Center for Precision & Automated Agricultural Systems (CPAAS) 2010

WASHINGTON STATE UNIVERSITY

Table of Contents

WSU Center for
Precision & Automated Agricultural Systems
24106 N. Bunn Rd.
Washington State University
Prosser, WA 99350
509-786-9235
www.cpas.wsu.edu

2010 Message from Director Qin Zhang

The Center for Precision and Automated Agricultural Systems (CPAAS) was established in 1999 (formerly known as the Center for Precision Agricultural Systems - CPAS), and was designed to offer a framework for precision agriculture efforts at WSU. The center is striving for preeminence by promoting creative research and extension activities for precision and automated agricultural production.

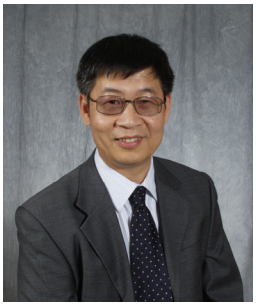
We are to develop solutions for more effective growing, harvesting and processing of specialty crops that will improve the quantity, quality and safety of produce in the state of Washington, Pacific Northwest, and worldwide. To reach this goal, CPAAS has constructed basic research facilities needed to conduct agricultural automation technologies research and development. More importantly, the center has a small but highly skilled professional team to support research personnel performing effective research and development activities. In 2010, five postdoctoral research associates, four graduate students, and four visiting scholars performed research and/or education activities at CPAAS.

To acquire and leverage funds to support research and extension, CPAAS has put forth great effort in organizing trans-disciplinary research teams, both within WSU and at a multi-institutional level. CPAAS faculty have collaborated and/or led the development of several successful grant proposals. For example, under the initiative and organization of Dr. Fran Pierce, center director prior to July 2010, CPAAS facilitated two successful NIFA-SCRI grant proposals. In creating practical technologies, CPAAS is also focusing on developing interactive partnerships with several statewide specialty crop commodity groups. The industry has sponsored research projects targeted to create practical engineering solutions, either in the format of research commission sponsored projects or by way of collaborative technology development with an industry partner.

Our international collaboration has brought students, scholars and scientists from around the world. A notable accomplishment is that the center was the responsible unit for initiating and developing formal international collaboration with Kyoto University in Japan.

We are committed to developing a "*World preeminent and Washington relevant*" research, education and extension team dedicated to providing solutions in agricultural automation.

Working together, we will be successful!



Qin Zhang
Professor Biological Systems Engineering
Director Center for Precision &
Automated Agricultural Systems

Dr. Qin Zhang is the Director of the Center for Precision and Automated Agricultural Systems (CPAAS), and a Professor in the Department of Biological Systems Engineering at Washington State University (WSU).

He received his Ph.D. degree in Agricultural Engineering from the University of Illinois at Urbana-Champaign in 1991, his M.S. degree in Agricultural Engineering from the University of Idaho in 1987, and his B.S. degree in Mechanical Engineering from Zhejiang Agricultural University in China in 1982.

Prior to his arrival at WSU, Dr. Zhang was a professor of off-road equipment engineering at the University of Illinois at Urbana-Champaign (UIUC), and before joining the faculty at UIUC in 1997, he worked in Caterpillar Inc. as a Senior Engineer.

Dr. Zhang has focused his teaching and research activities on developing fundamental technologies with respect to agricultural equipment and automation. Based on his research, he has written one textbook, four separate chapters in other books, published over 90 peer reviewed journal articles, presented over two hundred papers at national and international conferences, and has awarded nine U.S. patents.

He is currently serves as the Elsevier editor for *Computers and Electronics in Agriculture*. He has been invited to give numerous seminars and short courses at fourteen universities, six research institutes and nine industry companies in the United States, Germany, Mexico, Japan, Korea and China; and invited to give keynote speeches at international technical conferences six times.

Manoj Karkee
Assistant Professor
Biological Systems Engineering

Dr. Karkee was born and raised in mid hills of the Himalayan country of Nepal, some 400 KM east of capital city Kathmandu. After completing high school in his home village, he moved to Kathmandu for his associate and undergraduate degrees. He received his B.S. degree in Computer Engineering in 2002 from Tribhuvan University and moved to Asian Institute of Technology, Bangkok, Thailand for his M.S. degree in Remote Sensing and GIS. In 2005, he joined Iowa State University for his PhD in Agricultural Engineering and Human Computer Interaction. He spent five years in Ames, Iowa for his pre and post doctoral research and education.

Dr. Karkee joined WSU in 2010 and has been affiliated with and housed in CPAAS since the beginning of his tenure at WSU.

