

Greenness Calibrating Plates

Greenness Calibrating Plates are tools used to benchmark green tones to assess the nitrogen status in plants.



i Overview

📁 Specs

🔗 Guidelines

👤 Use Case

- ★ Use greenness calibrating plates for assessing plant health
- ★ Two types: standard and simplified (as of March 2024)
- ★ Applications range from nitrogen status assessment to
- ★ Can be used for destructive and non-destructive measurements
- ★ May also be used in conjunction with other Petiole Pro functionality
- ★ Greenness calibrating plates are designed with adaptability in mind, allowing for use in diverse field conditions and with multiple crop species.



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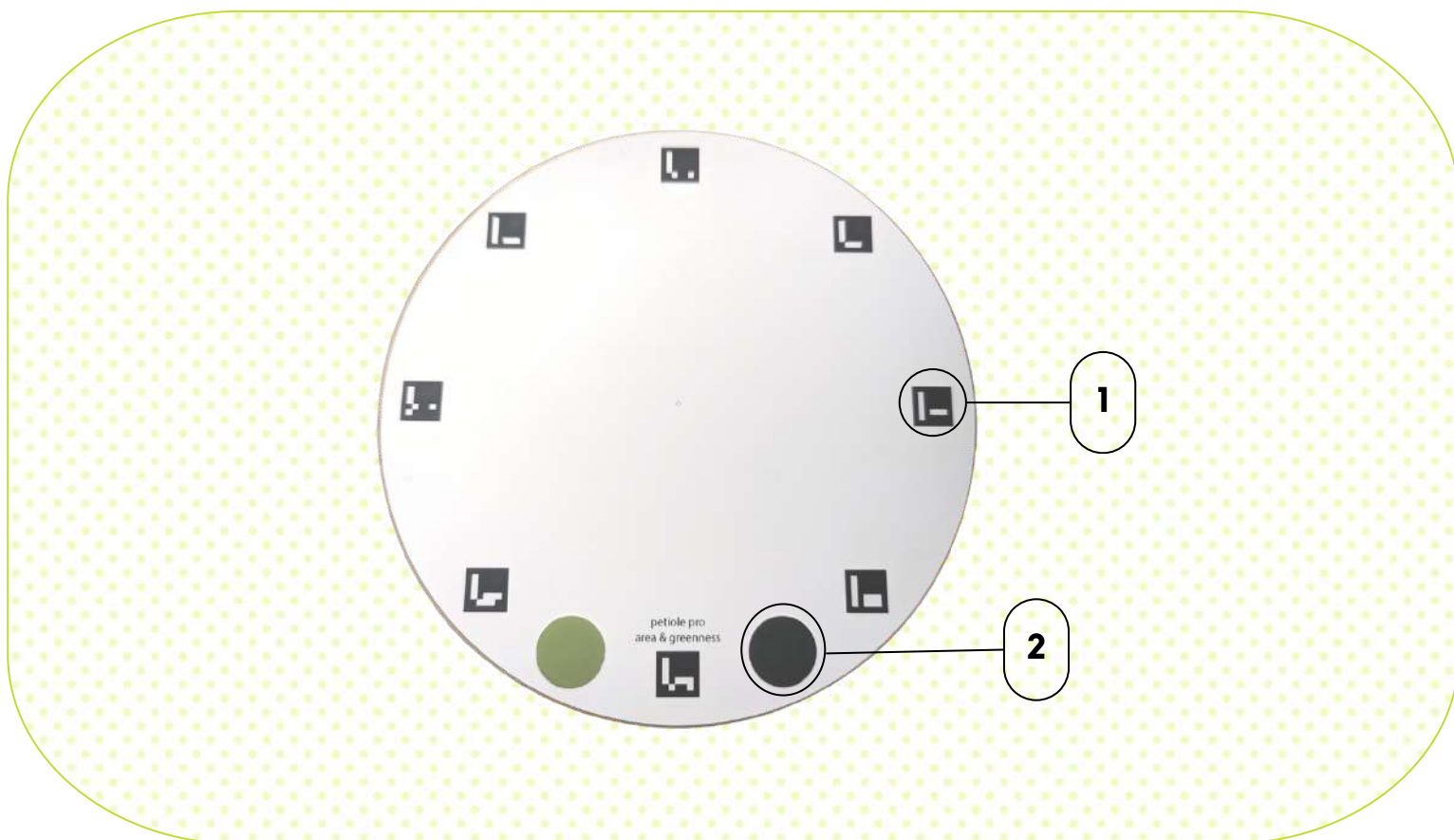


