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DCZ-CAAS Conference and Study Tour

“Digital tools for organic and small-scale farming”

June 30 to July 05, 2019 in Germany



Report on a conference and study tour entitled “Digital tools for organic and small-scale farming” for Chinese experts in Germany to explore small-scale organic farming and digital tools to enhance sustainable and digital agricultural production in China.

Rapporteurs: Dr. Eva Sternfeld (DCZ) and Paul Mieke (DCZ)



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List of Abbreviations

ATB	Leibniz Institute for Agricultural-Engineering and Bioeconomy
BMEL	German Federal Ministry of Food and Agriculture
CAAS	Chinese Academy of Agricultural Sciences
DCZ	Sino-German Agricultural Centre
HNEE	University for Sustainable Development Eberswalde
IARRP	Institute for Agricultural Resources and Regional Planning (CAAS)
JKI	Julius Kühn Institute
S&T	Science and Technology platform of DCZ
WUR	Wageningen University & Research
ZALF	Leibniz Centre for Agricultural Landscape Research

List of Participants

No.	Name	Institution
1	Prof. Dr. YANG Peng Vice Director	Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
2	Dr. CHEN Tianjin	Department for International Cooperation, Division for Bilateral Partnership Chinese Academy of Agricultural Sciences
3	LIU Shuang Research coordinator	Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
4	Prof. WANG He	CAAS Talent Recruiting Program Chinese Academy of Agricultural Sciences
5	Associate Prof. WANG Xiangfeng	Institute of Agricultural Sustainable Development Shandong Academy of Agricultural Sciences
6	Ms. Prof. Dr. CHAI Xiujuan	Agriculture Information Centre, CAAS
7	Prof. Dr. WU Wenbin	Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
8	Prof. Dr. YU Qiangyi	Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
9	Ms. Prof GUO Jianhua	Nanjing Agriculture University, College of Plant Protection
10	Ms. Prof Dr. QIAO Yuhui	College of Resources and Environmental Sciences China, Agriculture University
11	Prof. Dr. ZHANG Bin	Soil Science Department, Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
12	Mr. WU Jiaqiang	CEO Jieshi Agriculture Sci & Tech. Company
13	Prof. Dr. ZHANG Huimin	Institute of Agricultural Resources and Regional Planning Chinese Academy of Agricultural Sciences
14	Dr. Eva Sternfeld	Science Advisor, Sino-German Agricultural Centre, DCZ
15	Paul Mieke	Junior Expert, Sino-German Agricultural Centre, DCZ

Preface

The conference and study tour “Digital tools for organic and small-scale farming” was planned and realized as part of the 2018/2019 work plan of the Sino-German Agricultural Centre (DCZ). The successful organisation of the activity would not have been possible without the great support of a number of people. We especially like to thank Prof. Dr. Zhang Bin and Prof. Wu Wenbin from the Institute for Agricultural Resources and Regional Planning (IARRP) of CAAS for bringing together a group of highly qualified experts for this trip. On the German side our thanks go to Prof. Dr. Cornelia Weltzien, Dr. Christiane von Haselberg, Helene Foltan and their team of the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) in Potsdam for organising the joint conference and issuing the invitation letters for the participants from China. Further, we would like to thank Prof. Dr. Katharina Helming, Dr. Maja Tesmer and Dr. Carsten Hoffmann of the Leibniz Centre for Agricultural Landscape Research (ZALF) who perfectly organised the visit to ZALF including field demonstrations. Franziska Rutscher of the Brodowin cooperative provided an insight into the philosophy of organic farming and challenges of transforming a former state-owned farm into a collectively owned organic farm. We are also grateful to the organisers of the Organic Field Days at Frankenhausen for implementing a guided tour by Sven Lürig (University of Kassel), and Prof. Dr. Dieter Trautz (University of Applied Sciences Osnabrück, Faculty of Agricultural Sciences and Landscape Architecture) and Dr. Insa Kühling (Institute for Agricultural and Nutritional Sciences, Martin Luther University Halle-Wittenberg) who accompanied the group during its one-day visit to the Organic Field Days.

Last but not least our sincere thanks go to our backstopping team at IAK Agrar Consulting in Leipzig Ms. Stanimira Penkova, Ms. Doris Baumbach and Ms. Anne Grimm, who managed the logistics of the tour with great expertise. On the Chinese side thanks go to Ms. Zheng Jiang from IARRP, who took care of booking flights and visa matters of the CAAS participants.

