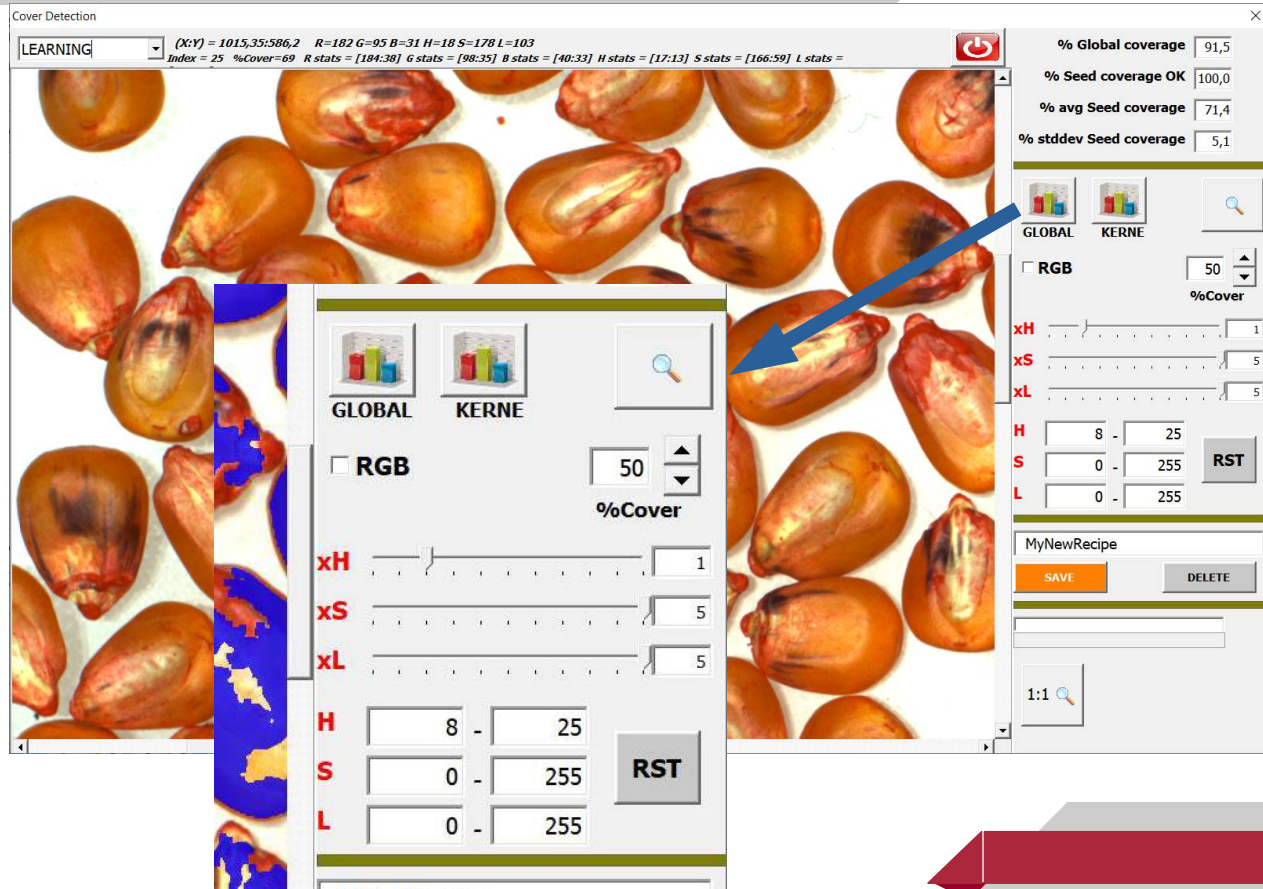
2. Check and optimize your seed coating process by analyzing the seed coverage

Tuning interface for color parameters:

These parameters are used to perform color processing and coverage analysis.

Default values are related to the learning procedure that computes the best fitted parameters regarding the color distribution of the reference sample.

The default color space is H S L (Hue- Saturation- Luminance). However, the image can be processed using the R G B (Red-Green-Blue) color space.



