Chenchen Kang, Ph.D.

Assistant Professor, Department of Agricultural Science and Engineering

Otis L. Floyd Nursery Research Center, Tennessee State University, McMinnville, TN

Email: ckang1@tnstate.edu | Tel: (931) 259-4304 | Website | LinkedIn | Google Scholar

Executive Summary

- Deep expertise in automated and autonomous agricultural machinery and robotic systems
- First author of six and co-author of five publications in high-impact journals
- Teaching Assistant for one graduate course, three guest lectures, and co-mentor for a Capstone design team
- Research funding: Secured two grants as co-PI and contributed to two additional grant proposals

Education

Ph.D. in Biological and Agricultural Engineering, **Washington State University** Aug 2018 – May 2023

- Advisors: Qin Zhang & Manoj Karkee
- Thesis: Decision-support system for water stress assessment and deficit irrigation management in wine grapes

M.S. in Agricultural Mechanization Engineering, **China Agricultural University** Sep 2016 – June 2018

- Advisor: Decheng Wang
- Thesis: The design and experimental study on the cylinder-type cutter-head for King Grass

B.S. in Agricultural Engineering, **China Agricultural University** Sep 2012 – June 2016

- Outstanding Graduate Award

Professional Experience

Assistant Professor Aug 2025 – Present

Department of Agricultural Science and Engineering
Otis L. Floyd Nursery Research Center, Tennessee State University

Postdoctoral Researcher May 2023 – Aug 2025

Department of Agricultural and Biological Engineering
Fruit Research and Extension Center, The Pennsylvania State University

- Advancing robotic approaches for precision spray systems, Funded by USDA NIFA Project #PEN04822 and Accession #7005925
- Precision crop monitoring for advancing the sustainability of controlled environment agricultural systems, Funded by Pennsylvania Department of Agriculture Specialty Crop Block Grant #C940001528
- Advancing Pest Management for Grapes and Berries with Robotic Spraying System, Funded by USDA NIFA CARE Accession #1032282

Research Assistant Aug 2018 – May 2023

Department of Biological Systems Engineering
Center for Precision & Automated Agricultural Systems, Washington State University

- Smart irrigation system using IoT and big data analytics (PhD research), Funded by USDA NIFA Accession #1005756
- High-Resolution Vineyard Nutrient Management, Funded by USDA NIFA SCRI CAP Accession #1023501

Research Assistant Sep 2016 – June 2018

Department Agricultural Engineering
China Agricultural University

- Design and experimental study on the cylinder-type cutter-head for King Grass

Research Interests and Expertise

General Area: Agricultural automation and mechanization

Particular Focus: Sensing, modeling, and control technologies for automated agricultural systems

- Decision-support systems
- Integrated robotic systems
- Machine vision and 3D point cloud data analytics
- Intelligent machine systems

Publications

Journal Articles

1. **Kang, C.,** Krishna Kumar, S., & He, L. (2025). Integrated approach to green fruit thinning: Combining computer vision and precision sprayers for effective chemical thinning. ***Precision Agriculture***. (Accepted)

2. **Kang, C.,** Mu, X., Seffrin, A. N., Di Gioia, F., & He, L. (2025). A recursive segmentation model for Bok Choy growth monitoring with Internet of Things (IoT) technology in controlled environment agriculture. ***Computers and Electronics in Agriculture****, 230*, 109866. https://doi.org/10.1016/j.compag.2024.109866

3. **Kang, C.,** Diverres, G., Karkee, M., Zhang, Q., & Keller, M. (2024). Assessing grapevine water status through fusion of hyperspectral imaging and 3D point clouds. ***Computers and Electronics in Agriculture****, 226*, 109488. https://doi.org/10.1016/j.compag.2024.109488

4. **Kang, C.,** He, L., & Zhu, H. (2024). Assessment of spray patterns and efficiency of unmanned sprayers used in planar growing systems. ***Precision Agriculture***, 1–21. https://doi.org/10.1007/s11119-024-10166-5

5. **Kang, C.,** Diverres, G., Paudel, A., Karkee, M., Zhang, Q., & Keller, M. (2023). Estimating soil and grapevine water status using ground-based hyperspectral imaging under diffused lighting conditions: Addressing the effect of lighting variability in vineyards. ***Computers and Electronics in Agriculture****, 212*, 108175. https://doi.org/10.1016/j.compag.2023.108175

6. **Kang, C.,** Diverres, G., Karkee, M., Zhang, Q., & Keller, M. (2023). Decision-support system for precision regulated deficit irrigation management for wine grapes. ***Computers and Electronics in Agriculture****, 208*, 107777. https://doi.org/10.1016/j.compag.2023.107777