Dr. Karkee has established a strong research program in agricultural automation and mechanization area with particular emphasis on machine vision systems for production agriculture. He has been working on sponsored research projects in machine vision including crop load estimation, fruit tree and bush pruning, and water and nutrient stress monitoring. His research program has also placed efforts on application technology area including solid set fixed canopy application systems. He has been actively published in journals such as *Computers and Electronics in Agriculture*, *Biosystems Engineering*, and *The Transactions of ASABE* and has frequently presented at national and international conferences.

Dr. Karee's areas of expertise and interest include:

- Machine vision and computational intelligence for production agriculture
- Automated and robotic agricultural machinery systems
- Agricultural systems design, modeling, simulation, and control

Karen Lewis
WSU Regional Tree Fruit Specialist
Grant-Adams Area Extension

Lewis joined WSU in 1987 and became an affiliate at CPAAS in 2010. She earned her B.S. degree in Plant Sciences and her M.S. degree in Horticulture at the University of Arizona. While at the UA, she worked as an assistant in extension to the State Specialist in Fruit, Nut, and Vine Crops.

Karen's extension and applied research program has been guided by active participation and leadership in international, national and state grower-member industry organizations. Karen participates on the WSU Tree Fruit Research and Extension Team, the Columbia Basin Irrigated Agriculture Team and the UW Ag Health and Safety Team. She serves as an Ex Officio member on the Washington Tree Fruit Research Commission, and is an advisor on four industry boards.

Karen has been instrumental in the planting trends of high density, high efficiency competitive apple orchard systems and in the development and utilization of mobile platforms. Karen works with other agencies and grower-member organizations in the development of premier educational opportunities for the Hispanic tree fruit industry workforce.

Karen currently is a Co-PI on the "Comprehensive for Automation in Specialty Crops" and the "Innovative Technologies for Thinning Fruit" Specialty Crop Research Initiative (SCRI) projects.

Current program focus:

- Development and integration of mechanized / labor assist technologies for tree fruit pruning, thinning and harvest
- Competitive apple orchard systems
- Engineering, horticultural and economic solutions for the sustained production of high quality tree fruit nursery stock
- Light duty electric vehicles for on-farm operations

Francis J Pierce
Professor
Biological Systems Engineering
Crop and Soil Sciences
Past Director—CPAS

Pierce was the Director of the Center for Precision Agricultural Systems (CPAS) from 2000 through the middle of 2010 in addition to being a professor in the Departments of Crop and Soil Sciences and Biological Systems Engineering at Washington State University. He received his Ph.D. in Soil Science from the University of Minnesota in 1984. Prior to his arrival at WSU in September 2000, he was a professor of soil science at Michigan State University. His research efforts on precision agriculture have been nationally recognized, and in 1993 he organized the North Central Regional Research Committee on Site-Specific Management, which meets annually with scientists across the U.S. and Canada. He organized and edited a book *The State of Site-Specific Management for Agriculture*, and co-authored an invited review article for *Advances in Agronomy* on aspects of precision agriculture. Currently he is leading an effort to produce a series of books for ESRI on the topic of applications of GIS for agriculture.

Pierce retired from WSU in March of 2011 and now holds Emeritus status.

Matthew Whiting
Professor
Horticulture and Landscape Architecture

Dr. Whiting received his undergraduate education and Masters degree at the University of Guelph in Ontario Canada. He then came to WSU and achieved his Ph.D. in 2001.

Whiting has directed Washington State University's stone fruit physiology research and outreach program since 2002. The program has addressed key horticultural and physiological research issues, focusing on sweet cherry.

Dr. Whiting's program is leading the industry in the transition to high efficiency orchard systems. Considerable emphasis is placed on developing management systems for establishing and maintaining planar architectures and facilitating the incorporation of automation and mechanization.

He joined CPAAS officially as an affiliate researcher in 2010 and brings internationally renowned stone fruit horticultural expertise and modern orchard trellis architecture knowledge to the center. He has been invited to speak around the world on orchard systems innovations, whole-tree physiology, and practical strategies for efficient production of superlative fruit. He has published over 30 peer reviewed journal articles, edited one book, *Producing Premium Cherries*, and secured over $5.5 m in competitive grant funds in support of his program.

His areas of research interest include:

- Genetic, horticultural, and physiological components of consistent, sustainable, and profitable stone fruit production
- Development of high efficiency sweet cherry orchard systems

Linda Root
Fiscal Specialist II

Root came to WSU five years ago from a background of managing a small business for seventeen years. The Center was CPAS when she came and she helped facilitate the spinoff of AgWeatherNet and has been working to assist the growth of CPAAS. She has an AA degree in Business Management from Columbia Basin College and performs functions in Center finance management, grant management, purchasing, travel, event planning and principal assistant to the director. She extends this support to affiliated faculty.

