Transition to more water efficient agriculture production in Thailand

Fact finding



Greet Blom Zandstra[1]
Corné Kempenaar[1]
Ario Rothuis[2]

[1] Agrosystems Research
[2] Wageningen International

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Wageningen Plant Research Report

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Summary

Thailand will face major water scarcity problems. The question is how Thailand can remain an important producer of agriculture crops (such as rice) while facing severe water shortages in the near future. To generate ***"****more crop per drop****"*** a sequence of innovations need to be introduced.

Kasetsart University (KU) contacted WUR in 2015 to explore possibilities for a Thai-Dutch cooperation in public private partnerships (PPP) on research, development (R&D) and implementation of precision agriculture (PA) technologies, water management and decreasing post-harvest losses. The Dutch government provided WUR a budget to invest in the relationship and to explore the possibilities through a mission to Thailand. After a visit of KU to WUR in August 2016, three experts of WUR visited Thailand from 9 till 15 October 2016 to draw up a PA program outline and identify specific research projects.

Specifically for collaboration in food technology, a mission from Food Innopolis Thailand visited WUR 9 June 2016. A visit to Food Innopolis in Thailand was included in our schedule.

During both visits, many topics for cooperation were identified and project ideas for further elaboration were discussed. The meetings between KU, WUR and other parties resulted in a list of PA technologies and water management topic of interest to Thailand to make their agriculture more sustainable (both economic and ecological). Several possible projects were mentioned in the discussion. The next step is to describe the projects in detail and elaborate further cooperation. The results are described in this report.

1 Introduction

1.1 Background

Agriculture is the major user of water in Thailand (>70%). Thailand's changing climate patterns have led to droughts caused by irregular rainfall. In addition, there is no clear policy for the extraction of groundwater resulting in over-exploitation of groundwater sources. It is expected that by 2025 Thailand will face major water scarcity problems. Currently Thailand is the world's largest rice exporter. Prolonged periods of drought are specifically impacting the production of rice[1].
The question is how Thailand can remain an important producer of agriculture crops (such as rice) while facing severe water shortages in the near future.

In the context of water scarcity and the ambition to remain an important producer of food for the region and the world, Thailand is challenged to do more with less water. To generate ***"****more crop per drop****"*** a sequence of innovations need to be introduced. For this particular project the focus will be on 1) decrease of water losses and salinity problems in the supply system (actions related to irrigation and drainage and alternative more water efficient crops); 2) increase the production (actions related to Precision Agriculture) and 3) decrease of post-harvest losses (actions related to storing, cooling, processing and marketing).

1.2 Objectives

Although the Netherlands is well known for its expertise in water management, this usually addresses issues related to safety, dike construction, erosion etc. That the Netherlands has also specific expertise on water and agriculture is less well known. Wageningen UR implements various projects related to integrated water management, drought resistance, effects of climate change on water availability and agriculture production etc. However so far not with Thailand. The implementation of this project can contribute to a more intense collaboration with Thailand. The proposed exchange of information can be the basis for a more structural cooperation involving not only scientific institutes but also policy makers, farmers associations etc.

1.3 Methodology

Kasetsart University (KU) contacted WUR in 2015 to explore possibilities for a Thai-Dutch cooperation in public private partnerships (PPP) on research, development (R&D) and implementation of precision agriculture (PA) technologies, water management and decreasing post-harvest losses. The Dutch government provided WUR a budget to invest in the relationship and to explore the possibilities in a mission to Thailand. After a visit of KU to WUR in August 2016, three experts of WUR visited Thailand from 9 till 15 October 2016 to draw up a PA program outline and identify specific research projects. During these days, WUR visited KU campuses and discussed with KU experts of different faculties. WUR also visited and discussed with experts of Thai Research Fund, Mitrphol, King Mongkut University, East-West Seeds, Chulalongkorn University, Food Innopolis, National Science and Technology Development Agency (NSTDA) and the National Center for Genetic Engineering and Biotechnology (BIOTEC) to better understand possibilities for cooperation, both from R&D needs and funding perspective. The program is in the appendix.

