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

Opto Machines

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

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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

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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

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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.

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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:

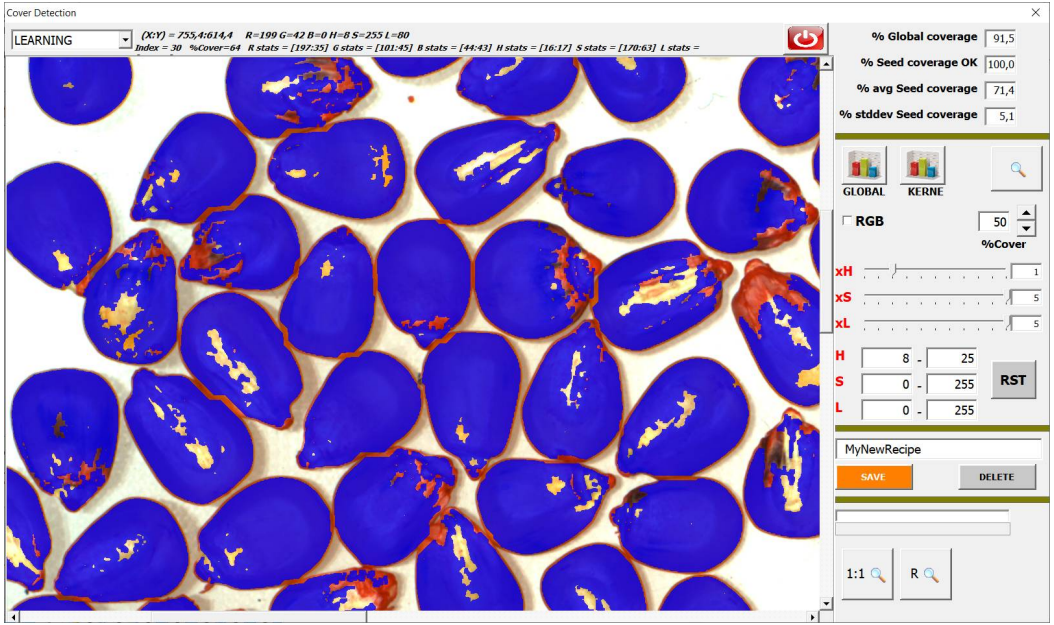
1) Automatic color parameters are computed with the help of a learning procedure based on the analysis of a reference seeds sample, i.e. seeds with a reference coverage.

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



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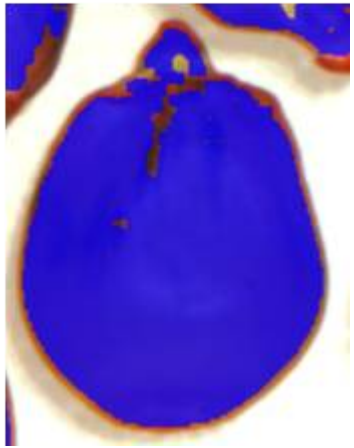
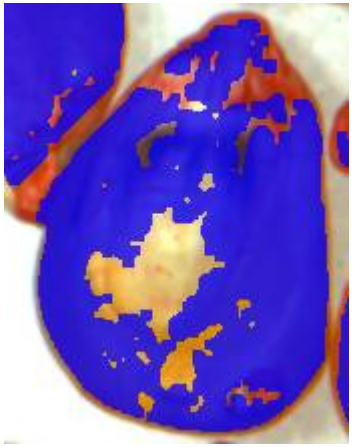
Measurements :

- **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 %

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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

↳ $\bar{\Sigma}$ (seed %)