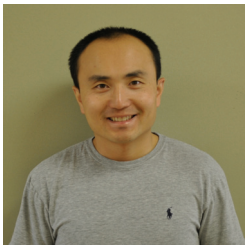
Patrick Scharf
Engineering Technician III

Scharf was born and raised on a small dairy farm in east central Wisconsin. It was there that his interest and education in engineering and fabrication began. He completed his Associate Degree in Engine Technology in 1991 and worked for Kohler Engines, in their R & D department. In 1995 he ventured to the University of Wisconsin-Madison to pursue his undergraduate degree in Animal Science. During his time at the UW he was employed by UW Engineering Department's Powertrain Control Research Lab, which was funded by Ford Motor Company. Also during this time he started a small Black Angus beef herd on the family farm. In 1996, he bought the family farm from his parents and began the conversion of the conventional row crop farm to an organic pasture based beef farm. In 1999 Scharf completed his undergraduate education and eventually moved back to the farm to expand his pastured beef enterprise. In early 2007, after two years of drought and rising feed costs, Scharf decided to liquidate the beef enterprise and return to the engineering side of his resume. Scharf took a job with the USDA-ARS in Pendleton, Oregon, working as an engineering technician. In 2009, the agricultural engineering deptartment in Pendleton was discontinued and Scharf was hired as an engineering technician at CPAAS. Scharf's role at CPAAS is multifaceted. Scharf manages the shop, equipment, and facilities. Scharf also plays a key role in the design and fabrication of researcher's and student's projects, facilitating researcher's and student's needs in regards to these projects, and guiding students through the design of their projects .

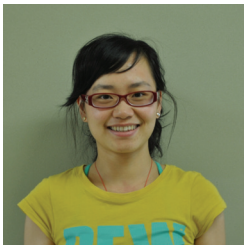
Postdoctoral Research Associates

Xiaoqiang Du,
Ph.D.

Long He,
Ph.D.



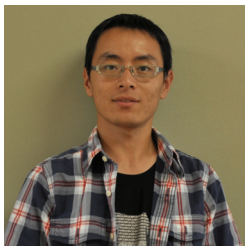
Qi Wang,
Ph.D.



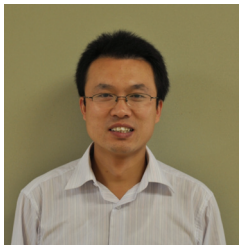
Yongni Shao,
Ph.D.

Graduate Students

Joshua Kendall
MS Student



Meng Wang
Ph.D. Student



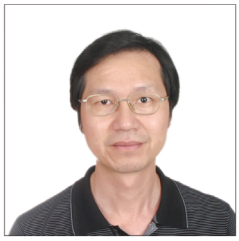
Jianfeng Zhou
Ph.D. Student

Jingjin Zhang
Ph.D. Student

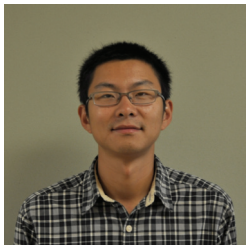
Visiting Professors

Yongqian Ding
Nanjing Agricultural University

Qinghua Yang
Zhejiang University of Technology

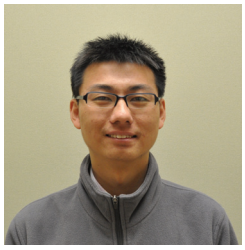


Exchange Students/Visiting Scholars



Du Chen
Arrived 10/09/09
China Agricultural University

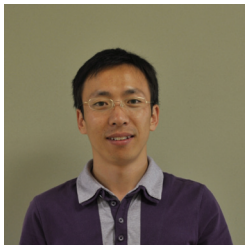
Feng Kang
Arrived 02/02/09
China Agricultural University



Ruilong Luo
Arrived 11/20/10
China Agricultural University

Hui Wang
Arrived 12/09/09
China Agricultural University

Hong Sun
Arrived 10/03/09
China Agricultural University



Yong Zhao
Arrived 09/01/10
China Agricultural University

Project Summaries

3D Reconstruction of Trees and Bushes for Mechanical Pruning

Bikram Adhikari, Manoj Karkee, Qi Wang, Matt Whiting, Qin Zhang

Summary. Pruning is a labor intensive operation in fruit production, which constitutes a significant component of total production cost. Automation and mechanization can reduce labor demand from such labor intensive tasks. This work focuses on development of a three dimensional (3D) machine vision system to map apple trees for automatic pruning. A sensor platform consisting of a stereo-vision and time-of-flight-of-light-based 3D camera was developed to move the sensors along a row of fruit trees and bushes. Stereo and 3D images were captured for a cherry tree in laboratory environment and for apple trees and red raspberry bushes in a commercial orchard. Stereo imaging processing has shown promising results for 3D reconstruction of trees. Currently, further image processing is in progress to reconstruct 3D plant structure using 3D camera-based images trees and to identify pruning points.