Eva Sternfeld and Paul Mieke (on behalf of DCZ)

1. Background and Objective

The topic of the study tour reflects the increasing interest of Chinese scientists in sustainable agriculture, in reduction of high inputs of agrochemicals and modernization of agriculture. It takes further into account that the Chinese agricultural sector is still dominated by smallholders. According to China’s 3rd agricultural census from 2016, still 70 % of China’s arable land is cultivated by small-scale farmers, 90 % of rural employees are employed in small farms and 80 % of grain is produced by small farmers. With an average of 0.5 ha per household small farms in China are really small. The topic of the conference and excursion therefore focused on the opportunities that smart technologies could offer for small-scale and organic farmers.

The conference and post-conference excursion with a focus on organic farming has already been part of the work plan 2018/2019 for the S&T platform and originally been planned for May 2019. Because of the opportunity to include the visit to the Organic Field Days at Frankenhausen (July 3-4), a very important biannual organic farming convention in Germany, it was decided to shift the study tour to the first week in July 2019. The originally proposed title of the conference was adapted to take up

and continue the successful dialogue on digitalization in agriculture that was initiated at the DCZ-CAAS conference during the Sino-German Agricultural Week in November 2018.

Specifically, the preparation of the study tour could build on the good contact established with Prof. Weltzien from ATB, who was one of the key-note speakers at the conference in November 2018. The topic of this year's conference focusing on "Digital tools for small-scale and organic farming" was developed in February 2019 during a meeting at ATB in Potsdam with Prof. Weltzien, ATB research coordinator Dr. Christiane von Haselberg, public relations officer Helene Foltan and DCZ science advisor Eva Sternfeld. In March 2019, the idea was discussed and agreed with the colleagues from CAAS/IARRP (Prof. Zhang Bin, Prof. Wu Wen Bin, research coordinator Liu Shuang) and Dr. Chen Tianjin, Department for International Cooperation of CAAS. The colleagues from CAAS suggested to bring together two groups of agricultural scientists for this tour, one group specialized in smart agriculture (organised by Prof. Wu Wenbin, Chief Scientist of Key Laboratory for Smart Farming at CAAS) and another group specialized in organic agriculture (organised by Prof. Zhang Bin, Head of Soil Health Group at IARRP). It was also agreed with CAAS that the Chinese side covers the international travel costs and hotel costs of the Chinese participants and the German side pays for transportation and catering in Germany. In March 2019, the colleagues started to recruit the participants for the excursion. In April 2019, ATB issued the invitations. In early May 2019, Dr. von Haselberg, Helene Foltan and Eva Sternfeld met for a second preparation meeting at ATB in Potsdam, where logistic details of the conference were planned. Mid of May (20. calendar week) DCZ invited Dr. Carsten Hoffmann from ZALF as short-term expert for the preparatory workshop in Beijing at the IARRP. Dr. Hoffmann was also in charge of the coordination of the visit at ZALF on July 3. IARRP researchers selected for the Germany excursion as well as their PhD students (about 40 participants) took part in Hoffmann's workshop on research data management and data platforms. A roundtable afterwards about ongoing research projects and a possible cooperation between IARRP and ZALF was attended by five researchers of IARRP, Dr. Carsten Hoffmann and Eva Sternfeld.

In addition, Eva Sternfeld established contacts with the organic farming village Brodowin in Brandenburg and the organisers of the Organic Field Days at Frankenhausen and arranged guided tours in English language.

1.1. Participants

Of the original group of 18 persons 5 had to cancel their travel plans for health reasons, other job obligations or visa problems. The final group consisted of 9 researchers and 4 administrators of CAAS. The participation of the Vice Director of IARRP Prof. Yang Peng, Dr. Chen Tianjin, in charge of bilateral cooperation at CAAS, and Wang He, in charge of the talents recruitment programme, proved of CAAS' great interest in strengthening the bilateral scientific contacts in agricultural science. Especially Yang, Chen and Wang used the opportunity to exchange with responsible administrators and research coordinators at the German institutes visited. Apart from IARRP (six participants), the Agricultural Information Center of CAAS, the Institute for Agriculture Sustainable Development of the Shandong Academy for Agricultural Sciences, the College of Plant Protection of the Nanjing Agriculture University, the College of Resources and Environmental Sciences of the China Agricultural University were represented in the delegation.