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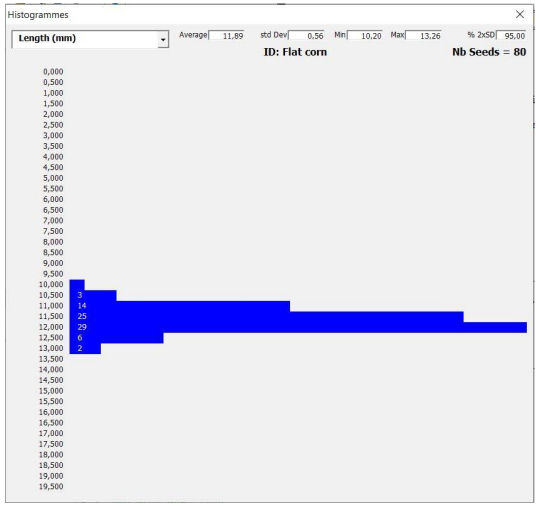
Measurements :

- **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



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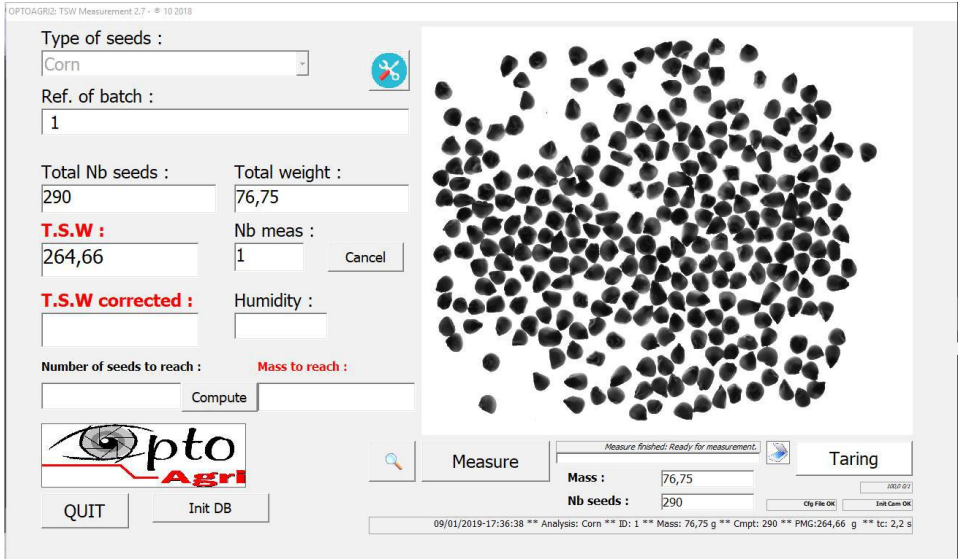
Measurements :

- **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**



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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.