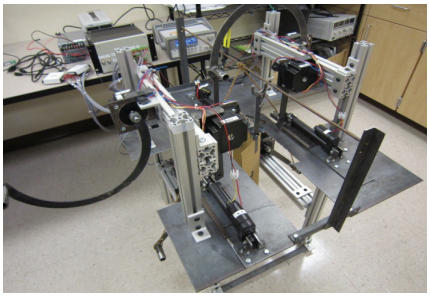
A young commercial apple orchard (Allan Bros. Inc., Prosser, WA) in the central leader-based fruiting wall architecture, left: rows (fruiting walls) of apple trees, and right: data acquisition platform showing imaging sensors and object of interest

Automated Hop Twinning Machinery and Technology Investigation

Xiaoqiang Du, Long He, Qin Zhang
Cooperated with S.S. Steiner, Inc.

Summary. This project is attempting to develop a twinning machine for mechanical hop twinning operations. The first phase is to prove a conceptual device for knot tying on overhead cable via a laboratory scale feasibility study. The process includes the design of a conceptual knot tying device, ordering components, testing device fabrication, system tuning and tests. As the primary goal of this project phase was to prove the concept, and the developed testing system has demonstrated its capability on performing the desired functions, it is reasonably to conclude that the developed conceptual device is capable of performing mechanical knot tying. The remaining challenges include how to improve the accuracy and reliability, and how to integrate it on a field platform.

Hop field with twining work done



Hop twining conceptual platform

Hop twining platform control system

Mechanical Cherry Harvester Research

Du Chen, Xiaoqiang Du, Qin Zhang,
SCRI project

Summary. This research is part of the broad SCRI project to develop a sustainable stem-free sweet cherry production, processing, and marketing system. The basic goal of this research is to improve labor efficiency and safety by developing mechanical and/or mechanical-assist harvest technologies. In 2010, we did experiments to quantify the dynamic response of cherry trees to forced excitation and compare harvesting efficiency of different harvesting methods. The results we got will provide the necessary information for developing a mechanical stem-free cherry harvester.

In-field dynamics test on UFO cherry tree

Performance comparison between two prototype harvesters

Hand-held Mechanical Blossom Thinning Device for Sweet Cherry

Karen Lewis, Meng Wang, Qin Zhang
WFTRC Project

Summary. Blossom thinning is a common practice for producing larger and better quality fruits in tree fruit production. Mechanical thinning has the potential to decrease the labor cost compared to hand thinning and is more targeted than chemical thinning. This study aimed to develop a hand-held mechanical thinner suitable for thinning blossoms on various fruit trees. Experiments were conducted on different fruit tree training systems of sweet cherry including UFO (Upright Fruit Offshoots), Y–trellis, Steep Leader, etc. and were conducted both in the USA and Chile in 2010.

Mark Hanrahan (Washington Grower) thinning UFO cherry block using the hand-held mechanical thinner.

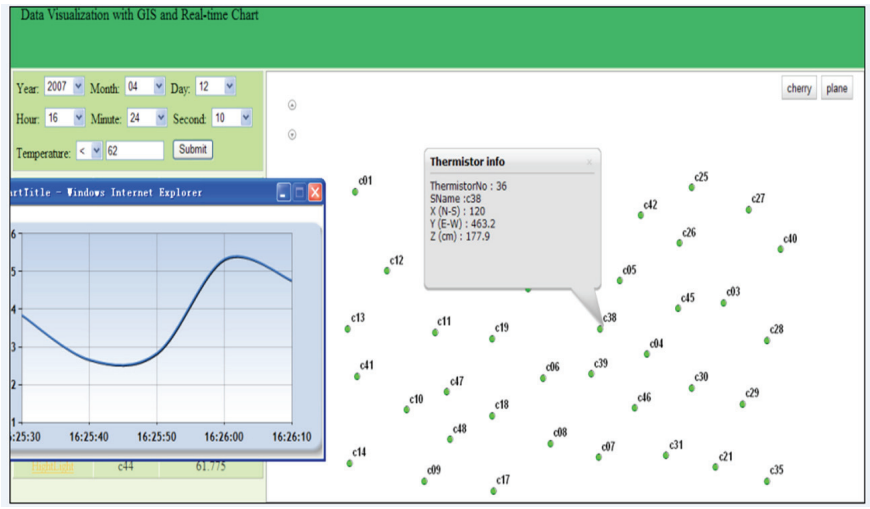
Data Visualization and Decision Support for Sensor Based Crop Management

Yongni Shao, Li Tan, Qin Zhang

Summary. A prototype of a data visualization and decision support tool has been developed with the following features and capabilities:

- Built based on an open-source data mining tool. It has an open architecture design with which users can add their own visualization/data processing plug-ins.
- Supports 2-D visualization for geo-spatial data collected in the field. The 2 -D images can be overlaid with Google earth. We have implemented this idea with the PAR data provided by UC Davis.
- Supports 3-D visualization for geo-spatial data collected in the field. The visualization is done through OpenGL, and users can perform on-the-fly rotations and zoom the 3-D image.
- Imports data in user-defined formats. We drafted a meta-data definition standard in XMI and sent out to other teams for discussion.
- Identify the position of tree using the young trees with simple geometry.