The screenshot displays the 'Cover Detection' software interface. The main window shows a large image of orange seeds. A smaller inset image shows the same seeds with a blue and yellow color mask overlaid. The interface includes a top status bar with the following data: (X:Y) = 1015,35:586,2 R=182 G=95 B=31 H=18 S=178 L=103, Index = 25 %Cover=69 R stats = [184:38] G stats = [98:35] B stats = [40:33] H stats = [17:13] S stats = [166:59] L stats = [166:59]. The 'LEARNING' dropdown is set to 'LEARNING'. The 'GLOBAL' and 'KERNE' tabs are selected, showing color histograms. The 'RGB' checkbox is unchecked, and the '%Cover' slider is set to 50. The 'xH', 'xS', and 'xL' sliders are set to 1, 5, and 5 respectively. The 'H', 'S', and 'L' sliders are set to 8, 0, and 0 respectively, with a range of 0-255. The 'RST' button is visible. The right sidebar shows summary statistics: % Global coverage 91,5, % Seed coverage OK 100,0, % avg Seed coverage 71,4, and % stddev Seed coverage 5,1. There are also 'GLOBAL' and 'KERNE' tabs, a search icon, and a 'MyNewRecipe' section with 'SAVE' and 'DELETE' buttons. A blue arrow points from the right sidebar towards the seed image.

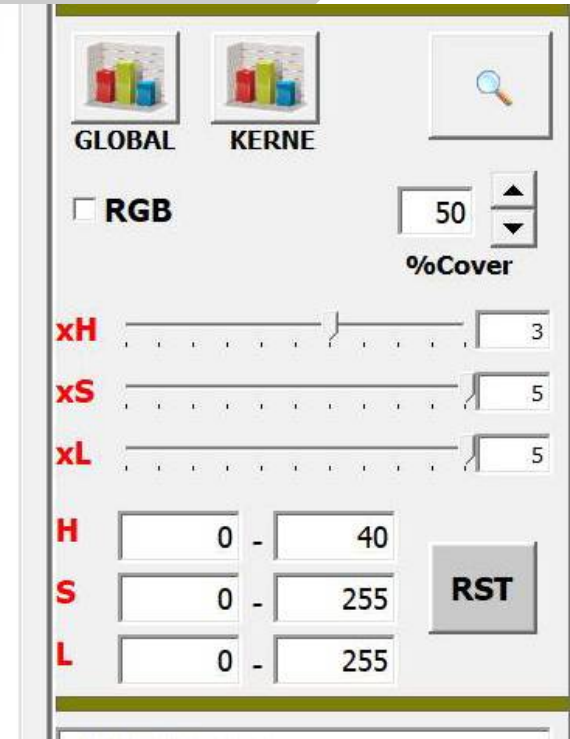
2. Check and optimize your seed coating process by analyzing the seed coverage

Tuning interface for color parameters:

The operator can play on both aspects of the color analysis by:

1) Adjusting the « color core » for color segmentation (in HSL or RGB space) in order to increase or decrease the significant coverage area in the image. This will influence the Overall coverage surface ratio.

2) Adjusting the « %cover» threshold to select which seeds are correctly covered. This will influence the Seed coverage OK ratio.



2. Check and optimize your seed coating process by analyzing the seed coverage

Tuning interface for color parameters: Modifying the coverage area

To increase or decrease the coverage area, use the sliders to widen the range for color thresholds.

Cover Detection (No data)

LEARNING Index = -1 %Cover = 7 R stats = 7 G stats = 7 B stats = 7 H stats = 7 S stats = 7 L stats = 7

% Global coverage 99,5

% Seed coverage OK 100

% avg Seed coverage 7,6

% stddev Seed coverage 0,7

GLOBAL KERNE

RGB 50 %Cover

xH 3

xS 5

xL 5

H 0 - 40

S 0 - 255

L 0 - 255

RST

MyNewRecipe

SAVE DELETE

Update OK

Cover Detection (X:Y) = 744:100 R=0 G=0 B=0 H=0 S=0 L=0

LEARNING Index = 0 %Cover = 7 R stats = 7 G stats = 7 B stats = 7 H stats = 7 S stats = 7 L stats = 7

% Global coverage 47,1

% Seed coverage OK 4,5

% avg Seed coverage 36,5

% stddev Seed coverage 8,4

GLOBAL KERNE

RGB 50 %Cover

xH 1

xS 1

xL 5

H 8 - 25

S 123 - 239

L 0 - 255

RST

MyNewRecipe

SAVE DELETE

Update OK

2. Check and optimize your seed coating process by analyzing the seed coverage

Tuning interface: save a recipe

Parameters can be saved into a recipe file, which will appear in the recipe list from the main window.