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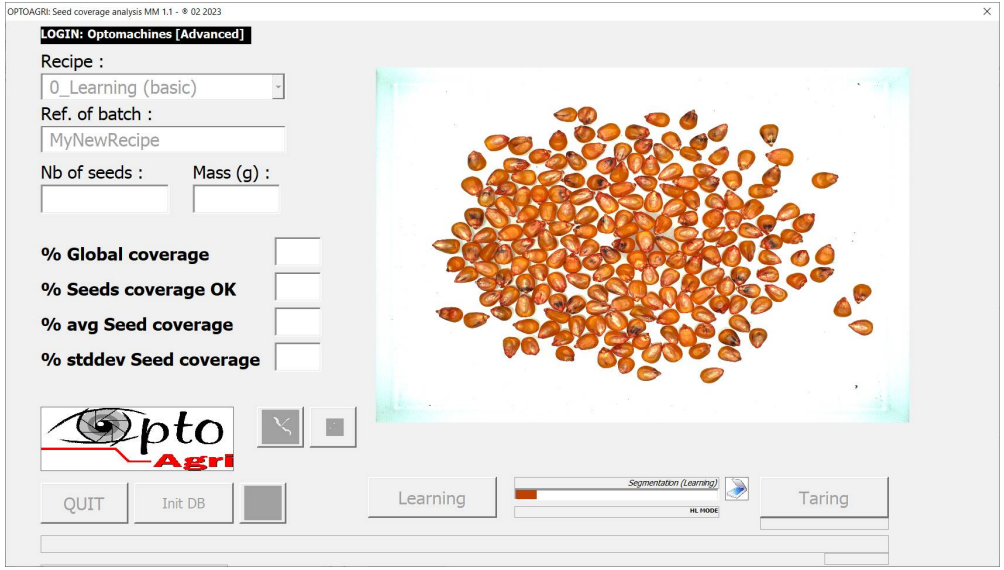
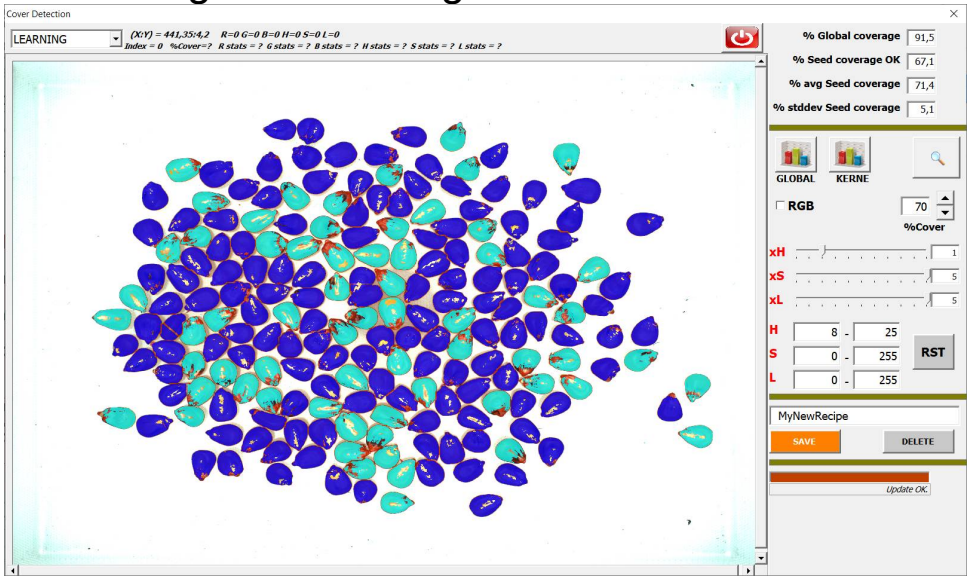
2. Check and optimize your seed coating process by analyzing the seed coverage

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.