Equipment for PAR data collection



Data visualization based on the GIS

Current Status and Technical Challenges of Asparagus Mechanical Harvesting

Du Chen, Qin Zhang

This review summarized current status of asparagus mechanical harvesting. The following issues could be concluded:

- Mechanical aid, non-selective harvester and selective harvester are developed to help ease the labor intensity and increase efficiency.
- Selective harvester remains as a feasible way to solve this problem. However, costs associated with crop damage and loss due to inaccurate operation in harvesting process is a critical problem to be solved before commercialization.
- Integration of a mobile robotic system with 3-D visual detection device could offer a potential solution for automatic harvesting of asparagus in the future.

Asparagus harvester

Detection of Grapevine Leafroll Disease Using Multispectral Image Analysis

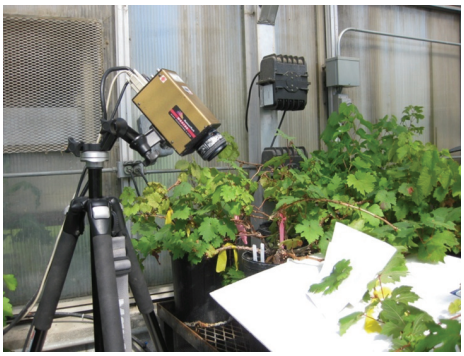
Ashok Alva, Hong Sun, Qin Zhang

Summary. Grapevine leafroll disease (GLD) is one of the most widespread viral diseases of grape production. It causes problems including delayed fruit ripening and maturity, lower sugar content, reduced anthocyanin's, increased acidity, reduced yields, poor wine quality, reduced economic returns, and ultimately, demise of vine viability causing the need to remove and replant individual vines or complete vineyards.

An integrative method was used to detect and evaluate the GLD infection based on the spectral reflectance and multispectral image processing techniques.

Visible band (R,G,B) was selected to segment infection symptoms based on Hue Saturation Intensity (HIS) space. Infection indicator and infection parameters were defined to present and evaluate the severity of GLD.

Test results indicated that it's feasible to use ratio of infected area (RIA) and ratio of color index (RCI) to monitor and evaluate the infection status of GLD.



Acknowledgement of Support

This research was supported in part by Washington State University Agricultural Research Center federal formula funds, Project No. WNP0745, No. WNP0728, and No. WNP 0420 received from the U.S. Department of Agriculture National Institutes for Food and Agriculture (NIFA) and by the Washington State Tree Fruit Research Commission (WTFRC), the Oregon Sweet Cherry Commission, the Washington Wine Commission and Washington Association of Wine Grape Growers, the Fresh Pear Committee, the Washington Red Raspberry Commission, and the Washington Blueberry Commission. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture."

Publications

BOOKS

Rovira-Mas, F., Zhang, Q., & Hansen, A.C. (2010). Mechatronics and Intelligent Systems for Off-roadVehicles.

PROFESSIONAL ARTICLES – REFEREED

Chávez, J.L., F.J. Pierce and R.G. Evans, 2010. Compensating inherent linear move water application errors using a variable rate irrigation system. *Irrigation Science Journal*, 28: 203-210.

Chávez, J.L., F.J. Pierce, T.V. Elliot and R.G. Evans, 2010. A remote irrigation monitoring and control system (RIMCS) for continuous move systems. Part A: Description and development. *Precision Agriculture Journal*, 11: 1-10.

Chávez, J.L., F.J. Pierce, T.V. Elliot, R.G. Evans, Y. Kim and W.M. Iversen, 2010. A remote irrigation monitoring and control system (RIMCS). Part B: Field testing and results. *Precision Agriculture Journal*, 11: 11-26.

Cui, D., Zhang, Q., Li, M., Hartman, G.L., & Zhao, Y. (2010). Image processing methods forquantitatively detecting soybean rust from multispectral images. Biosystems Engineering.107(3), 186-193.

Ellis, K., T. A. Baugher and K. M. Lewis. 2010. Results from survey instruments used to assess technology adoption for tree fruit production. *HortTechnology* : A Publication of the American Society for Horticultural Science. 20:1043-1048

Kise, M., B. Park, G.W. Heitschmidt, K.C. Lawrence and W.R. Windham, 2010. Multispectral imaging system with interchangeable filter design. Computers and electronics in agriculture, 72(2): 61-68.