[1] Water in Crisis – Thailand, Sahisna Suwal, https://thewaterproject.org/water-in-crisis-thailand

2 Enhanced adoption of Precision Agriculture technology in Thai farming systems by R&D cooperation between Thailand and The Netherlands

2.1 Introduction

Kasetsart University, Wageningen UR and parties mentioned before agreed that they will put efforts in describing PA R&D project proposals in formats used by Thai research funds, so they can be used to acquire the budgets needed to do the R&D. The proposals will be focussed on developing PA technologies and applications for important issues Thai farmers and AgriFood industries are facing. Most of the R&D will be done in by Thai scientists and experts. WUR will be subcontracted to provide scientific knowledge and practical experience, specific materials (models, software) and or methods. This will be agreed upon in a Thai-Dutch PPP contract.
Below, the PA topics of interest to Thailand and projects identified are summarized. KU and others Thai research institutes will develop with WUR the project proposals. The initiative is with the Thai institutes. Proposal will be send to Dr Kempenaar for comment. He will align with experts of WUR with specific PA expertise. For inspiration, see www.precisielandbouw.eu files with reports on PA applications, and see www.akkerweb.nl.

2.2 PA topics identified

1. Sensor systems for crop growth monitoring, yield prediction and yield mapping. Crops of interest are sugarcane, cassava, corn and rice. East West Seeds is also interested in monitoring crops for production of vegetable seeds. Sensor system should provide data on yield per ha, and also data on quality of the produce. Use of satellite data in yield mapping is also mentioned in discussions. Thailand has unprocessed satellite data, which can be used to map crop biomass on fields in South East Asia.
2. Sensor systems for detection of nutrient stress, water stress, diseases, pests and weeds in crops. This system should be based on sensing from drone (UAS) or mobile platforms. Crops of interest are rice (nutrients, small fields), sugarcane (diseases, large fields)), aromatic coconut palm trees (pest, high trees) and orchard fruits (see also 3).
3. Early warning systems (EWS) and decision support systems (DSS) for disease management. Crops of interest are Dorian fruit, where Phytophthora species cause serious damage.
4. Soil sensors and DSS for optimization of nutrient application, irrigation and pesticide use in crops. E.g., use of soil maps to advice on variable rate of herbicides.
5. Use of sensor data and big data in farming systems. Thailand needs media to transfer knowledge to large companies (via internet, see Akkerweb approach)and small farms (via smartphone (see GEOPOTATO approach).
6. Robotics. The development of small autonomous platforms working on solar energy is mentioned.
7. Use of crop quality data obtained by sensors in food processing.

2.3 Projects discussed in meetings

1. Site specific VRA nutrient application in crops. Rice, sugarcane, cassava, corns are crops of interest. Requirements: Multispectral crop data, preferably also soil maps. WUR experts: Kempenaar, van Evert, Booij. This work will also provide crop growth and yield data. The project can be linked to GISTDA project on 23 stationary poles with hyperspectral camera's in crops in Thailand.
2. Detection of diseases in crops with hyperspectral cameras on drones. Examples are smut disease in sugar cane and Rhinoceros beetle in coconut palm trees. WUR experts: Polder, Mucher, Kempenaar.
3. Phytophthora control in Durian fruits using EWS and DSS. WUR experts: Kessel, Kempenaar
4. Drone crop growth monitoring for yield and quality predictions (see 1, this could be extended to vegetable crops in which East West Seeds is interested. WUR experts: Polder, Mucher, Kempenaar, van Evert.
5. Autonomous weeding robot in cassava. WUR experts: van Henten, IJsselmuiden, Pekkeriet, Blok.
6. Big data project, connection with farmers via platform like Akkerweb and smart phones, e.g. sat based recommendation. Kempenaar, Been, van der Wal
7. Implementation of PA technology in potato productions in North Thailand and Myanmar (Late blight EWS, nutrient application, etc.). WUR expert: Kempenaar, Haverkort, De Vries.

2.4 Conclusions

The meetings between KU, WUR and other parties resulted in a list of PA technologies of interest to Thailand to make here agriculture more sustainable (both economic and ecological). At least 7 possible projects were mentioned in the discussion. The next step is to describe the project in detail. KU and other parties are invited to develop these plans in cooperation with WUR.