2. Study Tour

Day 1: June 30, 2019 (Sunday)

The participants and Paul Miehe (DCZ) arrived from China on June 30. The pick-up at airport Berlin Tegel was organised by Eva Sternfeld (DCZ). After a lunch break in a beer garden and a short city tour in Berlin the group was transported to Potsdam.

Day 2: July 01, 2019 (Monday)

Conference “Digital tools for organic and small-scale farming” at the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) Potsdam Bornim (Conference Day 1)

In the morning of the first day of the conference at the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) Potsdam on “Digital tools for organic and small-scale farming” Eva Sternfeld delivered a welcome speech. She thanked the cooperating institutions, the ATB and the Chinese Academy of Agricultural Sciences (CAAS). In her introduction, she emphasized that the topic of the conference is overdue regarding the massive transformation and modernisation of China’s agricultural sector and China’s aim to reduce agrochemicals in agricultural production. She further stressed the importance of smallholder farmers for China.

Eva Sternfeld briefly introduced the Sino-German Agricultural Centre (DCZ). Following her welcome speech, a short video produced by CAAS on the occasion of the Sino-German Agricultural Week was shown. The video demonstrated the achievements and aims of the DCZ S&T platform.

As second speaker Prof. Dr. Cornelia Weltzien, the Vice Scientific Director of ATB, introduced her institution and ATB’s national and international networks, including working groups with China. Here she especially mentioned a cooperation with the Nanjing Agricultural University that just has been established with support of the two ministries’ mobility grant. ATB as a research institution with around 50 % agronomists and 50 % engineers is focusing on the interface between agriculture and technology. ATB analyses, models and evaluates bioeconomic production systems. ATB has a cross-cutting approach on bioeconomy and aims to put the results of research into practice. She briefly introduced the concept of precision farming and precision livestock production as major research areas of ATB. In particular Prof. Dr. Weltzien mentioned the sensor-based assessment of livestock and plant production. She also described that ATB is working on postharvest processes, for instance the production of lactic acid from different agricultural residues. Moreover, the new building at ATB is heated with wood from the short rotation coppice plantation at ATB. Finally, she highlighted the upcoming FRUTIC Symposium on Innovations in Pre- and Postharvest Supply Chain of Fresh Produce on September 04, 2019 in Hong Kong.

The next speaker was Prof. Dr. Yang Peng, Vice Director of the IARRP of CAAS. In his speech, he highlighted China’s aim to reduce poverty and hunger in the country. He introduced the institute and its different divisions.

Dr. Chen Tianjin from the Department for International Cooperation, Division for Bilateral Partnership of CAAS, reported on the research progress and international cooperation. He gave a brief introduction to CAAS with around 7.000 professional experts across the country and 34 institutes in China with various disciplines. He also mentioned the Graduate School at CAAS, which stands open for young Chinese as well as for international graduates. He also introduced the

scientific research platforms of CAAS. CAAS hosts the biggest gene bank and the second largest scientific library. Dr. Chen Tianjin also mentioned the role of CAAS as a think tank for the Chinese government, which provides important policy suggestions every year. He further introduced the Belt and Road Initiative and stressed its importance for agriculture in this context. Finally, he briefly introduced the CAAS talent recruitment programme on behalf of Wang He and encouraged ATB to cooperate in this field.

The next speaker, Dr. Anja Hansen, introduced ATB's research programme 1 "Precision agriculture and precision livestock farming". In her speech, she described the structure, research areas and the special research focus.

A presentation by Prof. Reiner Brunsch (ATB and Chair of the Leibniz Research Alliance "Food and Nutrition") on "Potential of digitization in agriculture in the context of circular economy" concluded the opening session. Brunsch reminded us that in view of the challenges for agriculture in times of climate change "we have to reduce our food systems dramatically", in other words, reduce the intake of proteins and eat less meat.



Figure 1: Group photo at the ATB conference on 'Digital tools for organic and small-scale farming' (Source: Leibniz-Institut für Agrartechnik und Bioökonomie ATB e.V.)