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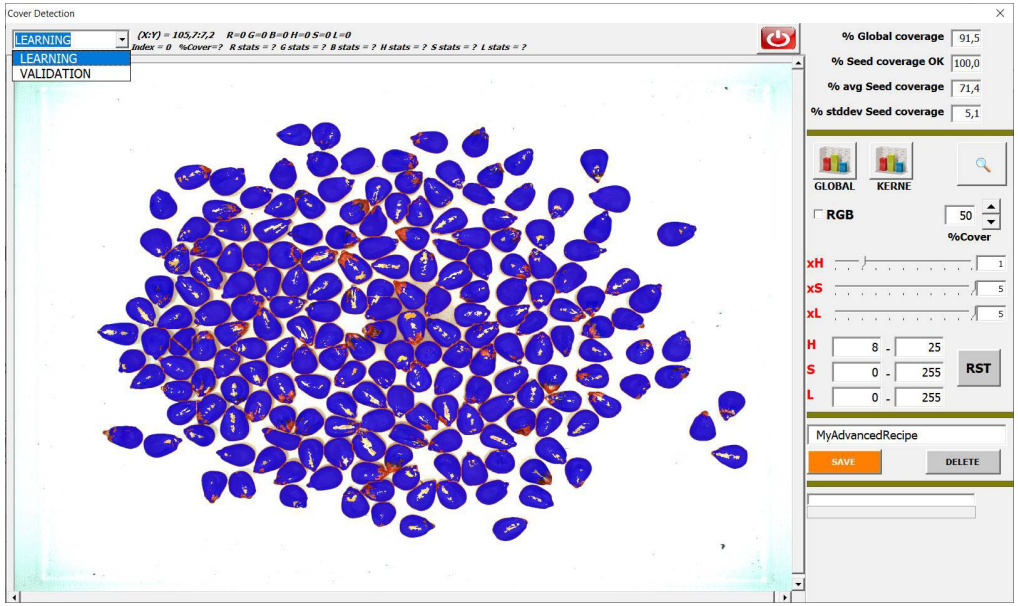
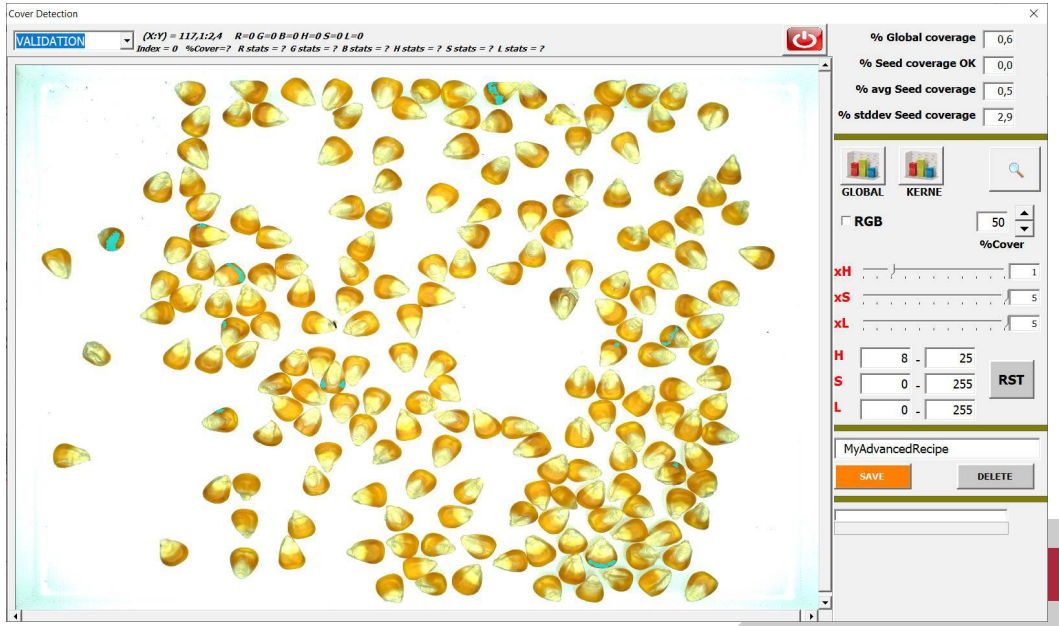
2) ADVANCED LEARNING:

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.