Figure 2-1 Visit at MitrPhol *(Photo: Mr. Sarawut Chantachitpreecha)*

3 Water use efficiency in crop production in Thailand

3.1 Introduction

In Thailand, 36,100 km^2 of land are salt affected. There are two types of saline soils. One is inland in the Northeast (ca. 28,500 km^2) where source of salt originates from rock salt layers underlying the area. The other type occurs along the coastal areas (ca. 5,800 km^2) where the salt originates from seawater. The problem of salinity has become one of the major difficulties in crop cultivation for both inside and outside irrigation areas, in which yield reduction has become clearly manifest already.
Apart from problems with salinity, Thailand will possibly also become wetter in the wet season in the lower-Northern and Western regions and drier in the dry season in North-Eastern and upper North, resulting in floods or extreme drought, respectively.
Overall, farmers are not able to neutralize the adverse effects of the more extreme climate change or to cope with the increasing salinity effects on crop productivity and need for more crop resistance by an improvement of the water management or the availability of more (salt, drought) tolerant cultivars and adaptation measurements.

Research on water issues in Thailand is progressing, but implementation of the results and overcoming regulatory hurdles are difficult. A substantial step forward might be made by a better monitoring of the inputs and outputs of water. Water pricing might also be an important strategy to let farmers change their habits. It will be important to convince the government and farmers and to get involvement of the business sector. We discussed which topics would be appealing for funding: Animal waste, pollution? Link with 'Agriculture'; irrigation equipment + sensors (Terraco waterproofing systems, Netafim).
Main problems in Thailand in this context are: water quality, flooding and pollution, while water demand, especially in and around big cities, is sharply increasing. Water management in Thailand is always policy involved and a bottleneck is that the government is redundant to initiate the required steps. The rivers are under control by different authorities, depending on location and theme, while hardly no cooperation or any alignment occurs. Thailand's' most urgent demands are: forest recovery and soil erosion protection.

3.2 Water management and salinity topics identified

For further cooperation NL-Thailand following main topics were addressed:

1. Focus on small scale farming (max 1 ha), adaptation technology to small scale farming systems and should be specialised to control from farmer perspective.
2. Training farmers and consultant training (as already intensively done by East West Seed) are highly important.
3. Reuse waste water from industry and water from aquaculture, water quality and possibilities for water recycling in the field (increase of the availability of nitrate and phosphate), possibilities for an integrated approach (aquaculture-agriculture) and the impact of effluent from aquaculture on surface water are important issues. Research might focus on Quality Testing and Procedures for water Management with potential funding from: Thai research Fund, Ministry of Agriculture (provided that Wageningen UR is allowed to take part in the budget).
4. Water use for tourism. In Thailand tourism is a major source of income. Water shortage is a main problem and water recycling in hotels will be a very important research subject. Because of its high importance, projects on this theme will easily be funded by the government.
5. Priming / coating seeds (fertilizer, pesticides) and seed quality are important issues, which can adequately be addressed in cooperation with East West Seed.

6. KU indicated that they focus in their research on following crops: Flowers (orchid, over fertilization), rice, coconut (water stress, flooding), maize, sweet corn, grain, tropical fruits, durian, pomelo, longan, sugar cane, cassava (age effect, adaptation potential, smart cultivar selection).
7. KU emphasized its good relationship with MitrPhol, Fertilizer Companies and the Soil & Fertilizer Society in Thailand.
8. The surplus value of WUR was discussed, for which the extended knowhow on modelling, sensing technologies and the broad experience in PPS-projects were mentioned as important aspects.

3.3 Project ideas discussed in the meetings

Following ideas for elaboration in proposals were discussed:

1. To assess the impact of uplift of salt and saline water to crop cultivation to major crops especially rice.
2. To combine and model the effect of climate change along with saline water to quantify potential and actual growth and yield of crops, preferable rice.
3. To evaluate, model and improve crop adaptation to saline water along with better field management.
4. To develop practical measures in terms of water management in the field to reduce the impact of water logging and saline water. The need for better understanding of the situation in the field (soil information, weather conditions, erosion, leaf mapping, scouting upcoming diseases, etc) by monitoring techniques was discussed. Different applications, like introduction of drip irrigation and fertigation techniques, application of mulching techniques and the development of smart phone technology were suggested.
5. To evaluate and water catchment techniques and to develop suitable methodologies for implementation of these techniques in practice. Herewith, more insight in the economic feasibility is needed.
6. To use the opportunities for breeding and selection for salt and drought tolerant crops. A new variety of rice to be more salt tolerant is being developed at the moment at KU-KPS and may be used as input shortly.

