Transfer Student and Honors Graduate Chutao Liu Achieves Research Success with NMSP

By Lisa Fields

Cornell Agricultural Sciences 2017 Graduate Chutao Liu arrived in the USA in 2015 for the first time as a college junior from Beijing, China. Liu said, "I grew up in Beijing without direct exposure to agriculture. When I entered University, I wanted to study an area of the life sciences that would have great importance to society. My awareness of the problems facing China's food production system inspired me to study agriculture. Inadequate soil and water conservation has caused many problems for farmers and the ecosystem, so I decided to prepare for a career where I could potentially contribute to more sustainable food production."

Liu's exposure during his classes in Beijing to the highly productive agriculture of the USA led him to seek first-hand experience here. "I had the opportunity to come to the USA through China Agricultural University's transfer arrangement with Cornell's College of Agriculture and Life Sciences (CALS). I arrived here with other transfer students, which helped my transition, but I also liked the campus and Ithaca right away and I felt comfortable in the quieter atmosphere here."

At Cornell, Liu chose a major in Agricultural Sciences with a concentration in Crop Production and Management. His major advisor, Professor Quirine Ketterings, Director of the Nutrient Management Spear Program (NMSP) said, "Chutao started his research with us by working with another Agricultural Sciences student, Rachel Breslauer in the spring of 2016. Rachel mentored him in lab procedures for the corn stalk nitrate test, and we assigned him a small independent project that spring semester."

Liu continued as a NMSP summer intern that year. Ketterings explained, "Chutao did a great job on his project with Rachel. He became confident with doing research, readily taking on his own independent project for his internship. His project was part of our research led by PhD student Sarah Lyons on nitrogen management of brachytic dwarf brown midrib forage sorghum. Chutao developed the objectives for his study, designed a really nice project and took charge of every step in the process. He wrote both an excellent honors research thesis and a really nice [agronomy factsheet](#) about brachytic dwarf brown midrib forage sorghum."

Chutao Liu, Agricultural Sciences senior and undergraduate researcher in the Nutrient Management Spear Program, Department of Animal Science, Cornell University. His poster, "Proximal Sensing Technology to Predict the Quality of Forage Sorghum for Optimal Time of Harvest" won first prize at the 2016 ASA/SSSA/CSSA meeting held in Phoenix, Arizona.

Liu's project title was 'Proximal Canopy Sensing to Predict Forage Sorghum Yield and Quality and Optimal Time of Harvest.' Liu described, "Crop canopy sensing methods read red and near infra-red light reflected from the

vegetation to determine the normalized differential vegetation index or NDVI, which is a measure of crop greenness and vigor. The NDVI has been used as a yield prediction tool in corn to guide precision applications of nitrogen fertilizer. My project aimed to determine if NDVI could be used to accurately predict yield and quality over time for forage sorghum so farmers can identify the best harvest time to meet their forage yield and quality goals. I used the GreenSeeker sensing tool, a hand-held device to determine the NDVI in three forage sorghum field trials in Aurora and Varna. Every week from 19 until 80 days after planting I walked through the plots, sensing with the GreenSeeker. The crop was harvested weekly from 63 until 124 days after planting, which was 2 weeks past typical harvest in the soft dough stage. Yield was measured at each harvest and samples were analyzed for fiber, fiber digestibility, lignin, starch, and crude protein."

Some clear data trends that emerged were noted by Liu. "Statistical analysis of the combined 2015 data from both locations indicated that mid-season sensing has potential in predicting forage sorghum yield as well as quality over different harvest times. With delay in harvest, yield, lignin and starch levels increased while crude protein and starch digestibility decreased. In 2016, conditions at Varna were very droughty and the seed took almost a month to germinate. The weather impacted crop physiology and that in turn impacted NDVI-based predictions of yield and quality. Additional data are needed, but there is good potential to develop guidelines for applying NDVI that can be useful to farmers."

"My internship and follow-up research and writing this past year gave me the benefit of working hands-on throughout the research process," Liu said. "From each step of field work through data compilation and statistical analysis, I learned very important skills and really enjoyed my time in the field, too."

Ketterings commented, "Chutao put in a phenomenal effort. We were very excited when his poster presentation about his project won first prize at the 2016 Annual Meeting of the American Society of Agronomy's student poster competition in Phoenix. He really deserved that recognition!"

Liu enrolled in the Honors Program in the fall of 2016 and recently successfully defended his honors thesis. In May 2017 he will graduate from Cornell University with a BS degree in Agricultural Sciences with distinction in research.

"I had very good guidance in developing my poster and learning presentation skills so the information would be concise and clear to the audience of professionals," Liu explained. "It has been a great experience to work with so many friendly people who patiently instructed me in the research process, starting with learning how to ask the right questions."

After graduation in May, Liu returns to China for an internship in a collaborative program between Cornell and an organic food company, Hebei-Quimei Agricultural and Sciences Technology Co. Ltd. He said, "The company contracts with over 3500 farmers who grow a wide range of crops for processing. I'm really excited to get field research experience in organic agriculture, and to work in China with Cornell Professors Jane Mt. Pleasant and Antonio DiTommaso."

Liu will be pursuing a Master's degree in Organic Agriculture at Wageningen University in the Netherlands. "My desire is to get specialized in an area of Agronomy, and currently I'm thinking about either farming ecology or soil management. My experiences at Cornell and my graduate degree program will help set my career direction. I hope to fulfill my dream of having a positive impact on the food production system."

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