After the lunch break, Helene Foltan, in charge of public relations at ATB, guided a tour through ATB's research facilities. The group visited the short rotation coppice plantation which will be used as climate-friendly heating fuel for the institute's new main building in the near future. Dr. Hans-Jörg Gusovius introduced the processing of fiber materials and Dr. Joachim Venus demonstrated the pilot plant facility for lactic acid.



Figure 2: Visit to the short rotation coppice plantation at ATB (Source: DCZ)

The first conference session in the afternoon focused on recent developments in digital farming and data acquisition. Four speakers (Prof. Dr. Weltzien, Chai Xiujuan, Marco Donat and Yu Qiangyi) provided insights into data acquisition, intelligent sensing and plant phenotyping, the ‘Digital Agricultural Knowledge and Information System’ (DAKIS) and platforms for remote sensing.

In the second afternoon session, four speakers discussed “Digital approaches for managing soils and for precision horticulture”. Dr. Robin Gebbers (ATB) introduced an integrated system for site-specific soil fertility management, Prof. Dr. Eckart Kramer (HNEE) talked about experiments for a precise lime application in Brandenburg, Dr. Manuela Zude-Sasse showed technologies for precision horticulture, and Prof. Wu Wenbin demonstrated how big data could be used for the digital management of an apple orchard.

The first day of the conference concluded with a get together and barbeque in the garden of ATB.



Figure 3: Get together and barbeque in the garden of ATB Bornim (Source: DCZ)

Day 3: July 02, 2019 (Tuesday)

Conference “Digital tools for organic and small-scale farming” at the Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB) Potsdam at the Marquardt Fieldlab for Digital Agriculture (Conference Day 2)

The second day of the conference was held at the premises of ATB’s Digital Fieldlab in Potsdam-Marquardt. The first session in the morning with five presentations by Zhang Huimin (CAAS), Guo Jianhua (Nanjing Agriculture University), Zhang Bin (CAAS), Wu Jiaqiang (Jieshi Agriculture Sci & Tech) and Peter Groot Koerkamp from Wageningen University & Research (WUR), resp., focused on topic-related advances in organic and small-scale farming. In the second session, three presentations by Mohammad Zare (ATB), Andreas Meyer-Aurich (ATB) and Prof. Qiao Yuhui (China Agriculture University), resp., looked at the challenges of digitalization for organic and small-scale farmers.

A particular highlight of the conference was the presentation of selected research projects at ATB’s Fieldlab. Ramin Shamiri presented the SunBot Project. Dr. Robin Gebbers demonstrated sensor systems for soil analysis. PhD candidate Li Minhui explained her research about advanced sensor use with drones, Dr. Karl-Heinz Dammer presented a new sensor for the early detection of stripe rust in grain, and Dr. Zude-Sasse explained sensors for assessing the CO₂ exchange in the field.



Figure 4: Dr. Robin Gebbers presenting sensors for soil analysis and presentation of the SunBot project by Ramin Shamiri (Source: DCZ)



Figure 5: Li Minhui explains her research drones and Dr. Manuela Zude-Sasse presents sensors for CO₂ assessment for measuring the fruit ripeness (Source: left picture DCZ & right picture Leibniz-Institut für Agrartechnik und Bioökonomie ATB e.V.)



Figure 6: Dr. Karl-Heinz Dammer explains sensors for disease detection (Source: DCZ)

In the final wrap-up session, Prof. Weltzien identified a number of common interests and potential for a cooperation especially in the field of image analysis for disease detection. She also mentioned that there is obviously still a gap between digital farming and organic farming although these digital tools have a great potential for organic farming, especially in the field of disease detection. She also mentioned that the conference focused a lot on data acquisition and sensors but did not so much touch the topic of robotics. On behalf of CAAS, Prof. Wu Wenbin emphasized that the Chinese delegation learnt a lot and that there is a strong interest from the Chinese side in a cooperation with Germany. He promised he will submit a report to MARA with a recommendation of future cooperation projects.

Day 4: July 03, 2019 (Wednesday)

Visit to Leibniz Centre for Agricultural Landscape Research (ZALF) Müncheberg

In the morning of July 3, the delegation visited ZALF. The Scientific Director Prof. Dr. Katharina Helming, Head of the Research Group Landscape Research Synthesis, introduced the institute's ongoing projects such as the Digital Knowledge and Information System (DAKIS) which started just a few weeks ago. In the DAKIS project, spatially and functionally diversified agricultural systems of the future are to be explored.