3.4 Conclusions

The discussions on the water management topics resulted in the observation that in the proposals more focus, more depth and specific green application were needed. We agreed that the scientists from KU will further elaborate the proposals and will indicate clearly what contribution from WUR-side will be needed.

The conceptual proposal for integrated water management in tourist areas as proposed by the delegates from the Water resources development research unit (KU) was considered to be very technical. It was agreed that a plant component should be added.

New concepts will be send to WUR by e-mail.

4 Collaboration on Food Technology

Food Innopolis at Thailand Science Park is a kind RDI hub for the Thai Food Industry. It is a state enterprise offering research, development and innovation services and facilities for the food industry. Presently 15 food companies have R&D staff at Thai Science Park, including international companies. Representatives from Food Innopolis visited WUR in June 2016. WUR visited Food Innopolis in October 2016.

It was discussed that WUR could be a knowledge partner engaging directly in R&D projects with companies at Food Innopolis, or more on a distance providing advice and training. Food Innopolis will undertake a needs assessment among the companies. One of the areas of interest is protein/meat replacement. It was agreed to have further contact on this issue.

5 Final wrap up

The project team has agreed upon following:

- We await for responses from the TRF, Mitr Phol and Friesland Campina before further action will be taken again.
- With KNITL two proposal are under construction
- Corné Kempenaar will contact East West Seed for further cooperation
- Corné Kempenaar and Greet Blom Will contact KU< KNMITL and BIOTEC within a few weeks to get information about the progress on the writing of the proposals
- Arjo Rothuis remains alert on the progress of Food Innnopolis
- Arjo Rothuis remains in contact with dr. poon about the Erasmus+ program and possibilities of exchange of (PhD) students as soon as project ideas are concrete.



Figure 4-1 Photo session during the seminar at KU *(Photo: Mr. Sarawut Chantachitpreecha)*

Annex 1 Minutes on the visit of a delegation from KU at WUR (August 31th & 1 September 1th, 2016)

5.1 Participants

5.1.1 Thailand

Assoc. Prof. Dr. Siree Chaiseri	Acting Vice President for Research
Asst. Prof. Dr.Kampanat Pensupa	Acting Vice President for Academic Services
Asst. Prof. Dr. Buncha Chinnasri	Acting Assistant to the President
Asst. Prof. Dr. Nuchanata Mungkung	Dean, Faculty of Economics
Assc. Prof. Dr. Bancha Kwanyuen	Dean, Faculty of Engineering, Kampaengsaen Campus
Asst. Prof. Dr. Chainarong Rattanakreetakul	Associate Dean for Research and Academic Services Faculty of Agriculture, Kampaengsaen Campus
Assc. Prof. Dr. Namfone Lumdubwong	Associate Dean for Research, Faculty of Agro-Industry
Asst. Prof. Dr.Jirawat Kanasut	Head-Department of Water Resources Engineering, Faculty of Engineering
Asst. Prof. Dr.Punpim Puttaraksa	Deputy Head-Department of Water Resources Engineering Faculty of Engineering
Assc. Prof. Dr.Chawalit Kittichakarn	International Undergraduate Program, Faculty of Engineering

5.1.2 Dutch side

Prof. Dr. Tiny van Boekel	Wageningen UR Education Institute
Dr. Arjo Rothuis	Manager International Cooperation Asia (excl. China)
Dr. Leonard Sagis	Wageningen UR Agrotechnology and Food Sciences
Dr. Corné Kempenaar	Wageningen UR Applied Plant Research/Plant Research International
Dr. Bert Lotz	Wageningen UR Applied Plant Research/Plant Research International
Dr. Greet Blom	Wageningen UR Applied Plant Research/Plant Research International
Dr. Henk Ritzema	Assistant Professor Water Resources Management Group
Dr. Jan Broeze	Wageningen UR Food Processing, Chain Management
Dr. Nina Waldhauer	Wageningen UR Food Processing, Chain Management
Dr. Andries Richter	Assistant Professor Wageningen University Social Sciences, Environmental Economics and Natural Resources
Prof. Dr. Ekko van Ierland	Professor Wageningen University Social Sciences, Environmental Economics and Natural Resources
Dr. Robert Sparrow,	Assistant Professor Social Sciences Group, Environmental Economics and Natural Resources
Prof. Dr. Harrie Wichers	Professor Food & Biobased Research. Fresh, Food & Chains
Prof. Dr. Huub Savelkoul	Professor & Head of Cell Biology & Immunology Group
Dr. Huub Löffler,	Director Wageningen International
Different Thai students	Temporarily working at Wageningen UR