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1 Standard calibrating plate

2 Simplified calibrating plate

Standard Calibrating Plate



1 Marker, side length 1 cm

2 Colour marker, $\varnothing = 1.6$ cm

Intellectual Property: Patent

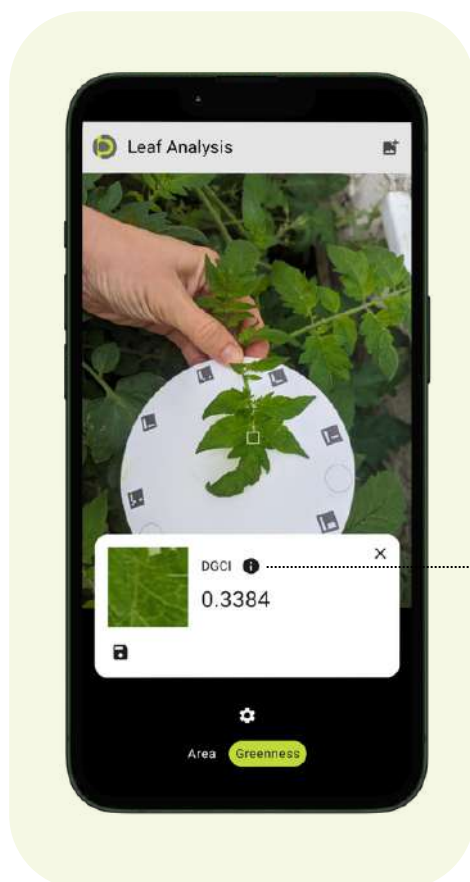
The UK Registered Design No. 6313938 was registered on 20 September 2023.

Usage

The Greenness Calibrating Plate facilitates non-invasive assessments of plant nitrogen status by enabling the quantification of the Dark Green Colour Index (DGCI) in indoor or outdoor environment.

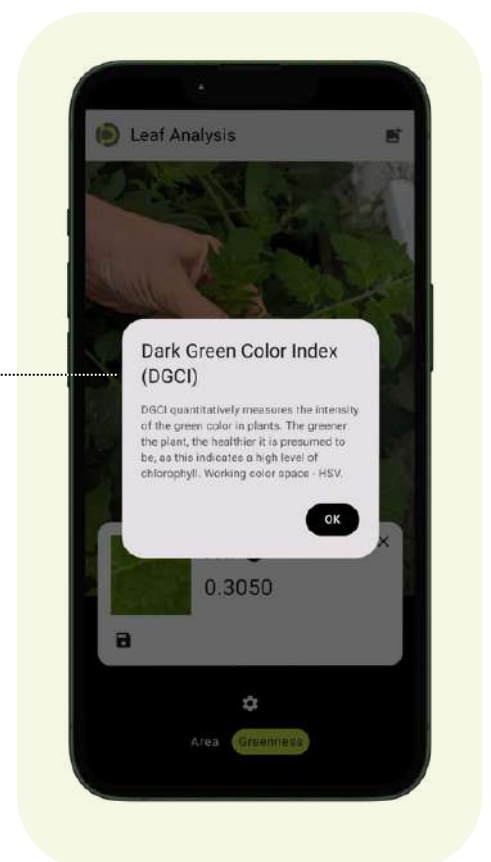


DGCI value is a relative measure of chlorophyll content in plant leaves



Information card

Information button



Additional information on DGCI can be found in the mobile app

Application

DGCI values showed significant linear relationship with soil plant analysis development (SPAD) values.

The DGCI measurements obtained with greenness calibrating plate can be correlated with SPAD values to accurately estimate chlorophyll content.