Dr. Carsten Hoffmann introduced the BonaRes project, a long-term experiment investigating sustainable subsoil management. Following the presentations, the group had the opportunity to visit the long-term field experiment V140, an experiment that has been running continuously on site at ZALF since the year 1963. Dr. Dietmar Barkusky explained that the V140 experiment is one of the few of this type on sandy soil. Different ratios of mineral and organic fertilizers are applied here. A ZALF researcher then demonstrated how drones can be utilized for the analysis in the field.



Figure 7: Dr. Dietmar Barkusky explains the V140 trial field (Source: DCZ)



Figure 8: Presentation of a drone application at the V140 trial field (Source: DCZ)

Visit to organic farm Eco-Village Brodowin

In the afternoon of July 3, the group visited the eco-village Brodowin in northern Brandenburg close to the Polish border. Franziska Rutscher from the Brodowin cooperative showed the facilities of the Demeter certified farm including a cattle barn and a modern dairy facility and explained the philosophy of bio-dynamic agriculture.



Figure 9: Cattle barn at eco-village Brodowin (Source: DCZ)

Day 5: July 04, 2019 (Thursday)

Visit to Organic Field Days at Frankenhäusen

On July 4, the group was among the more than 11,000 visitors of the 2nd Organic Field Days at Staatsdomäne Frankenhäusen (Hessian State Domain) near Kassel, which is an organic farm and the research facility and experimental farm of the University of Kassel. This biannual event, jointly organised by the Hessian Ministry of Agriculture, the University of Kassel and the Foundation for Ecology & Farming (SÖL), provided the



Figure 10: Visit of organic field days in Frankenhäusen`

unique opportunity to learn about practice and research in organic agriculture and livestock husbandry. Among other topics the group observed robots for weeding and soil cultivation, saw long-term experimental fields of the farm and exchanged views with scientists of the Julius Kühn Institute (JKI) on options for biological pest control. At the booth of the University of Kassel, the Chinese visitors also learnt that the university's department for organic agriculture has about 20 professors and more than 1,000 students.

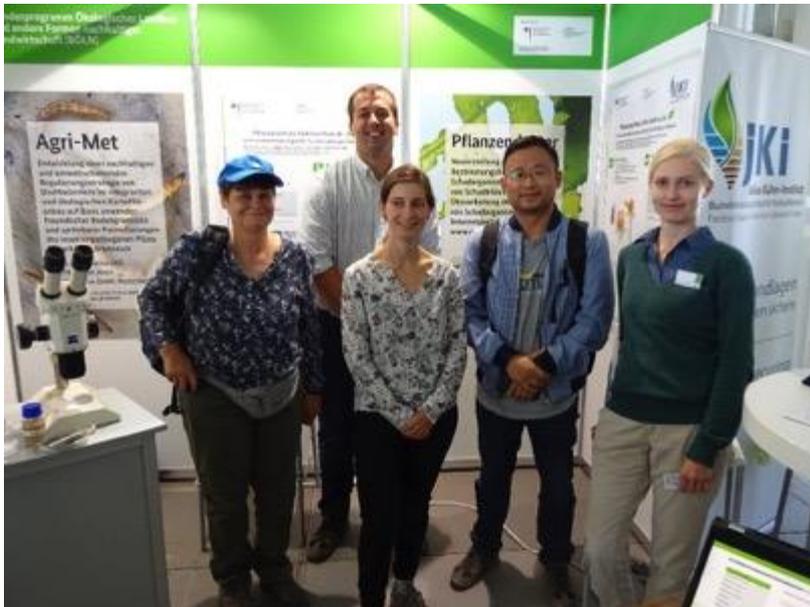


Figure 11: Discussion of Julius Kühn Institutes' projects at the Organic Field Days

Meeting with Prof. Dr. Dieter Trautz at the Organic Field Days at Frankenhausen

Prof. Dr. Dieter Trautz from the Faculty of Agricultural Sciences and Landscape Architecture, University of Applied Sciences Osnabrück, and Dr. Insa Kühling, from the Institute for Agricultural Sciences, Martin Luther University Halle-Wittenberg, accompanied the group during its visit at the Organic Field Days and provided an overview of their research on "Precision Farming in Organic Agriculture and Technology Transfer into Conventional Agriculture".



