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## EDUCATION

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- 2010.09 - 2014.06 Ph.D. in Plant Nutrition, China Agricultural University, China
- 2007.09 - 2010.06 M. Sc. in Soil Science, South China Agricultural University, China
- 2003.09 - 2007.06 B. Sc. in Environmental Science, Agricultural University of Hebei, China

## PROFESSIONAL EXPERIENCE

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- 2017.12-present Associate Professor, Department of Smart Agriculture, Nanjing Agricultural University, China
- 2017.08-2017.12 Visiting Scholar, Michigan State University, U.S.
- 2014.06-2017.12 Lecturer, Department of Agriculture, Nanjing Agricultural University, China

## RESEARCH INTERESTS

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- Precision Agriculture and Nutrient Management
- Agro-Informatics and Sustainable Development

## RESEARCH PROJECTS

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- National Natural Science Foundation of China (NSFC) support Project: Diagnosis model for nitrogen status based on time-series vegetation index in winter wheat, 31601222, 2017/01-2019/12, ¥190,000, PI.
- The Fundamental Research Funds for the Central Universities Project: Diagnosis model for nitrogen status based on time-series vegetation index in winter wheat, KJQN201725, 2017/01-2019/12, ¥100,000, PI.
- The National Key Research and Development Plan: High efficient ground and aerial spraying technology and intelligent equipment, 2016YFD0200700, Project 2: Research and development of

key parts on intelligent equipment of agricultural aviation for plant protection, Subproject: The key diagnosis technology of crop disease based on hyperspectral, 2016/01-2020/12, ¥1,000,000, PI.

- Natural Science Foundation of Jiangsu Province supported Project: Non-destructive estimation of rice plant nitrogen status with Unmanned Aerial Vehicle, BK20150663, 2015/07-2018/06, ¥200,000, PI.
- The Fundamental Research Funds for the Central Universities Project: Canopy sensors based precision nitrogen management strategy for rice, KYZ201502, 2015/01-2017/12, ¥200,000, PI.

## PUBLICATIONS

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### First author or Corresponding author

- Li, S., Yuan, F., Ata-UI-Karim, S. T., Zheng, H., Cheng, T., Liu, X., Tian, Y., Zhu, Y., Cao, W., **Cao, Q.\***, 2019. Combining color indices and textures of UAV-based digital imagery for rice LAI estimation. **Remote Sensing**, 11(15): 1763. Doi: 10.3390/rs11151763 (IF<sub>5</sub>=5.353, Q1)
- Li, S., Ding, X., Kuang, Q., Ata-UI-Karim, S. T., Cheng, T., Liu, X., Tian, Y., Zhu, Y., Cao, W., **Cao, Q.\***, 2018. Potential of UAV-based active sensing for monitoring rice leaf nitrogen status. **Frontiers in Plant Science**, 9: 1834. Doi: 10.3389/fpls.2018.01834 (IF<sub>5</sub>=6.612, Q1)
- Cao, Q.**, Miao, Y. \*, Shen, J., Yuan, F., Cheng, S., Cui, Z., 2018. Evaluating two Crop Circle active canopy sensors for in-season diagnosis of winter wheat nitrogen status. **Agronomy**, 8(10): 201. Doi: 10.3390/agronomy 8100201 (IF<sub>5</sub>=3.64, Q1)
- Cao, Q.**, Miao, Y. \*, Feng, G., Gao, X., Liu, B., Liu, Y., Li, F., Khosla, R., Mulla, D.J., Zhang, F., 2017. Improving nitrogen use efficiency with minimal environmental risks using an active canopy sensor in a wheat-maize cropping system. **Field Crops Research**, 214: 365-372. Doi: 10.1016/j.fcr.2017.09.033 (IF<sub>5</sub>=6.19, Q1)
- Cao, Q.**, Miao, Y. \*, Li, F., Lu, D., Gao, X., Liu, B., Chen, X., 2017. Developing a new Crop Circle active canopy sensor - based precision nitrogen management strategy for winter wheat in North China Plain. **Precision Agriculture**, 18: 2-18. Doi: 10.1007/s11119-016-9456-7 (IF<sub>5</sub>=5.004, Q1)
- Cao, Q.**, Miao, Y. \*, Shen, J., Yu, W., Yuan, F., Cheng, S., Huang, S., Wang, H., Jiang, R., Yang, W., Li H., 2016. Improving in-season estimation of rice yield potential and responsiveness to topdressing nitrogen application with Crop Circle active crop canopy sensor. **Precision Agriculture**, 17(2): 136-154. Doi: 10.1007/s11119-015-9412-y (IF<sub>5</sub>=5.004, Q1)
- Cao, Q.**, Miao, Y. \*, Feng, G., Gao, X., Li, F., Liu B., Yue, S., Cheng, S., Ustin, S., Khosla, R., 2015. Active canopy sensing of winter wheat nitrogen status: an evaluation of two sensor systems. **Computers and Electronics in Agriculture**, 112: 54-67. Doi: 10.1016/j.compag.2014.08.012 (IF<sub>5</sub>=5.494, Q1)
- Cao, Q.**, Miao, Y. \*, Wang, H., Huang, S., Cheng, S., Khosla, R., Jiang, R., 2013. Non-destructive estimation of rice plant nitrogen status with Crop Circle multispectral active canopy sensor. **Field Crops Research**, 154: 133-144. Doi: 10.1016/j.fcr.2013.08.005 (IF<sub>5</sub>=6.19, Q1)
- Cao, Q.**, Cui, Z., Chen, X., Khosla, R., Dao, T. H., Miao, Y. \*, 2012. Quantifying spatial variability of indigenous nitrogen supply for precision nitrogen management in small scale farming. **Precision Agriculture**, 13: 45-61. Doi: 10.1007/s11119-011-9244-3 (IF<sub>5</sub>=5.004, Q1)