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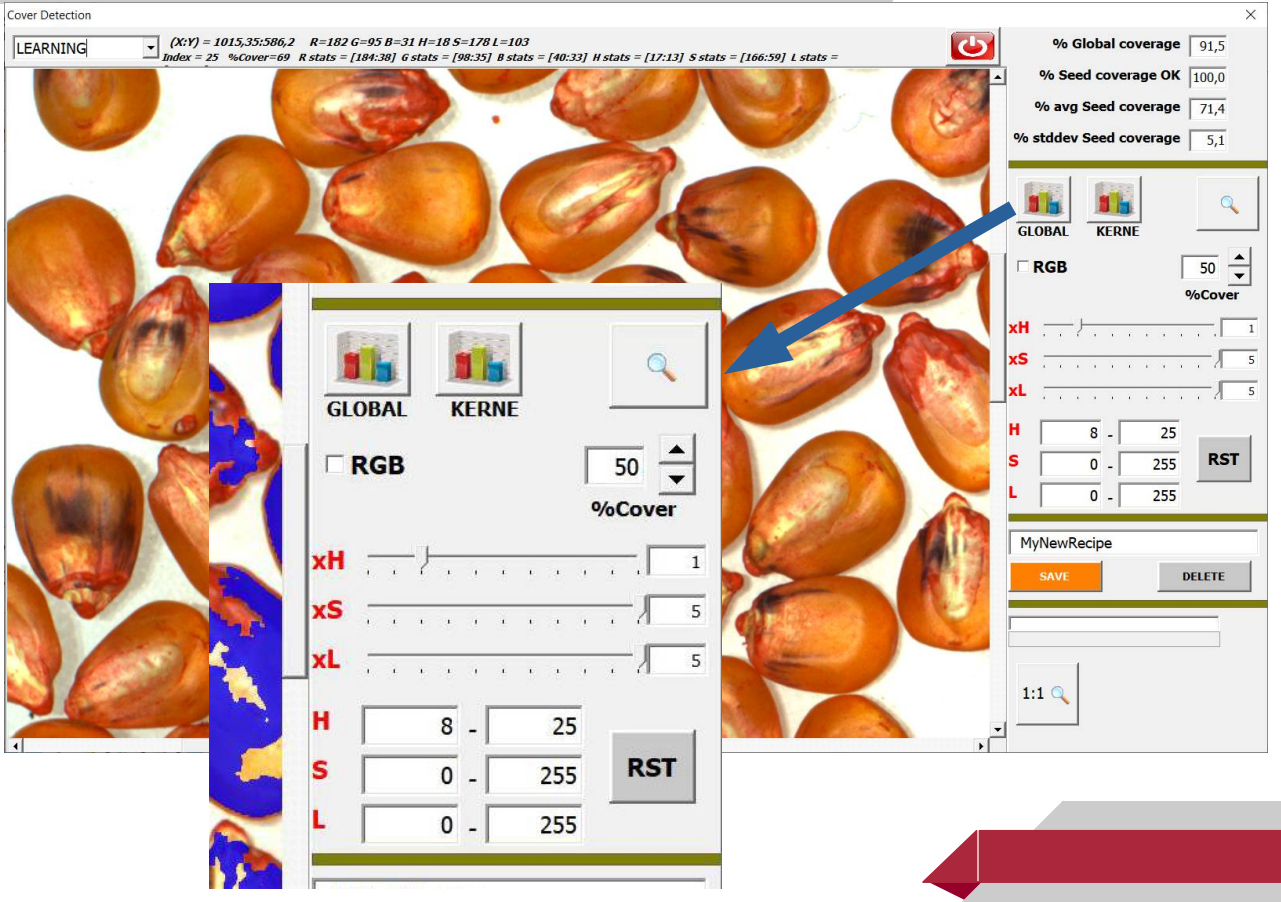
Tuning interface for color parameters:

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.



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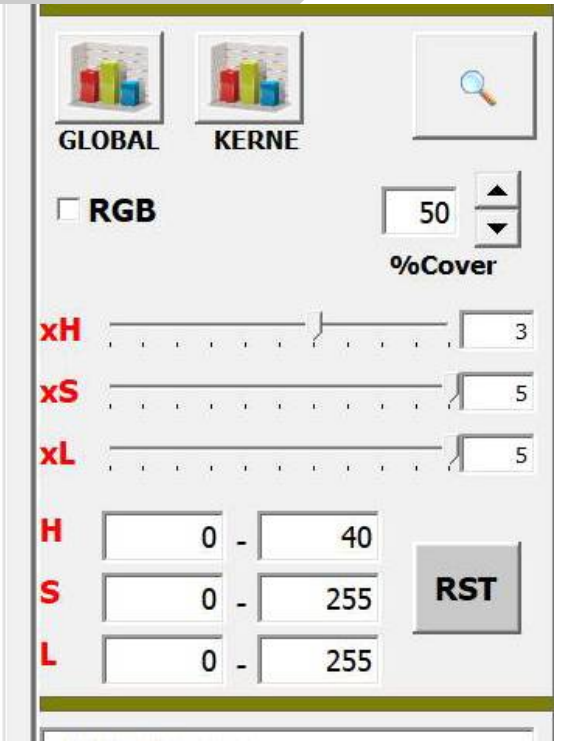
Tuning interface for color parameters:

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.