Enter a name into the edit area then click on the « save » button.

After closing the tuning interface, the new recipe will appear in the recipe list from the main window.

The screenshot displays the 'Cover Detection' software interface. At the top, it shows technical data: $(X:Y) = 1015,35;586,2$, $R=182$, $G=95$, $B=31$, $H=18$, $S=178$, $L=103$, $Index = 25$, $\%Cover=69$, $R\ stats = [184;38]$, $G\ stats = [98;35]$, $B\ stats = [40;33]$, $H\ stats = [17;13]$, $S\ stats = [166;59]$, $L\ stats =$. The main window shows a seed image with a blue overlay representing coverage. A dialog box titled 'MyNewRecipe' is open, featuring a 'SAVE' button and a 'DELETE' button. Below the dialog, a recipe list is visible, containing: 'LOGIN: Optomachines [Advanced]', 'Recipe :', 'Corn Recipe 01' (selected), '0_Learning (advanced)', '0_Learning (basic)', 'Corn Recipe 01', and 'CornRY01'. On the right side, a control panel includes '% Global coverage' (91,5), '% Seed coverage OK' (100,0), '% avg Seed coverage' (71,4), and '% stddev Seed coverage' (5,1). It also has 'GLOBAL' and 'KERNE' icons, an 'RGB' checkbox, a '%Cover' slider (set to 50), and sliders for 'xH', 'xS', 'xL', 'H', 'S', and 'L'. A blue arrow points from the 'MyNewRecipe' dialog to the recipe list.

2. Check and optimize your seed coating process by analyzing the seed coverage

Routine measurement recipe

To run a measurement, select a measurement recipe, enter an ID for the sample then click on « Measure ».

The measurement recipe is a simpler and faster procedure than the learning ones. It simply applies the color parameters to process the overall coverage surface and seed classification.

OPTOAGRI: Seed coverage analysis MM 1.1 - © 02 2023

LOGIN: Optomachines [Advanced]

Recipe :
Corn Recipe 01

Ref. of batch :
MyRoutine

Nb of seeds : 138 Mass (g) : 32,42

% Global coverage 42,7

% Seeds coverage OK 46,6

% avg Seed coverage 31,5

% stddev Seed coverage 34,7

pto Agri

QUIT Init DB Measure Taring

13/03/2023-11:40:48 ** Analysis: Corn Recipe 01 ** ID: MyRoutine ** Mass: 32,42 g ** Nb :138** Coverage rate:46,6% ** tc: 35,5 s

Tcy = 45,71 s

2. Check and optimize your seed coating process by analyzing the seed coverage

How biometry and thousand seed weight measurements can help ?

Doing comparative measurement between natural and coated seeds will give a reliable indication of the loading. Example with beets:

	Natural	Green coating	Brown coating
TSW	9,58 g	27,16 g	25,04 g
Number	936 seeds	694 seeds	1073 seeds
Weight of sample	8,97 g	18,85 g	26,87 g
Area	9,15 mm²	14,26 mm²	14,08 mm²
Diameter eq	3,43 mm	4,26 mm	4,20 mm
Standard dev	0,22	0,20	0,19
# in TSW		+17,60 g /1000 grains	+ 15,46 g / 1000 grains

3 - Conclusion :

- 1) Fast : results in less than 1 minute**
- 2) Non destructive tool**
- 3) Easy learning procedure**
- 4) Other applications included:**
 - Seed characterization**
 - Thousand seed weight**



*Let's discuss
on our booth !*



OPTOmachines
8, rue Richard Wagner
F-63200 Riom



Tel. 04.73.64.10.06
Mail: optomachines@optomachines.fr

Thank you for your attention.