More details

- ★ Hassanijalilian, O., Igathinathane, C., Doetkott, C., Bajwa, S., Nowatzki, J., Esmaili, S.A.H. (2020). Chlorophyll Estimation in Soybean Leaves Infield with Smartphone Digital Imaging and Machine Learning. *Comput. Electron. Agric.*, 174, 105433. <https://doi.org/10.1016/j.compag.2020.105433>
- ★ Rorie, R.L., Purcell, L.C., Mozaffari, M., Karcher, D.E., King, C.A., Marsh, M.C. and Longer, D.E. (2011), Association of "Greenness" in Corn with Yield and Leaf Nitrogen Concentration. *Agron. J.*, 103: 529-535. <https://doi.org/10.2134/agronj2010.0296>
- ★ Yuan, Y., Chen, L., Li, M., Wu, N., Wan, L. and Wang, S. (2016), Diagnosis of nitrogen nutrition of rice based on image processing of visible light, 2016 *IEEE FSPMA Conference 2016*, pp. 228-232. <https://doi.org/10.1109/FSPMA.2016.7818311>

Light

For optimal results in greenness assessment, it is crucial to maintain consistent lighting conditions each time a photo is taken. Uniform light ensures that variations in the measured greenness are due to changes in the plant's condition rather than fluctuations in lighting, thus improving the reliability of the assessment.



✓ Do

Outdoor usage of the Greenness Calibrating Plate requires taking photo in your own shadow

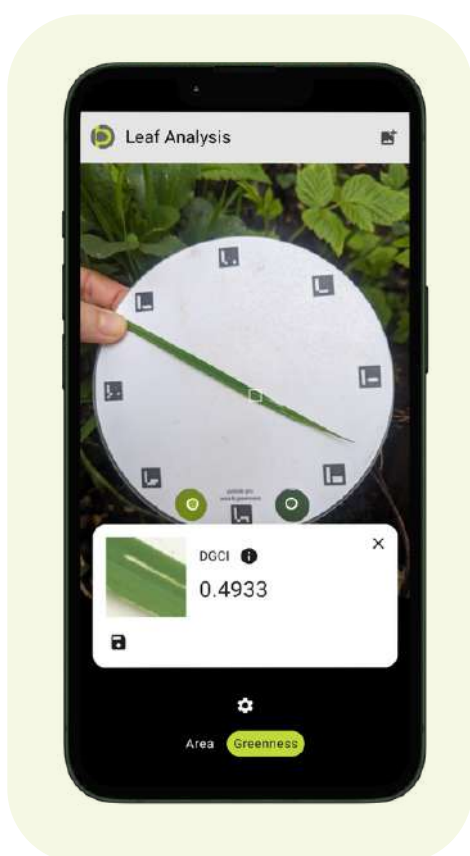


✗ Don't

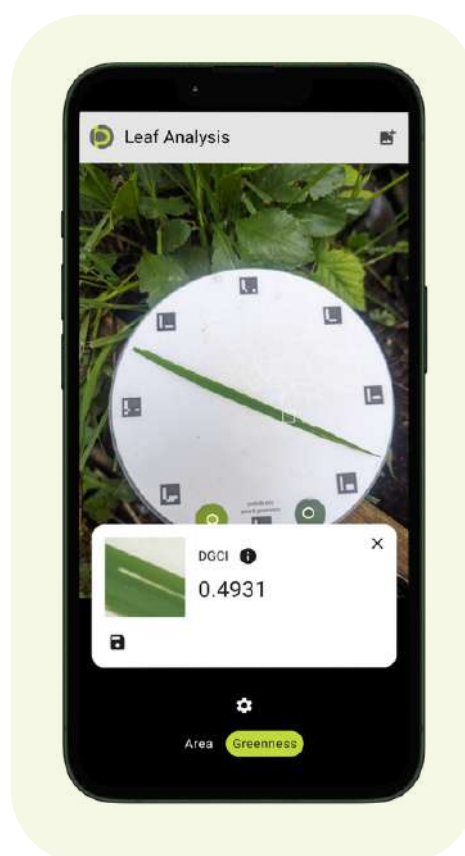
Do not permit direct sunlight when taking a photo, as it will compromise the accuracy

Destructive & Non-destructive

Measurements with a Greenness Calibrating Plate can be performed using both destructive and non-destructive methods, with the chosen approach not affecting the accuracy of the measurement



Non-destructive
measurement



Destructive
measurement

Distance

While taking a photo of the Greenness Calibrating Plate, all eight markers and two colour markers are visible to the camera from a close distance



To ensure the accuracy of the assessment, the photo of the Greenness Calibrating Plate, along with a leaf, must be taken from as close distance as possible.