Co-author

- Yang, G., Yu, W., Yao, X., Zheng, H., **Cao, Q.**, Zhu, Y., Cao, W., Cheng, T. \*, **2021**. AGTOC: A novel approach to winter wheat mapping by automatic generation of training samples and one-class classification on Google Earth Engine. **International Journal of Applied Earth Observation and Geoinformation**, 102(13): 102446. Doi: 10.1016/j.jag.2021.102446
- Yao, B., Wang, X., Lemaire, G., Makowski, D., **Cao, Q.**, Liu, X., Liu, L., Liu, B., Zhu, Y., Cao, W., Tang, L. \*, **2021**. Uncertainty analysis of critical nitrogen dilution curves for wheat. **European Journal of Agronomy**, 128(4): 126315. Doi: 10.1016/j.eja.2021.126315
- Zhang, J., Qiu, X., Wu, Y., Zhu, Y., **Cao, Q.**, Liu, X. \*, Cao, W. \*, **2021**. Combining texture, color, and vegetation indices from fixed-wing UAS imagery to estimate wheat growth parameters using multivariate regression methods. **Computers and Electronics in Agriculture**, 185: 106138. Doi: 10.1016/j.compag.2021.106138
- Zhang, K. #, Liu X. #, Ma Y., Wang, Y., **Cao, Q.**, Zhu, Y., Cao, W., Tian, Y. \*, **2021**. A new canopy chlorophyll index-based paddy rice critical nitrogen dilution curve in eastern China. **Field Crops Research**, 266: 108139. Doi: 10.1016/j.fcr.2021.108139
- Tian L., Xue, B., Wang, Z., Li, D., Yao, X., **Cao, Q.**, Zhu, Y., Cao, W., Cheng, T. \*, **2021**. Spectroscopic detection of rice leaf blast infection from asymptomatic to mild stages with integrated machine learning and feature selection. **Remote Sensing of Environment**, 257: 112350. Doi: 10.1016/j.rse.2021.112350
- Jiang, J. #, Zhang, Z. #, **Cao, Q.**, Liang, Y., Krienke, B., Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2020**. Use of an active canopy sensor mounted on an unmanned aerial vehicle to monitor the growth and nitrogen status of winter wheat. **Remote Sensing**, 12(22): 3684. Doi: 10.3390/rs12223684
- Jiang, J., Wang, C., Wang, Y., **Cao, Q.**, Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2020**. Using an active sensor to develop new critical nitrogen dilution curve for winter wheat. **Sensors**, 20(6): 1577. Doi: 10.3390/s20061577
- Zhang, K., Liu, X., Ma, Y., Zhang, R., **Cao, Q.**, Zhu, Y., Cao, W., Tian, Y. \*, **2020**. A comparative assessment of measures of leaf nitrogen in rice using two leaf-clip meters. **Sensors**, 20(1): 175. Doi: 10.3390/s20010175
- Fu, Z., Jiang, J., Gao, Y., Krienke, B., Wang, M., Zhong, K., **Cao, Q.**, Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2020**. Wheat growth monitoring and yield estimation based on multi-rotor unmanned aerial vehicle. **Remote Sensing**, 12(3): 508. Doi: 10.3390/rs12030508
- Zhang, K., Yuan, Z., Yang, T., Lu, Z., **Cao, Q.**, Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2020**. Chlorophyll meter-based nitrogen fertilizer optimization algorithm and nitrogen nutrition index for in-season fertilization of paddy rice. **Agronomy Journal**, 112(1): 288-300. Doi: 10.1002/agj2.20036
- Huang, S, Miao, Y., Yuan, F., **Cao, Q.**, Ye, H., Lenz-Wiedemann, V., Bareth, G., **2019**. In-season diagnosis of rice nitrogen status using proximal fluorescence canopy sensor at different growth stages. **Remote Sensing**, 11(16): 1847. Doi: 10.3390/rs11161847
- Wang, Y., Zhang, K., Tang, C., **Cao, Q.**, Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2019**. Estimation of rice growth parameters based on linear mixed-effect model using multispectral images from fixed-wing unmanned aerial vehicles. **Remote Sensing**, 11: 1371. Doi: 10.3390/rs11111371