Peterson, D. L. ,A. L. Tabb, T. A. Baughter, K. M. Lewis and D.M. Glenn. 2010. Dry bin filler for apples. *Applied Engineering in Agriculture* 26(4): 541-549

Rovira-Mas, F., & Zhang, Q. (2010). Design parameters for adjusting the visual field of binocular stereo cameras. Biosystems Engineering. 105(1), 59-70

Schupp, J., T.A. Baughter, K. Ellis, J. Remcheck, R. Duncan, S. Johnson, K. M. Lewis, G. Reighard and P. Heinemann. 2010. String blossom thinner designed for variable tree forms increases crop load management efficiency in trials in four peach-growing regions. HortTechnology: A Publication of the American Society for Horticultural Science. 20(2):409-414

Wang, Q., Zhang, Q., & Rovira-Mas, F. (2010). Auto-calibration method to determine camera pose for stereovision-based off-road vehicle navigation. *Environment Control in Biology* 48(2), 59-72.

ABSTRACTS AND PROCEEDINGS

Chen, D., & Zhang, Q. (2010, December 7). Dynamic response of sweet cherry tree to oscillating excitations for mechanical harvest. Preprints of IFAC AgriControl 2010 IFAC Agricontrol 2010,Kyoto, JAPAN. http://elam.kais.kyoto-u.ac.jp/agricontrol2010/

Ellis, K., T. A. Baugher and K. M. Lewis. 2010. Using surveys to overcome obstacles to specialty crop industry adoption of automated technologies. Paper No. 43. ASABE Annual International Meeting, Pittsburgh, PA. Peer reviewed

Kliethermes, Brian, A. Leslie, J. Koan, S. Wolford, D.M. Glenn, K. M. Lewis, T. A. Baugher and W. Messner. 2010. Novel approaches to passive bin filling for apples. Paper No. 10. ASABE Annual International Meeting, Pittsburgh, PA. Peer reviewed

Schupp, J., T. A. Baugher, K. Ellis, J. Remcheck, E. Winzeler, G. Henderson, S. Johnson, K. M. Lewis et al. 2010. String Blossom thinner designed for variable tree forms increases crop load management efficiency in trials in four peach growing regions. HortScience 45(8):S199

Zhang, Q. (2010, August 26). Potential mechanization and automation in horticultural crop production. Proceedings of IHC 2010 28th International Horticultural Congress, Lisbon, Portugal. http://www.ihc2010.org/

NON PEER REIEWED PRESENTATIONS

Canales, R., K. M. Lewis, 2010. Nuevas Herramienteas y Tecnologias/ New Tools and Technologies. Washington State Horticultural Association. Yakima, WA. Invited presentation

Chen, D., Zhang, Q., & Wang, S. (2010, June 22). Current status and technical challenges of asparagus mechanical harvesting. ASABE Paper 1008866 2010 ASABE Annual International Meeting, Pittsburgh, Pennsylvania. http://www.asabe.org

Du, X., D. Chen, Q. Zhang, F.J. Pierce and P.A. Scharf, 2010. Dynamic response of sweet cherry tree to oscillating excitations for mechanical harvest. Preprints of IFAC AgriControl 2010. 6pp.

Kang, F., F.J. Pierce, D.B. Walsh, Q. Zhang and S. Wang, 2010. A multi-nozzle sprayer system for targeted control of cutworm in vineyards. *ASABE Paper No. 1008686,* ASABE, St. Joseph, MI.

Kang, F., Pierce, F., Walsh, D., Zhang, Q., & Wang, S. (2010, June 22). A multi-nozzle sprayer system for targeted control of cutworm in vineyards. ASABE Paper 1008686. http://www.asabe.org

Lewis, K. M., 2010. Application Technology in Northwest Tree Fruit Orchards. SCRI Planning Meeting, Portland, OR. Invited presentation

Lewis, K. M., 2010. Bringing New Technologies to Pear Production. Washington State Horticultural Association. Yakima, WA. Invited presentation

Lewis, K. M., 2010. Linking Research and Extension. NIFA Systems Science Workshop, Pullman, WA. Invited presentation

Lewis, K. M., 2010. Mechanical Bloom Thinning in Stone Fruit, Yakima Valley Stone Fruit Day, Buena, WA. Invited presentation

Lewis, K. M., 2010.Mechanical Thinning in Apples – Darwin and Unibonn Trials. WSU Sunrise Orchard Field Day, Wenatchee, WA

Lewis, K. M., 2010.Mechanical Thinning in Cherries – Tractor Mounted and Hand Held. WSU Prosser Cherry Field Day, Prosser, WA. Invited presentation

Lewis, K. M., 2010.Mechanical Thinning Trials in Washington, NCW Stone Fruit Day, Wenatchee, WA. Invited presentation