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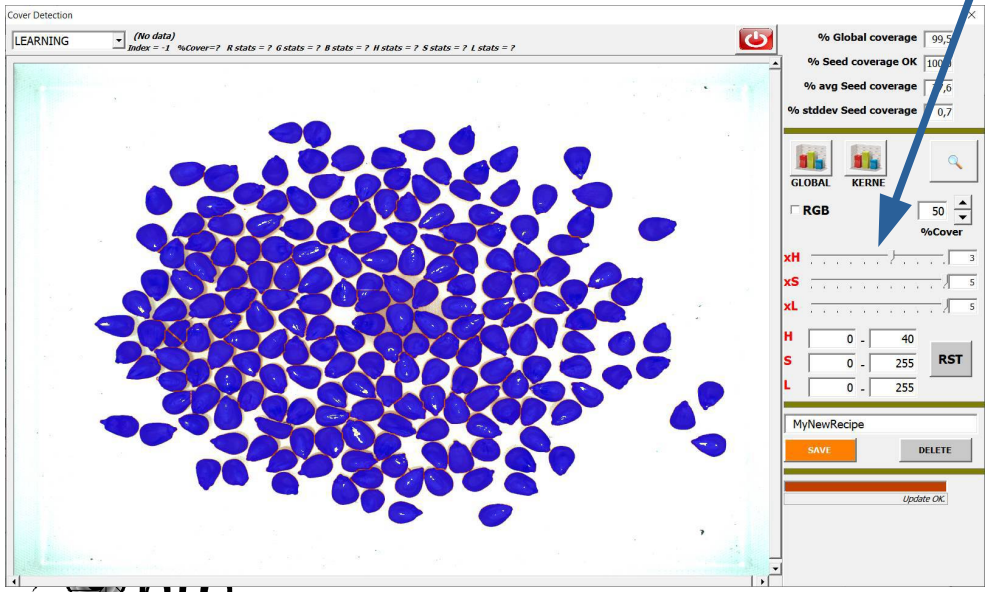
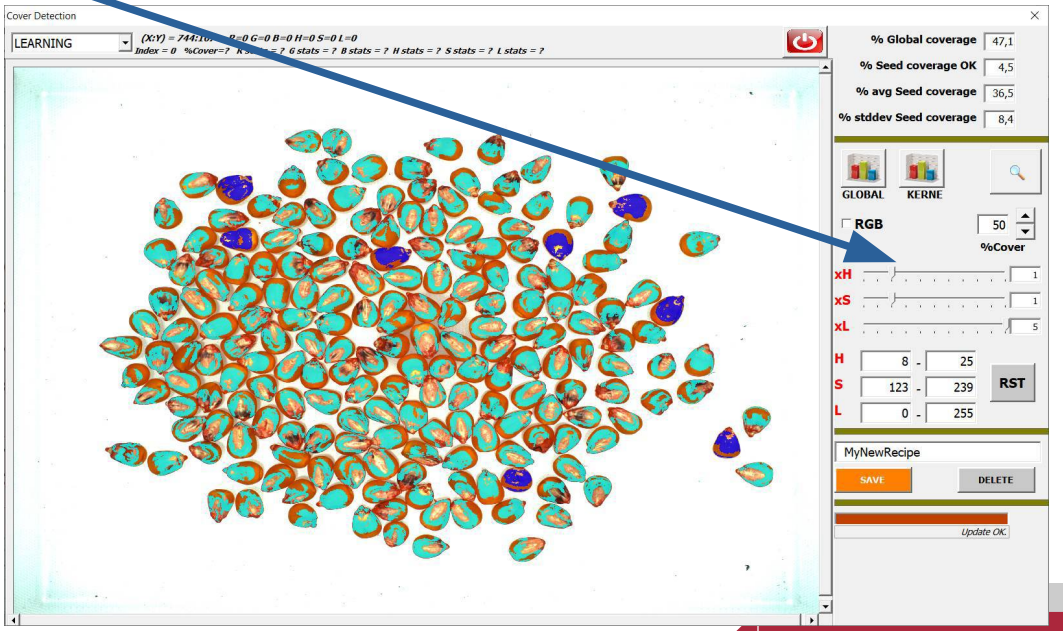
Tuning interface for color parameters: Modifying the coverage area