7. Asad, A. B., Paudel, A., Kshetri, S., **Kang, C**., Khanal, S. R., Shcherbatyuk, N., ... & Keller, M. (2025). Integrating Feature Selection and Machine Learning for Nitrogen Assessment in Grapevine Leaves using In-Field Hyperspectral Imaging. *arXiv preprint* arXiv:2507.17869. https://doi.org/10.48550/arXiv.2507.17869

8. Huan, X., Wu, M., Bian, X., Jia, J., **Kang, C.,** Wu, C., . . . Chen, J. (2024). Design and experiment of ordinary tea profiling harvesting device based on light detection and ranging perception. *Agriculture, 14*(7), 1147. https://doi.org/10.3390/agriculture14071147

9. Thapa, S., **Kang, C.,** Diverres, G., Karkee, M., Zhang, Q., & Keller, M. (2022). Assessment of water stress in vineyards using on-the-go hyperspectral imaging and machine learning algorithms. *Journal of the ASABE*. Advance online publication. https://doi.org/10.13031/ja.14663

10. Zhou, Z., Diverres, G., **Kang, C.,** Thapa, S., Karkee, M., Zhang, Q., & Keller, M. (2022). Ground-based thermal imaging for assessing crop water status in grapevines over a growing season. *Agronomy, 12*(2), 322. https://doi.org/10.3390/agronomy12020322

11. You, Y., Wang, H., Huan, X., Wang, D., **Kang, C.,** & Ye, B. (2021). Design and experiment of roller crushing device of king grass harvester. *Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery, 52*(4). https://doi.org/10.6041/j.issn.1000-1298.2021.04.014

12. Wu, B., Wang, D., Wang, G., Fu, Z., & **Kang, C.** (2017). Optimization and experiments of cut-condition device working parameter on mower conditioner. *Nongye Jixie Xuebao/Transactions of the Chinese Society of Agricultural Machinery, 48*(10). https://doi.org/10.6041/j.issn.1000-1298.2017.10.009

Conference Papers

1. **Kang, C.,** Krishna Kumar, S., & He, L. (2025). Integrated approach to green fruit thinning: Combining computer vision and precision sprayers for effective chemical thinning. *IFAC-PapersOnLine*. **(Refereed)**

2. **Kang, C.,** Mu, X., Seffrin, A. N., Di Gioia, F., & He, L. (2024). Bok Choy growth monitoring using IoT technology and a recurrent segmentation model. In *2024 ASABE Annual International Meeting* (p. 1). American Society of Agricultural and Biological Engineers. https://doi.org/10.13031/aim.202401198

3. **Kang, C.,** Diverres, G., Karkee, M., Zhang, Q., & Keller, M. (2023). Estimating grapevine water status: A combined analysis of hyperspectral image and 3D point clouds. *IVES Conference Series, GiESCO 2023*. https://ives-openscience.eu/34111/

4. **Kang, C.,** Karkee, M., Zhang, Q., Keller, M., Shcherbatyuk, N., & Davadant, P. (2022). Diagnosis of grapevine nutrient content using proximal hyperspectral imaging. In *The 15th International Conference on Precision Agriculture*, Minneapolis, MN. https://www.ispag.org/icpa/proceedings/?action=download&item=8959

5. Wu, B., Wang, D., Wang, G., **Kang, C.,** Ye, B., & Sun, Q. (2019). Experimental study on mechanical properties of connections between alfalfa leaves and stems. *2019 ASABE Annual International Meeting*, St. Joseph, MI. https://doi.org/10.13031/aim.201900510

6. **Kang, C.,** Wang, D., Wang, G., Feng, J., Lu, Z., Wang, Z., Gu, X., Luo, L., & Li, D. (2017). Optimum design of steel-roll round bale based on EDEM. *2017 ASABE Annual International Meeting*, St. Joseph, MI. https://doi.org/10.13031/aim.201701647

7. Wu, H., Wang, D., Wang, G., He, C., & **Kang, C.** (2016). Process research of forming round bale in logarithmic spiral round baler chamber based on EDEM. In *2016 ASABE Annual International Meeting* (p. 1). American Society of Agricultural and Biological Engineers. https://doi.org/10.13031/aim.20162461898

Research Grants and Proposals

1. Multi-functional and low-cost sensor station for orchard management. 2025. *State Horticultural Association of Pennsylvania*. (Co-PI, $9,981)

2. A low-cost microclimate monitoring system for orchard disease management. 2024. *State Horticultural Association of Pennsylvania*. (Co-PI, $10,983)

3. AgShred: Affordable grape selective harvesting via robotic elimination of defectives. 2023. *USDA Agricultural Marketing Service*. (Contributed to proposal developmentg)

4. Precision crop load management with targeted chemical blossom thinning for apples. 2023. *USDA AFRI*. (Contributed to proposal development, $601,250)

5. Advancing Pest Management for Grapes and Berries with Robotic Spraying System. 2023. *USDA NIFA CARE*. (Contributed to proposal development, $300,000)