Figure 12: Meeting with Prof. Dr. Dieter Trautz

3. Outcomes

- Thanks to a very good cooperation with ATB and ZALF, the organisation of the conference and post-conference excursion was very smooth and the results are promising. The colleagues from CAAS had been able to bring together a delegation of researchers, each of them being a highly qualified scientist in her/his respective fields. The additional nomination of the four administrators Chen Tianjin (International Cooperation), Wang He (Talents Recruitment Program), Yang Peng (Vice Director of IARRP) and Liu Shang (Research Coordinator of IARRP) demonstrated the great interest of CAAS to use the study tour to reach out for new cooperation projects. The visit to the research institutes (ATB and ZALF) as well as meetings with representatives of research institutions were important to show the Chinese guests the research facilities and promote face-to-face encounters with their German counterparts.

- In her concluding speech, Professor Dr. Weltzien (ATB) expressed the expectation that now the relationship between IARRP and ATB can be placed on the next level, namely the elaboration and application for joint research projects. To promote this kind of cooperation Chen Tianjin from the Department for International Cooperation of CAAS proposed to organise a visit by a CAAS vice president in the coming year and prepare for this event the signing of an MoU on the cooperation between IARRP and ATB.
- At ZALF, Prof. Zhang Bin had a separate meeting with Prof. Dr. Michael Sommer, Co-Head of Research Area “Landscape Functioning”, Head of working group “Landscape Pedology”. According to Zhang Bin the meeting was very successful and follow-up visits to design joint research projects have been agreed on.
- At both institutes, ATB as well as ZALF, it was impressively demonstrated that international PhD candidates are integrated and indispensable staff for the institutes’ research projects. Three Chinese PhD students who work at ATB actively participated in the conference and provided first-hand information for the Chinese guests on working and living conditions in Germany.
- Dr. Manuela Zude-Sasse (ATB, Precision Horticulture) expressed a strong interest in the upcoming PhD exchange programme. She is not only willing to accept more Chinese PhD candidates but also interested to send one of her German PhD students to China for field research.
- According to Maja Tesmer, Coordinator at ZALF for Strategic Science Management since January 2019, ZALF is presently working on a China strategy. The research coordinators of ATB and ZALF, Dr. Christiane von Haselberg (Research Coordinator at ATB) and Dr. Maja Tesmer (Strategic Science Management at ZALF) expressed their interest in the proposed workshop and study tour for German research coordinators to China.
- Eva Sternfeld has been invited as a key-note speaker for the International Conference on “Organic Industry Development and Rural Vitalization” organised by Prof. Qiao Yuhui, China Agriculture University, on September 25-26 in Beijing.
- Apart from this invitation the conference helped to make the work of the S&T platform and the DCZ more visible and strengthen the relation with CAAS.

4. Suggestions for Further Measures and Events

- The two conferences in cooperation with ATB have laid a foundation for the future cooperation with CAAS. This could be consolidated and officialised by preparing an MoU between IARRP and ATB to be signed during a follow-up visit of a CAAS delegation with a vice president in 2020. DCZ should support this activity by planning the framework programme of this tour.
- The Organic Field Days are a very suitable event to provide a first-hand introduction about topics and issues of organic farming in Germany in theory and practice. Here, Chinese visitors can meet representatives from research institutes and companies as well as farmers on the spot. With regard to the big interest in China in organic and sustainable farming it is recommended to keep the 3rd Organic Field Days in 2021 in mind as an event for organising a study tour for Chinese experts.
- The proposed workshop and study tour to China for German research coordinators of institutes affiliated to the BMEL seems to be an adequate tool. During this workshop, research coordinators will meet with their Chinese counterparts and discuss bilateral projects (joint research applications, PhD exchange programme, mobility grant, etc.) The idea for this workshop and study has been discussed with Chen Tianjin from the International Department, who assured the support of CAAS for this proposal. The idea was also presented to Ms Monnerjahn from BMEL 121 for Science and Education.

- A report about the outcomes of the conference and study tour should be presented at the Sino-German Agricultural Week in November 2019.