- Zhang, J., Liu, X., Liang, Y., **Cao, Q.**, Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2019**. Using a portable active sensor to monitor growth parameters and predict grain yield of winter wheat. **Sensors**, 19: 1108. Doi: 10.3390/s19051108
- Lu, N., Zhou, J., Han, Z., Li, D., **Cao, Q.**, Yao, X., Tian, Y., Zhu, Y., Cao, W., Cheng, T. \*, **2019**. Improved estimation of aboveground biomass in wheat from RGB imagery and point cloud data acquired with a low-cost unmanned aerial vehicle system. **Plant Methods**, 15: 17. Doi: 10.1186/s13007-019-0402-3
- Zhang, K., Liu, X., Ata-Ul-Karim, S. T., Lu, J., Krienke, B., Li, S., **Cao, Q.**, Zhu, Y., Cao, W., Tian, Y. \*, **2019**. Development of chlorophyll-meter-index-based dynamic models for evaluation of high-yield Japonica rice production in Yangtze River Reaches. **Agronomy**, 9(2): 106. Doi: 10.3390/agronomy9020106
- Zhang, K., Ge, X., Shen, P., Li, W., Liu, X., **Cao, Q.**, Zhu, Y., Cao, W., Tian, Y. \*, **2019**. Predicting rice grain yield based on dynamic changes in vegetation indexes during early to mid-growth stages. **Remote Sensing**, 11: 387. Doi: 10.3390/rs11040387
- Xu, X., Ji, X., Jiang, J., Yao, X., Tian, Y., Zhu, Y., Cao, W., **Cao, Q.**, Yang, H., Shi, Z., Cheng, T. \*, **2018**. Evaluation of one-class support vector classification for mapping the paddy rice planting area in Jiangsu Province of China from Landsat 8 OLI imagery. **Remote Sensing**, 10: 546. Doi:10.3390/rs10040546
- Liu, X., **Cao, Q.**, Yuan, Z., Liu, X., Wang, X., Tian, Y., Cao, W., Zhu, Y. \*, **2018**. Leaf area index based nitrogen diagnosis in irrigated lowland rice. **Journal of Integrative Agriculture**, 17: 111-121. Doi: 10.1016/S2095-3119(17)61714-3
- Huang, S., Miao, Y. \*, **Cao, Q.**, Yao, Y., Zhao, G., Yu, W., Shen, J., Yu, K., Bareth, G., **2018**. A new critical nitrogen dilution curve for rice nitrogen status diagnosis in Northeast China. **Pedosphere**, 28(5): 814-822. Doi: 10.1016/S1002-0160(17)60392-8
- Liu, X., Zhang, K., Zhang, Z., **Cao, Q.**, Lv, Z., Yuan, Z., Tian, Y., Cao, W., Zhu, Y. \*, **2017**. Canopy chlorophyll density based index for estimating nitrogen status and predicting grain yield in rice. **Frontiers in Plant Science**, 8: 1829. Doi: 10.3389/fpls.2017.01829
- Ata-Ul-Karim, S. T., Zhu, Y., **Cao, Q.**, Rehmani, M. I. A., Cao, W., Tang, L. \*, **2017**. In-season assessment of grain protein and amylose content in rice using critical nitrogen dilution curve. **European Journal of Agronomy**, 90: 139-151. Doi: 10.1016/j.eja.2017.08.001
- He, Z., Qiu, X., Ata-Ul-Karim, S. T., Li, Y., Liu, X., **Cao, Q.**, Zhu, Y., Cao, W., Tang, L. \*, **2017**. Development of critical nitrogen dilution curve of double cropping rice in south China. **Frontiers in Plant Science**, 8: 638. Doi: 10.3389/fpls.2017.00638
- Liu, X., Ferguson, R. B., Zheng, H., **Cao, Q.**, Tian, Y., Cao, W., Zhu, Y. \*, **2017**. Using an active-optical sensor to develop an optimal NDVI dynamic model for high-yielding rice production (Yangtze, China). **Sensors**, 17(4): 672. Doi:10.3390/s17040672
- Huang, S., Miao, Y. \*, Yuan, F., Gnyp, L. M., Yao, Y., **Cao, Q.**, Wang, H., Lenz-Wiedemann, V., Bareth, G. **2017**. Potential of RapidEye and WorldView-2 satellite data for improving rice nitrogen status monitoring at different growth stages. **Remote sensing**, 9(3): 277. Doi: 10.3390/rs9030227