Lewis, K. M., 2010.Plugging In – Opportunities for Plug In Electrics in Tree Fruit Production and Packing. Harvesting Green Energy Conference. Kennewick, WA. Invited presentation

Lewis, K. M., Baugher, T. A.,R. Duncan, K. Ellis, J. Harper, P. Heinemann , K. M. Lewis, G. Reighard, J. Schupp. 2010. String Blossom Thinner Designed for Variable Tree Forms Increase Crop Load Management Efficiency in Trials in Four U.S. Stone Fruit Growing Regions. Washington State Horticultural Association. Yakima, WA. K. M. Lewis – Presenter. Poster presentation

Lewis, K. M., M. Robinson, T. Schmidt, 2010. Mechanical String Thinner Trials in Nectarines and Apricots - Washington State Summary. Washington State Horticultural Association. Yakima, WA. K. M. Lewis – Presenter. Poster presentation

Lewis, K. M., T. Schmidt, I. Hanrahan, F. Castillo, 2010. Apple Mechanical Bloom Thinning Studies in Washington. Washington State Horticultural Association. Yakima, WA. K. M. Lewis – Presenter. Poster presentation

Singh S., T. Baugher, M. Bergerman, B. Grocholsky, G. Hoheisel, L. Hull, V. Jones, G. Kantor, H. Koselka, K. Lewis, W. Messner, H. Ngugi, J. Owen, J. Park, C. Seavert, D. Ames. 2010. Comprehensive Automation for Specialty Crops: Year 2 Achievements and Year 3 Goals. Washington State Horticultural Association. K. M. Lewis – Presenter. Poster presentation

Wang, Meng, H. Wang, Q. Zhang, K. M. Lewis, 2010. Hand Held Mechanical Thinning Device. Washington State Horticultural Association. Yakima, WA. K. M. Lewis – Presenter. Poster presentation

Wang, Q., Q. Zhang, F. Rovira-Más and L. Tian, 2010. A method to estimate heading direction for stereovision-based vehicle navigation in open agricultural fields. *ASABE Paper No. 1008559,* ASABE, St. Joseph, MI.

Wang, Q., Zhang, Q., Rovira-Mas, F., & Lei, L. (2010, June 22). A method to estimate heading direction for stereovision-based vehicle navigation in open agricultural fields. ASABE Paper 1008559 2010 ASABE Annual International Meeting, Pittsburgh, Pennsylvania. http://www.asabe.org/

Other Publications

Hoheisel G., N. Suverly, K.M. Lewis, M. Bush, T. Auvil, T. Smith. 2010. WSU DVD 0129. Proceedings of the 2008 Fruit School on Competitive Orchard Systems

Invention Disclosures

Zhang, Q., M. Whiting and Q. Wang, 2010. An Automated Device for Rapid and Accurate Rating of Fruit Size and Color. Filed March 19, 2010.

Zhang, Q., K. Lewis, M. Wang and H. Wang, 2010. A Hand-held Device for Cherry Thinning. Filed June 10, 2010.

Grants and Awards

GRANTS AND AWARDS

Gwen Hoheisel, Jay Brunner, Marvin Pitts, Qin Zhang "Development of a Smart Targeted Spray Application Technology Roadmap for Specialty Crops" USDA CSREES. $11,537

Qin Zhang "Asparagus Production Technologies" USDA-CSREES. $19,354

Qin Zhang, Karen Lewis "Intelligent Bin Dog System for Tree Fruit Production", WTFRC. $10,000

Qin Zhang, Karen Lewis "Hand –held Mechanical Thinning Devices for Cherry Production" Oregon Sweet Cherry Commission. $5,673

Qin Zhang, Karen Lewis "Hand-held Mechanical Thinning Devices for Cherry Production", WTFRC $39,705

Qin Zhang "Multispectral Image Analysis of Potatoes Under Different Nutrient Management with Center Pivot Irrigation" USDA-ARS. $15,000

Qin Zhang, Qi Wang "A Portable Device for Rapid and Accurate Rating of Fruit Size and Color" WTFRC. $48,396

Qin Zhang "A Systems approach to Superior Pear Fruit Quality" NW Pear Bureau. $17,349

Matthew Whiting, Amit Dhingra, Nnadozie Oraguzie, Francis Pierce, Qin Zhang, "A Total Systems Approach to Developing a Sustainable, Stem-free Sweet Cherry Production, Processing, and Marketing System", USDA NIFA (SCRI). $583,793

Bikram Adhikari, Manoj Karkee, Qin Zhang "Sensor system development for 3D mapping of fruit trees and bushes". ARC Sponsored Project

Karen Lewis, William Messner, "Platform and Bin Filler Technologies" WTFRC. $13,000

Karen Lewis, James Schepp, "Mechanized Thinning for Cropload Management" WTFRC. $10,000

Outreach

OUTREACH

The Center has made great efforts in outreach to promote academic collaboration between other institutions and to deliver technology to growers and stakeholders.