5.2 Wednesday 31 August 2016

Introduction & academic cooperation. After a welcome and acquaintance, Prof Tiny van Boekel, opened the session with a presentation of the organizational structure of Wageningen Universty & Research and possibilities on joint/dual degree programmes. Arjo Rothuis presented some more information on WUR research priorities, international cooperation and current Thai projects. Thereafter we had an introduction to Kasetsart University. During the discussion, attended by Leonard Sagis, two priorities from KU were discussed:
-KU PhD students that spend 6-12 months at WUR with TRF fellowship.
-WUR MSc students that do 4 month internship at KU.
WUR (Leonard Sagis) has experience with the first option, and it was agreed that is a good way to start more academic cooperation. Concerning point 2, at WUR MSc students are free to select their internship, but Wageningen International could advertise particular openings at KU. Particular interest of WUR is to have KU PhD students, problem is that WUR PhD program is 4 years and KU is 3 years. Another option would be to define a larger program with duration of 4-5 years involving both public and private parties, using mixed funding (TRF, Dutch Topsectoren). Under such a program KU and WUR PhD projects could be incorporated. At WUR it are the chair groups of the university that decide on the acceptance of PhD candidates. Potential KU candidates have to approach the respective chair groups. If needed Wageningen International can act as an intermediate.

Precision Agriculture. After presentations of Bert Lotz and Chainarong Rattanakreetakul it was discussed how Wageningen cooperate with different scientists, and how parties from business and government were involved in the research projects. In Thailand, similar sensors and data generating equipment (satellites, drones, etc) are used. KU has also contact with Univ. Twente on remote sensing.
For future cooperation, the Thai delegation was asked to spend time in the coming weeks to consider:
1) which crops are needed to study? 2) which areas are suitable? And 3) which topic is most interesting?

An interesting research topic might be the comparison of different fields based on the DSS schedule, described by Bert Lotz as a basis for the development of a new project. It was suggested that apart from cooperation with the industry (like f.e. Yara), also cooperation can be set up with 1 big farm or with a group of f.e. 20 small holders. For successful engagement of these parties, it should become clear how both the industry and the farmers will benefit from the project. A possible pilot project in N-E Thailand with rice farmers could be an option as well since donor funds could be available. There could also be a link with the recently approved PA development project from KU.
Appointment # 1: A joint project proposal will be prepared by Corné Kempenaar and Chainarong Rattanakreetakul

Water Use Efficiency in Agriculture
After presentations from Greet Blom and Bancha Kwanyuen it was discussed that in Thailand, research on water issues is progressing but implementation of the results and overcoming regulatory hurdles are difficult. A substantial step forward might be made by a better monitoring of the inputs and outputs of water. Water pricing might also be an important strategy to let farmers change their habits. It will be important to convince the government and farmers and to get involvement of the business sector. We discussed which topics would be appealing for funding: Animal waste, pollution? Link with 'Agriculture'; irrigation equipment + sensors (Terraco waterproofing systems, Netafim). It was not directly clear at the moment. So, we decided to communicate on these questions by e-mail during the next weeks.
Appointment # 2: Greet Blom and Bancha Kwanyuen will start an e-mail exchange to discuss the focus, parties to be involved, possibilities for funding, etc. for further elaboration in a joint proposal.