- Ata-Ul-Karim, S. T., Zhu, Y., Liu, X., **Cao, Q.**, Tian, Y., Cao, W. \*, **2017**. Comparison of different critical nitrogen dilution curves for nitrogen diagnosis in rice. **Scientific Reports**, 7: 42679. Doi: 10.1038/srep42679
- Ata-Ul-Karim, S. T., **Cao, Q.**, Zhu, Y., Tang, L., Rehmani, M. I. A., Cao, W. \*, **2016**. Non-destructive assessment of plant nitrogen parameters using leaf chlorophyll measurements in rice. **Frontiers in Plant Science**, 7: 1829. Doi: 10.3389/fpls.2016.01829
- Yuan, Z., **Cao, Q.**, Zhang, K., Ata-Ul-Karim, S. T., Tian, Y., Zhu, Y., Cao, W., Liu, X. \*, **2016**. Optimal leaf positions for SPAD meter measurement in rice. **Frontiers in Plant Science**, 7: 719. Doi: 10.3389/fpls.2016.00719
- Yuan, Z., Ata-Ul-Karim, S. T., **Cao, Q.**, Lu Z., Cao, W., Zhu, Y., Liu, X. \*, **2016**. Indicators for diagnosing nitrogen status of rice based on chlorophyll meter readings. *Field Crops Research*, 185: 12-20. Doi: 10.1016/j.fcr.2015.10.003
- Tilly, N. \*, Hoffmeister, D., **Cao, Q.**, Lenz-Wiedemann, V., Miao, Y., Bareth, G. **2015**. Transferability of Models for Estimating Paddy Rice Biomass from Spatial Plant Height Data. **Agriculture**, 5: 538-560. Doi: 10.3390/agriculture5030538
- Tilly, N. \*, Hoffmeister, D., **Cao, Q.**, Huang, S., Lenz-Wiedemann, V., Miao, Y., Bareth, G. **2014**. Multi-temporal Crop Surface Models: Accurate plant height measurement and biomass estimation with terrestrial laser scanning in paddy rice. **Journal of Applied Remote Sensing**, 8(1): 083671. Doi: 10.1117/1.JRS.8.083671
- Yao, Y., Miao, Y. \*, **Cao, Q.**, Wang, H., Gnyp, L. M., Bareth, G., Khosla, R., Yang, W., Liu, F., Liu C. **2014**. In-season estimation of rice nitrogen status with an active crop canopy sensor. **IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing**, 7: 4403-4413. Doi: 10.1109/JSTARS.2014.2322659

## PROFESSIONAL SERVICES

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- Guest Editor of Special Issue "Intelligent Agriculture: Crop Nutrient Management" in *Plants* (IF<sub>2020</sub>=3.935, Q1), Deadline for manuscript submissions: 30 Jun 2022.
  - Invited Manuscript Reviewer of: *Agronomy Journal*, *Precision Agriculture*, *Field Crops Research*, *European Journal of Agronomy*, *Remote Sensing*, *Remote Sensing and Environment*, *Computer and Electronics in Agriculture*, etc.

## MEMBERSHIPS

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- International Society of Precision Agriculture (ISPA)
  - American Society of Agronomy (ASA)
  - Crop Science Society of America (CSSA)
  - Soil Science Society of America (SSSA)