Media Releases and Features

Articles

1. "Spectrum smart vineyard irrigation," by Kate Prengaman, *Good Fruit Grower Magazine*, August 19, 2021. https://www.goodfruit.com/spectrum-smart-vineyard-irrigation/

2. "New computer vision system can guide specialty crops monitoring," by Jeff Mulhollem, *The Pennsylvania State University*, February 27, 2025. https://www.psu.edu/news/research/story/new-computer-vision-system-can-guide-specialty-crops-monitoring?utm_audience=Combined&utm_source=newswire&utm_medium=email&utm_campaign=agricultural%20sciences%20newswire&utm_content=03-03-2025-08-39&utm_term=Storie

    - Reprinted by: *HortiDaily*, February 28, 2025. https://www.hortidaily.com/article/9709666/new-computer-vision-system-guiding-crop-monitoring/
    - Reprinted by: *ScienceDaily*, March 4, 2025. https://www.sciencedaily.com/releases/2025/03/250304164416.htm

3. "Machine vision system monitors greenhouse-grown specialty crop," by Linda Wilson, *Vision Systems Design Magazine*, March 21, 2025. https://www.vision-systems.com/boards-software/article/55276457/machine-vision-system-monitors-greenhouse-grown-specialty-crop
4. "Variable-rate spraying shows promise in orchards," by Philip Gruber, *Lancaster Farming*, June 26, 2025. https://www.lancasterfarming.com/farming-news/produce/variable-rate-spraying-shows-promise-in-orchards/article_d4fac63d-cd6c-4e1e-b348-0fc8dcd5ee87.html
5. "Penn State researchers programmed AI models and trained computer vision system to track plant growth," by Timothy Bueno, *Fertilizer Daily*, March 3, 2025. https://www.fertilizerdaily.com/20250303-penn-state-researchers-programmed-ai-models-and-trained-computer-vision-system-to-track-plant-growth/
6. "Looking to the future: AgAID Institute," by Jordan Jobe, *Washington State University*, November 29, 2022. https://csanr.wsu.edu/looking-to-the-future-agaid-institute/

Podcast

1. "Challenges of developing field sensors," by Patricia A. Skinkis, *HiRes Vineyard Nutrition Podcast*, November 2023. https://extension.oregonstate.edu/podcast/hires-vineyard-nutrition-podcast/season-2-episode-4-challenges-developing-field-sensors

Conference Talks

1. Integrated approach to green fruit thinning: Combining computer vision and precision sprayers for effective chemical thinning. *8th IFAC Conference on Sensing, Control and Automation Technologies for Agriculture (**AgriControl 2025**)*, Davis, CA.
2. Integrating computer vision and precision sprayers for targeted green fruit chemical thinning. *Northeast Agricultural/Biological Engineering Conference (**NABEC 2025**)*, Ithaca, NY.
3. Assessment of spray patterns and efficiency of an unmanned sprayer used in planar growing systems. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2024**)*, Anaheim, CA.
4. Bok Choy growth monitoring using IoT technology and a recursive segmentation model. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2024**)*, Anaheim, CA.
5. A CFD-based precision spraying model for optimizing canopy coverage and minimizing drift. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2024**)*, Anaheim, CA.
6. Assessment of spray patterns and efficiency of an unmanned sprayer used in planar growing systems. *Northeast Agricultural/Biological Engineering Conference (**NABEC 2024**)*, State College, PA.
7. Estimating grapevine water status: A combined analysis of hyperspectral image and 3D point clouds. *22nd Group of International Experts for Cooperation on Vitivinicultural Systems Conference (**GiESCO 2023**)*, Ithaca, NY.
8. Estimating soil and grapevine water status using ground-based hyperspectral imaging under diffused lighting conditions. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2023**)*, Omaha, NE.
9. Hyperspectral imaging and stereovision-based water stress assessment in vineyards. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2022**)*, Houston, TX.
10. Diagnosis of grapevine nutrient content using proximal hyperspectral imaging. *15th International Conference on Precision Agriculture (**ICPA 2022**)*, Minneapolis, MN.
11. Decision-support system for precision irrigation in vineyards. *American Society of Agricultural and Biological Engineers Annual International Meeting (**ASABE 2021**)*, Online Conference.