Larger distances between the camera and the Greenness Calibrating Plate decrease accuracy



✓ Do

Take photo as close as possible

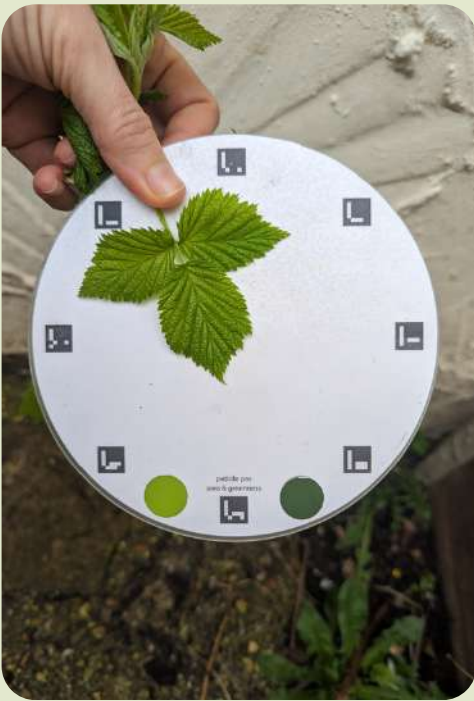


✗ Don't

Don't capture the photo from a far distance

Lens Maintenance

A clean lens is crucial for capturing clear, sharp images. Dirt, fingerprints, or smudges on the lens can scatter light, leading to blurred photos with reduced contrast and clarity. In the context of greenness measurement, such imperfections can significantly affect the accuracy of the assessment by distorting the true colour and detail of the subject, leading to erroneous interpretations of plant health or nutritional status



✓ Do

Ensure the lens is thoroughly wiped clean before capturing any photos with the Greenness Calibrating Plate



✗ Don't

Don't use a camera lens that is not properly cleaned; blurred images can result in inaccuracies

How to Measure Greenness

To measure greenness, take a photo of a leaf alongside the Greenness Calibrating Plate. Ensure all markers are visible and that the photo is captured with a clean lens. Avoid direct sunlight and take the photo in close proximity to the Greenness Calibrating Plate and the leaf.

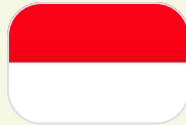
1. On your Android phone or tablet, open the Petiole Pro app 
2. In Leaf Analysis module tap  and select captured photo with Greenness Calibrating Plate
3. Select tab  and tap settings icon 
4. Choose **Small**, **Medium** or **Large** size of the pointer (ROI size)
5. Tap  in the right top corner of Greenness Settings submenu
6. Tap on the leaf to display the DGCI value next to the measurement's thumbnail
7. Tap save icon  to save the measurement in the Gallery
8. To take the next measurement, tap the icon  in the top right corner to open the next photo

Use Case

LED Light Ratios Enhance Pakchoy Growth



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Petiole Pro has been cited in a study published in *AGROMIX* by plant scientists from the public Universitas Diponegoro in Indonesia.

A study on the impact of red and blue LED light quality on the growth, yield, and physiology of Pakchoy (*Brasica rapa var chinensis*) plants in indoor farming reveals that a balanced ratio of red to blue LEDs significantly improves plant growth, chlorophyll and carotenoid levels, and fresh weight, with the R3:B7 ratio showing optimal results across all measured parameters

Citation: Rosyida, Karno, K., Putra, F. P., and Limantara, J. C. (2022). Efek cahaya LED merah dan biru pada pertumbuhan, hasil dan kandungan klorofil tanaman pakcoy (*Brassica chinensis* L.) dalam Growbox. *AGROMIX*, 13(2), 168-174. <https://doi.org/10.35891/agx.v13i2.3028>



AGROMIX

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Efek cahaya LED merah dan biru pada pertumbuhan, hasil dan kandungan klorofil tanaman pakcoy (*Brassica chinensis* L.) dalam Growbox

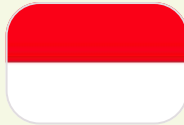
*The Effects of red and blue LED light on growth, yield and chlorophyll content of pakchoy (*Brassica chinensis* L.) plants*

Use Case

Enhancing Rice Growth on Saline-Sodic Soil



INSTITUT TEKNOLOGI BANDUNG



Petiole Pro has been cited in a pre-print published at *ResearchGate* by plant researchers from the national research university Institut Teknologi Bandung in Indonesia.

The study investigates the enhancement of rice plant growth on saline-sodic soil through the application of gypsum and rice husk biochar-cow manure amendments, as well as biopriming seeds with special bacteria. It demonstrates that certain amendments can significantly reduce soil salinity and sodicity, thereby improving physical-chemical characteristics of the soil and enhancing rice growth and yield.