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





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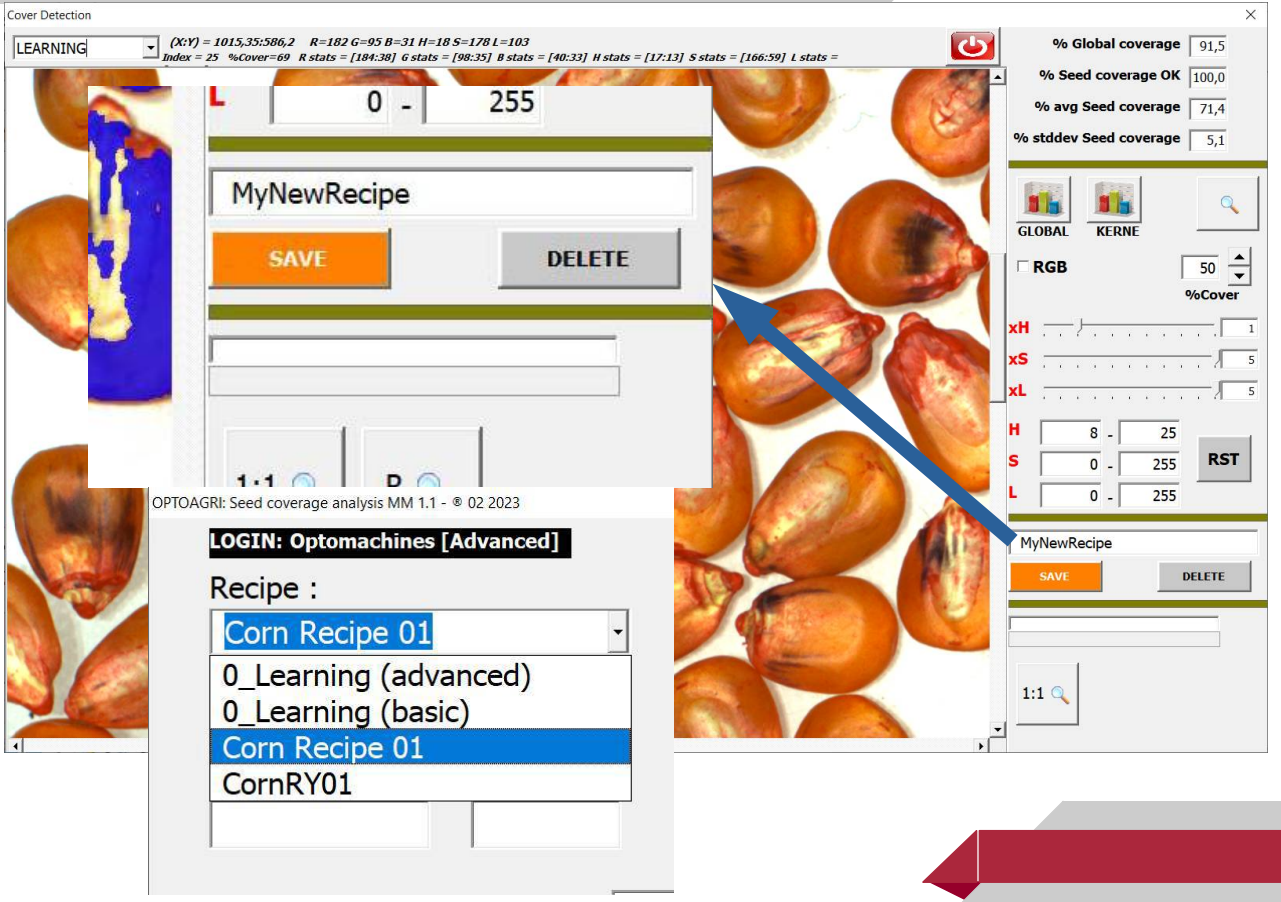
Tuning interface: save a recipe

