Determination by near infrared microscopy (NIRM) of nitrogen and carbon content of tomato (*Solanum lycopersicum* L.) leaf powder

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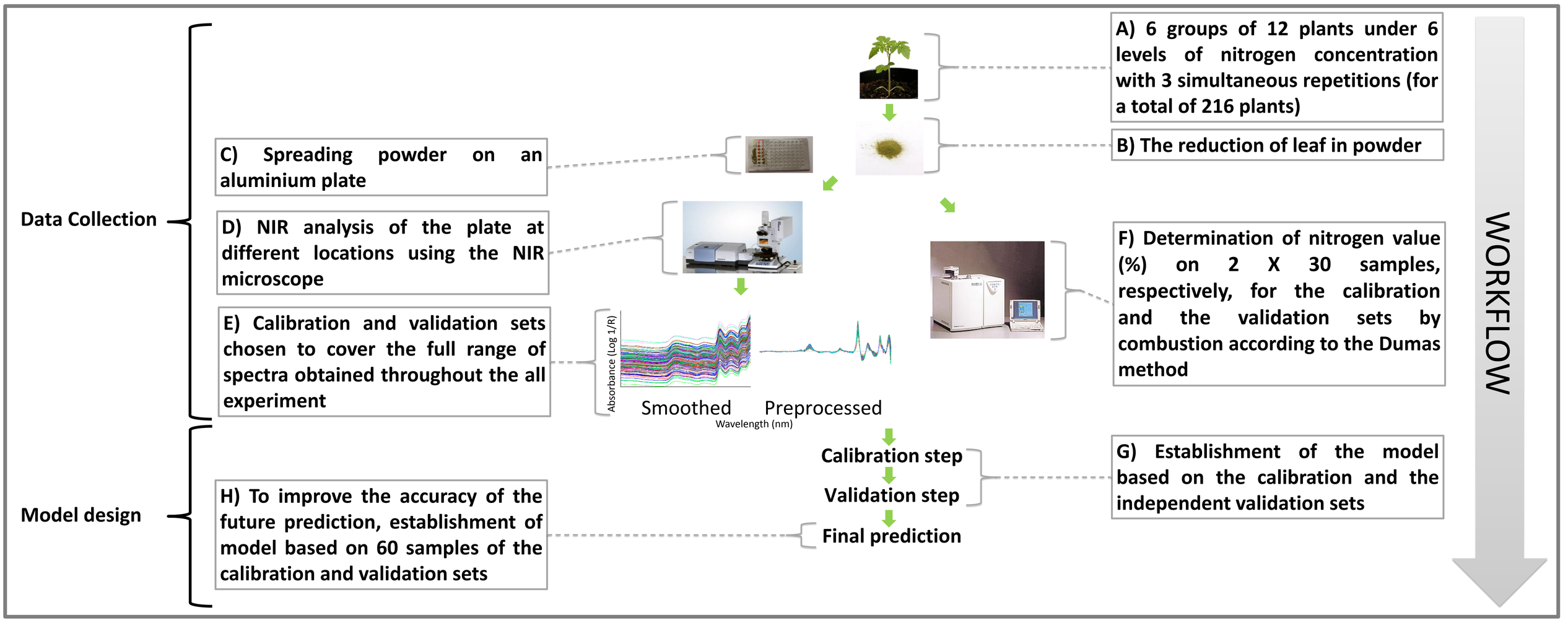
The chemical analysis of plant samples is time consuming and expensive. Near infrared microscopy (NIRM) approach was developed, inter alia as a rapid technique to predict the chemical composition of foods [1]. The accuracy of prediction via NIRM relies mainly on calibration and validation sets which represent the variation in the population, accurate laboratories, the adequate spectra pretreatments and the application of the best mathematical procedures [1]. In this study, NIRM was used for the first time to determine the nitrogen content in low samples amounts of tomato leaf powder.



Results and discussion

The calibration stage: the standard error of calibration (SEC), coefficient of determination at the calibration stage (R^2c) and ratio of performance to deviation (RPDc) were excellent (R^2c values higher than 0.90 and RPDc values higher than 3) [1-3]. However, the calibration model obtained for carbon content was not satisfactory (R^2_c < 0.50) [1-3]. **Figure 1.A** displays calibration and cross-validation results (the reference values versus NIRM predicted values) of the Model for determination of N-value in %.

The validation stage: the coefficient of determination (R^2p) and standard error of prediction were excellent (R^2p values higher than 0.90) [1-3]. **Figure 1.B** presents the reference values versus NIRM predicted values obtained for N-content (in %) for the samples of the validation set

The Final prediction: SEC, R^2c and RPDc were excellent (R^2c values higher than 0.95 and RPDc values higher than 5) [1-3].

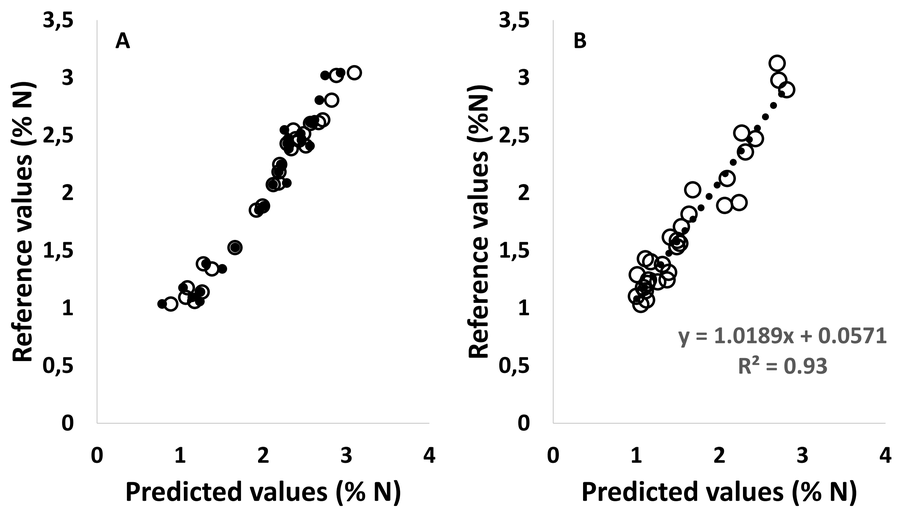


Figure 1. (A) Plot of % N in the *Solanum lycopersicum* L. samples analyzed in the calibration stage from Lequeue et al. (2016) [1]. Results of the reference values *vs* NIRM prediction (Model 3) are plotted. NIRM calibration (o) and cross-validation (•) results are displayed. **(B)** Plot of % N in the *Solanum lycopersicum* L. samples analyzed in the validation stage. Results of the reference values *vs* NIRM prediction are plotted.

Conclusion

The final NIRM model was successfully built to predict N-value (in %) from a very small quantity of tomato leaf powder by NIRM. It should be noted that protein or nitrogen content determination in reduced quantity of samples was not found in the current literature.

This study shows the potential of the NIRM approach for predicting the nitrogen content in low samples amounts (< 40 mg) of tomato leaf powder [1].

Perspectives

NIRM method has been used to detect plant stress due to various factors:

- the biological (e.g. [lipids]), chemical (e.g. [P]) and physical characteristics in plant samples (e.g. grains, leaves);
- the plant profile (e.g. nitrogen spatial distribution);
- the dynamic monitoring (e.g. kinetics of nitrogen use);
- local observations (e.g. leaf, stem, root).

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[3] Saeys W.; Mouazen AM.; Ramon H. (2005). *Biosystems Engineering*, **91**, 393 - 402

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