Citation: Magdalena, I., Manurung, R. (2022) Peningkatan Pertumbuhan Tanaman Padi pada Tanah Salin-Sodik melalui Aplikasi Amendemen Gypsum dan Amendemen Biochar Sekam PadiKotoran Sapi serta melalui Biopriming Benih dengan *Pseudomonas Aeruginosa* dan *Azotobacter chroococcum*, *Repository Tugas Akhir SITH-ITB*, Vol. 1. [Link to ResearchGate](#)

Repository Tugas Akhir SITH-ITB (2022), Vol. 1

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Peningkatan Pertumbuhan Tanaman Padi pada Tanah Salin-Sodik melalui Aplikasi Amendemen Gypsum dan Amendemen *Biochar* Sekam Padi-Kotoran Sapi serta melalui *Biopriming* Benih dengan *Pseudomonas Aeruginosa* dan *Azotobacter chroococcum*

Imelda Magdalena¹ • Robert Manurung^{1✉}¹ Sekolah Ilmu dan Teknologi Hayati, Institut Teknologi Bandung, Jalan Ganesha No. 10 Bandung 40132 Indonesia

Use Case

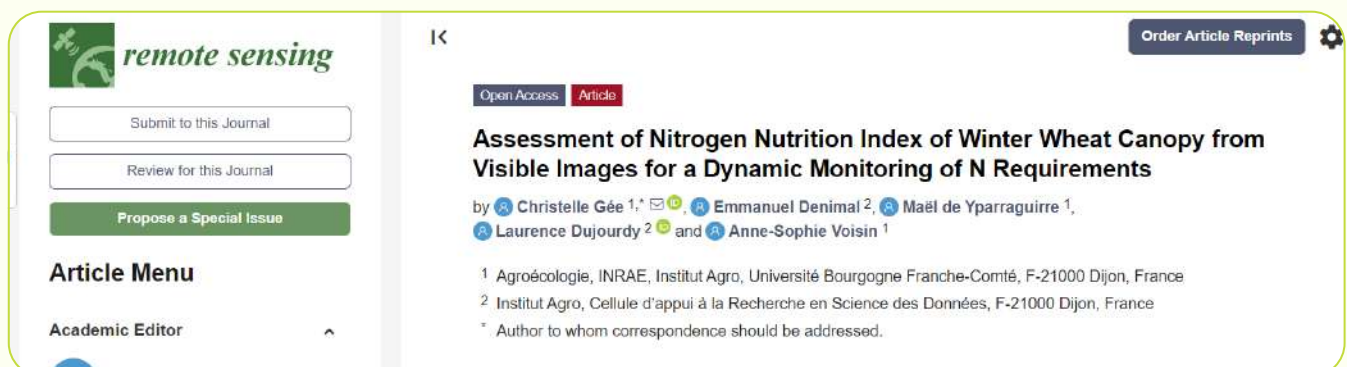
Advancing Non-Invasive Nitrogen Assessment in Wheat



Petiole Pro has been mentioned in a study published in *Remote Sensing* by plant scientists from the France-based public research institute, INRAE.

The research team investigated the use of visible images to estimate the nitrogen status in winter wheat, proposing a normalized dark green colour index (nDGCI) for this purpose. They found a strong correlation between nDGCI and the Nitrogen Nutrition Index (NNI), especially with a single wheat cultivar. This indicates that visible imaging could be a promising, non-invasive method for assessing nitrogen requirements in wheat fields, with the choice of cultivar significantly affecting accuracy.

Citation: Gée, C., Denimal, E., de Yparraguirre, M., Dujourdy, L., Voisin, A.-S., (2023) Assessment of Nitrogen Nutrition Index of Winter Wheat Canopy from Visible Images for a Dynamic Monitoring of N Requirements. *Remote Sensing*. 2023; 15(10):2510. <https://doi.org/10.3390/rs15102510>



Use Case

Image-based Measurement of Leaf Greenness



Petiole Pro has been featured among alternative approaches of image-based measurement of leaf greenness in training materials published in AgriSAT project by plant scientists from the University of Applied Sciences Weihenstephan-Triesdorf in Germany.

The main aim of AGRISAT is to facilitate smart agriculture that contributes to a more sustainable environment while also tackling climate change in Laos, Cambodia and Myanmar.