January
Dr. Pierce attended Meeting on proposal to Ag Forestry Research Society (AFRI) on Precision Agriculture hosted by Monsanto on January 26, 2010.

Karen Lewis presented and participated at Harvesting Green Energy Conference in Kennewick, WA.

February
Dr. Zhang presented to Weed Science Society of America Annual Meeting on the topic of Weed Control Automation. February 9-11, 2010.

CPAAS hosted visitors from Japan to initiate collaboration with Kyoto University Naoshi Kondo, Daisude Yamada, Hiroki Sakai, Momoyo Yamakawa on February 15, 2010.

March
Dr.'s. Pierce and Zhang gave seminars and met with faculty leaders and at South China University, Zhejiang University to promote collaborations internationally. March 22-31, 2010.

April
Congressional Visit Day organized by the Coalition on Funding Agricultural Research Missions and Biological and Ecological Sciences Coalition to provide graduate student perspective for encouraging federal support for the agricultural and environmental research. Center student Joshua Kendall attended.
April 20-23, 2010

May
Qin Zhang was particitpant in the BioDiesel Workshop in Moscow ID on May 25, 2010.

June
Matthew Whiting, Fran Pierce and Qin Zhang attended the OSU Pre-harvest Cherry Tour at the Dalles OR. June 3, 2010.

Matthew Whiting organized and Qin Zhang and Karen Lewis presented at WSU Cherry Field Day on June 18, 2010 to peers and cherry growers.

CPAAS hosted visiting scientist from China to facilitate future collaborations, Xu Ma, Long Qi, Qun Zhong from South China University on June 18, 2010.

Hosted Professor Mao from China Agricultural University on June 21 and Professors Yivin Ying, Fie Shen, Lijuan Zie from South China University on June 24, 2010.

July
Francis Pierce attended the 10th Annual International Conference on Precision Agriculture as committee chair in Denver CO. July 18-21, 2010.

Karen Lewis, Meng Wang and Qin Zhang demonstrated the Hand-held blossom thinning unit to tree fruit producers July 29, 2010.

CPAAS Hosted academic visit of scientists Tom Burks U of F, Dan Guyer MSU, Renfu Lu USDA ARS, on July 26 and 29, 2010.

August
Qin Zhang gave speech at the 28th International Horticultural congress in Lisbon Portugal. This was funded by the WTFRC. August 22-28, 2010.

Qin Zhang weas activity leader and committee member to the WAWGG Summer Tour Equipment Show August 5, 2010

September
CPAAS hosted researcher from John Deere Intl. Michio Kise on September 2, 2010

Hosted Visiting scientists from China Z. Mao, J. Song. September 4, 2010.

October
Qin Zhang visited Zhejiang University of Technology Institute of Mechanical & Electrical Engineering, Nanjing Agricultural University and Northwest Agricultural University to discuss the potential collaboration of research/ graduate education with CPAAS. Oct. 8-22, 2010.

Manoj Karkee attended the Oregon Blueberry Commission research pre-proposal meeting in Corvallis, OR Oct. 19, 2010.

Manoj Karkee attended the WTFRC pear research priority meeting in Yakima WA Oct. 20, 2010.

Hosted the WTFRC Technology Review and same was attended by Manoj Karkee and Karen Lewis on October 28, 2010.

November
Karen Lewis, Qin Zhang attended the WA Tree Fruit Research Commission Agricultural Automation and Mechanization Italy Study Tour (Tour Leaders). November 1-12, 2010.

Qin Zhang attended the Club of Bologna at the Intl Expo for Machinery of Agriculture (EIMA) November 13 and 14, 2010.

Manoj Karkee attended the NW cherry research review in Wenatchee WA. November 9, 2010.

CPAAS Hosted Hop Review. November 4, 2010.

December
Hosted WTFRC Stone Fruit Review and was attended by Manoj Karkee. December 2, 2010.

Xiaoqiang Du presented a paper at the Agricontrol 2010 conference at Kyoto University in Kyoto Japan. December 5-8' 2010.

Manoj Karkee attended Washington Red Raspberry Commission annual meeting in Lynden WA. December 6, 2010.

Service
Karen Lewis:
2008-2010 -Washington Department of Health Air Monitoring Project, Technical Review Panel, 2010. Panelist USDA NIFA Specialty Crop Research Initiative Grant Program.

Washington State University does not discriminate on the basis of race, ethnicity, color, creed, religion, national origin, gender, sexual orientation, age, marital status, the presence of any sensory, mental or physical disability, use of a trained guide dog or service animal by a disabled person, specially disabled veteran, veteran of the Vietnam era, recently separated veteran, and other protected veteran status in its administration of educational policies, programs or activities, or other University administered programs or employment.