Teaching Interests

Electrohydraulic systems and control; Machine vision; Artificial intelligence applications in agriculture; Applied data science in agriculture

Teaching & Mentorship

HORT 432 Deciduous Tree Fruits	Guest Lecture	Fall 2024
Penn State University		
ABE 590 Colloquium	Guest Lecture	Fall 2024
Penn State University		
Capstone Project	Co-mentor	Fall 2023
Department of Agricultural and Biological Engineering, Penn State University		
HORT 433 Vegetable Crops	Guest Lecture	Fall 2023
Penn State University		
AFS 102 Professional Development in Agriculture	Mentor	Spring 2022
Washington State University		
BSYSE 551 Electrohydraulic Systems Control	Teaching Assistant	Fall 2020
Washington State University		
Agricultural Engineering Freshman Advising Program	Mentor	Fall 2016, Spring 2017
College of Engineering, China Agricultural University		

Extension Activities

Talks

1. Use of Internet of Things technologies and computer vision system to monitor and manage soilless greenhouse leafy greens. *Mid-Atlantic Fruit and Vegetable Convention*, Hershey, PA, January 29, 2025. (Invited talk)
2. A low-cost microclimate monitoring system for orchard disease management. *Mid-Atlantic Fruit and Vegetable Convention*, Hershey, PA, January 30, 2025.
3. Advancing the sustainability of controlled environment agricultural systems. *Penn State's Ag Progress Days*, Pennsylvania Furnace, PA, August 14, 2024.
4. Robotic sprayer – enhanced control of spray region and coverage in vineyards. *Mid-Atlantic Fruit and Vegetable Convention*, Hershey, PA, February 1, 2024.
5. Spectral imaging in agriculture. *Precision Agriculture Technology Field Day, Penn State Extension*, Biglerville, PA, June 6, 2023.
6. Diagnosis of grapevine nitrogen content using proximal hyperspectral imaging. *Washington State Grape Society's Annual Meeting and Trade Show*, Grandview, WA, November 17, 2022

Demonstrations

1. Integrating computer vision and precision sprayers for targeted green fruit chemical thinning. *Penn State Fruit Research and Extension Center Field Day, Penn State Extension*, Biglerville, PA, June 25, 2025.
2. Multi-functional and low-cost sensor station for orchard management. *Penn State Fruit Research and Extension Center Field Day, Penn State Extension*, Biglerville, PA, June 25, 2025.
3. Robotic sprayer – enhanced control of spray region and coverage in vineyards. *Summer Field Day, Maryland Grape Growers Association*, Myersville, MD, June 21, 2025.
4. Four-wheel drive drone with ground sprayer. *Tech Field Day, Maryland Nursery, Landscape and Greenhouse Association and UMD Extension*, Laytonsville, MD, June 20, 2024. https://cdn.ymaws.com/mnlga.org/resource/resmgr/event_docs/tech_field_day_2024/z_tech_field_day_web_1_page.pdf
5. Robotic sprayer – enhanced control of spray region and coverage in vineyards. *Plant Protection Field Day, Penn State Extension*, Biglerville, PA, September 15, 2023.

Articles

1. Kang, C., & He, L. (2024, March 6). Introduce and evaluate an unmanned ground sprayer for vineyards and orchards. *Penn State Extension*. https://extension.psu.edu/introduce-and-evaluate-an-unmanned-ground-sprayer-for-vineyards-and-orchards

2. Kang, C., Mu, X., Seffrin, A. N., Di Gioia, F., & He, L. (2025). IoT-based precision monitoring system for soilless leafy greens. In *Proceedings of the Mid-Atlantic Fruit and Vegetable Convention*.

Honors and Awards

Dissertation nominated for "2024 Pellizzi Prize", Club of Bologna	2024
Arnie & Marta Kegel Endowed Fellowship, Washington State University	2022
BSE Outstanding Graduate Student Award, Washington State University	2022
Biological Systems Engineering Travel Award, Washington State University	2022
Academic Excellence Scholarship, China Agricultural University	2013–2017
Outstanding Graduate, China Agricultural University	2016
National Inspirational Scholarship, Ministry of Education (China)	2014–2015
Tsang Hin-chi Scholarship, China Agricultural University	2013–2015

Service

Proposal Reviewer

1. Confirmation of Candidature (PhD Research Proposal), School of Graduate Research, Central Queensland University
2. BARD – Binational Agricultural Research and Development Fund US–Israel
3. Graduate Student Competitive Grants Program, College of Agricultural Sciences' Office for Research and Graduate Education, Penn State University

Journal Reviewer

- *Computers and Electronics in Agriculture*
- *Journal of ASABE*
- *Smart Agricultural Technology*
- *Journal of Field Robotics*
- *Agricultural and Forest Meteorology*
- *Environmental Monitoring and Assessment*
- *Agronomy*
- *Cluster Computing: The Journal of Networks, Software Tools and Applications*
- *Fruit Research*
- *Agriculture*
- *Plant Methods*
- *Food Research International*

Professional Memberships

- Member: *American Society of Agricultural and Biological Engineers (ASABE)*
  - MS-48 Specialty Crop Engineering Committee
  - ITSC-312 Machine Vision Committee
  - ITSC-318 Mechatronics & Robotics Committee
- Member: *The International Society of Precision Agriculture (ISPA)*