Citation: Pray, L. (2022) AgriSAT Technical Training: Handheld sensors.
[Link to the AGRISAT presentation](#)

Alternative approach: Image-based measurement of leaf greenness

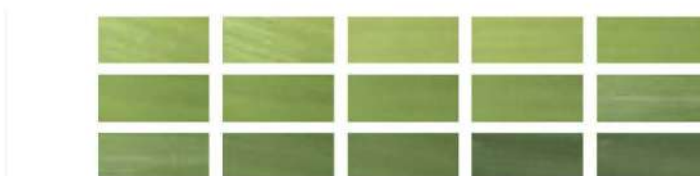
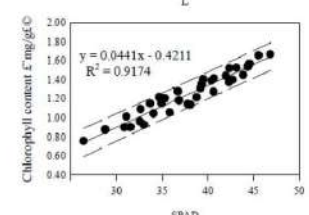
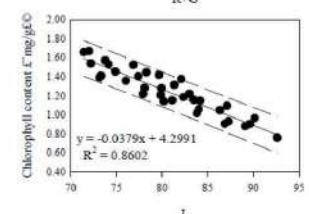
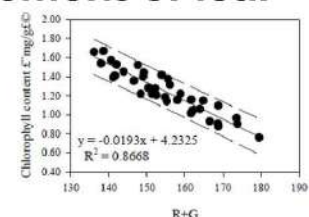


Fig. 2 - Leaves ordered according to their nutritional status. Greenness increases from the upper left to the bottom right.

(Smartphone App: Petiole Pro:
<https://petioleapp.com/>)

Hu et al., 2010, Assessment of chlorophyll content based on image color analysis, comparison with SPAD-502

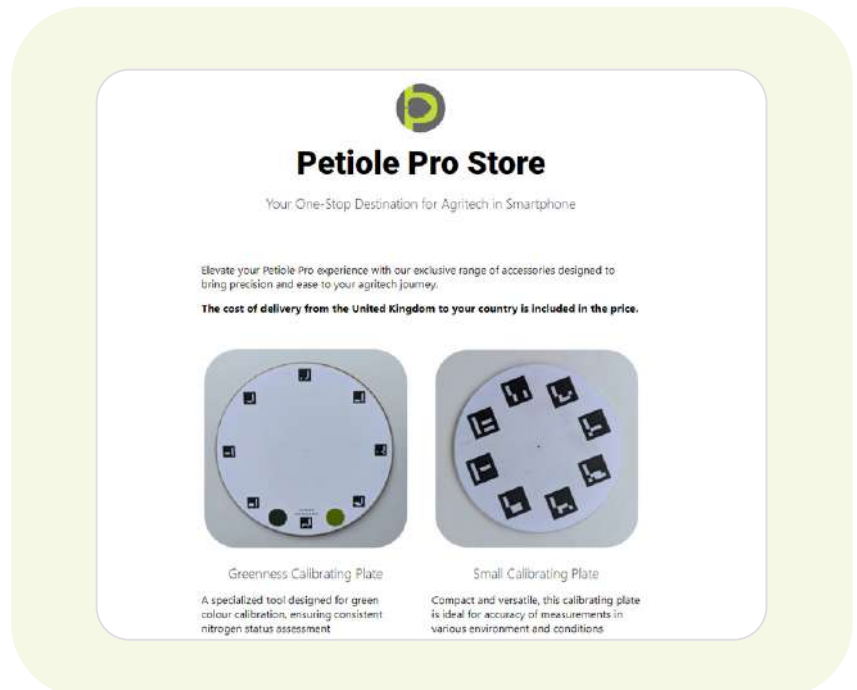


Where to get

Petiole Pro Store is your one-stop destination for agritech in smartphone

Elevate your Petiole Pro experience with our exclusive range of accessories designed to bring precision and ease to your agritech journey

[Visit Petiole Pro Store](#)



Citation

Seleznov, A. and Kuzmenko, M. (2024). Petiole Pro: Greenness Calibrating Plates. Instruction. V.001-03-24. London: Petiole LTD.
<https://doi.org/10.13140/RG.2.2.10583.28324>

Contacts

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Petiole LTD is a UK-based technological company that is developing solutions powered by artificial intelligence (AI) to improve productivity in agriculture, forestry and aquaculture. The company promotes plant science research and education and democratizes access to innovative digital tools for educational and research institutions worldwide.

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