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.



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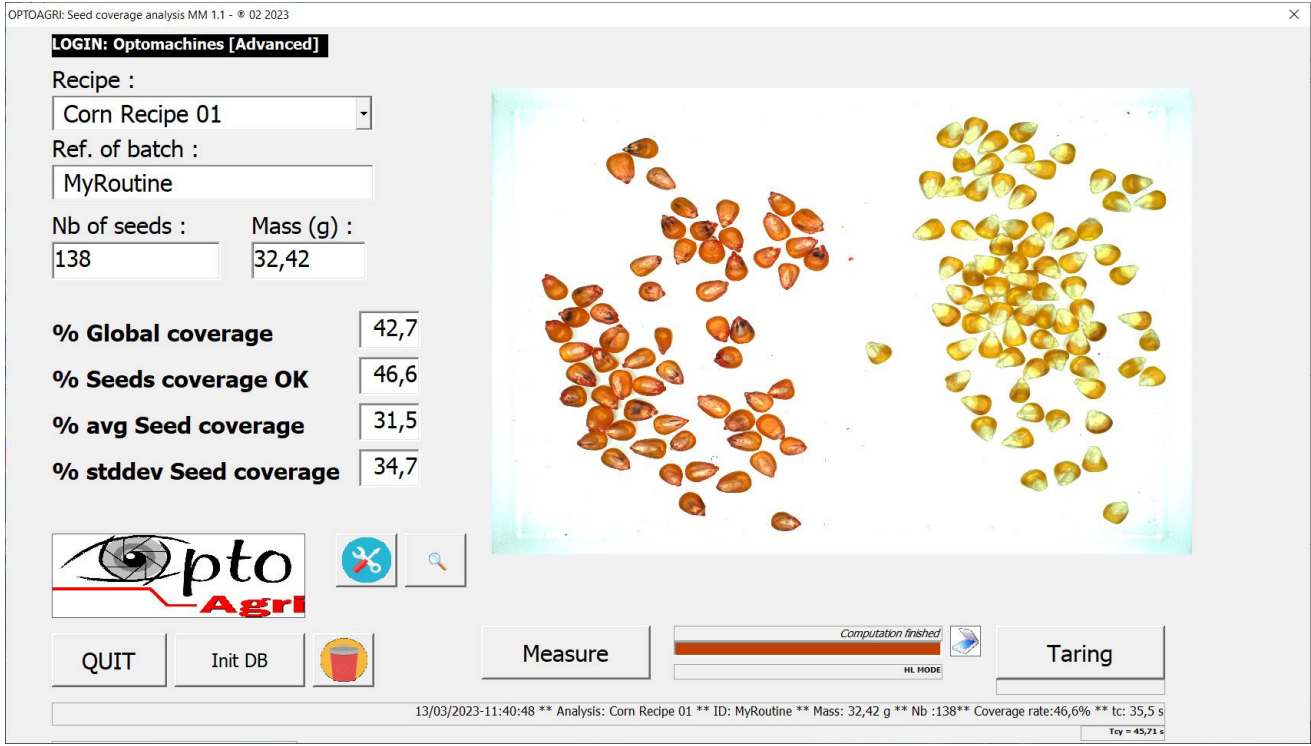
Routine measurement recipe

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.



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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

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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

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Let's discuss on our booth !

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Thank you for your attention.