5.3 Thursday 1 September 2016

Water management. After presentations from Henk Ritzema and Bancha Kwanyuen it was emphasized that in the Netherlands, water pricing will not affect water use by farmers because they have to pay for water drainage. Although problems on flooding are more common sense in the Netherlands than problems on drought, the models used for monitoring and control presented by Henk Ritzema can be used for both topics. In the Netherlands sophisticated alert systems are developed to evacuate citizens from the cities in case of flooding emergency, which are based on DSS (weather data, groundwater levels, etc.). Models are based on local knowledge and local requirements and solutions should be flexible.
Main problems in Thailand are in this context: water quality, flooding and pollution, while water demand, especially in and around big cities, is sharply increasing. Water management in Thailand is always policy involved and a bottleneck is that the government is redundant to do anything. The rivers are under control by different authorities, depending on location and theme, while no cooperation or any alignment occurs. Thailand's' most urgent demands are: forest recovery and soil erosion protection. But at the moment, not enough money is available for these needs. Main problem is: *lack of planning*.
For further cooperation NL-Thailand following main topics were addressed: Flood control from farmer perspective; Waste water, water quality and possibilities for water recycling in the field (increase of the availability of nitrate and phosphate) and the impact of effluent from aquaculture on surface water. Research might focus on Quality Testing and Procedures for water Management. Potential funding: Thai research Fund, Ministry of Agriculture (provided that Wageningen UR is allowed to take part in the budget).
Appointment # 3: KU to select priorities and look for potential funding and communicate with WUR by e-mail (Buncha Chinnasri, Bancha Kwanyuen & Greet Blom).

Water use for tourism. In Thailand tourism is a major source of income. Water shortage is a main problem and water recycling in hotels will be a very important research subject. Because of its high importance, projects on this theme will easily be funded by the government. Greet Blom mentions this subject being a big issue in Egypt as well and will send a flyer on this topic to Siree Chaiseri and start an email exchange on preparing a proposal on this theme.
Appointment # 4: Greet Blom will send a flyer on Recycling Water at Hotels to Siree Chaiseri. Siree and Greet start of an e-mail exchange on this theme for the preparation of a proposal on this theme.

Food Processing, & Chain Management. This session had presentations from Jan Broeze and Nina Waldhauer and Namfone Lumdubwong. During the discussion, the IP (Intellectual Property) issue was addressed. Jan Broeze explained why the IP on knowledge always stays with WUR. It was questioned how contacts between Wageningen UR and industry usually emerge? Jan and Nina mentioned different possibilities: Companies/industry takes the lead in contacting Wageningen UR; Companies and WUR contact each other on international meetings (conferences, fairs, etc.); The Dutch agricultural counsellor intermediate; The Account managers or business developers from WUR (like Arjo) bring parties together
It was mentioned that FBR include 200 people. In projects, mostly an integrated approach is used and economists are often part of the project team.
To find a focus for further cooperation KU-WUR, we agreed upon 3 topics:

1) HPP + PEF. A very interesting and innovative topic to become introduced or further developed in Thailand. Different companies already purchased the equipment, but are still not using it due to lack of expertise. So, more expertise on optimisation of the technology and procedures are needed. Jan Broeze is willing to support the initiation of research on Optimisation issues
2) Mild Separation/extraction and purification techniques. Companies in Thailand have shown to be ready for investments on these techniques. Dutch Topsectoren could be involved.
3) Logistics. Nina Waldhauer mentions the trade between Thailand and EU as current topic. Products as 'chicken' and high value crops like 'mango' appeared to be most promising to focus on. The Centre for Agricultural Crops Logistics Research was mentioned for allocation of funds.

Appointment # 5: It has been agreed that Namfone Lumdubwong, Jan Broeze and Nina Waldhauer will contact each other by e-mail to elaborate the 3 topics further and start preparing a preproposal.

To close this session, the attendees visited facilities of the Food and Bio-based Research Institute.

In the afternoon discussions were held in three parallel sessions:
Economics with:
Andries Richter on behalf of Ekko van Ierland (Wageningen University Social Sciences, environmental Economics and Natural Resources Group).
Robert Sparrow (Social Sciences Group, Environmental Economics and Natural Resources).
University-private sector research with:
Corné Kempenaar (Applied Plant Research/Plant Research International)
Relation between food, immunity and health with:
Prof. Dr. Harrie Wichers
Prof Huub Savelkoul

In the wrap-up, following reports and appointments from the discussions were mentioned:
Ad 1. Further exploration of possibilities for exchange of students. A graduated sandwich-student and an undergraduate student for an internship on themes like an evaluation on the economic impact assessment.
Appointment # 6: E-mail exchange by Nuchanata Mungkung, Robert Sparrow and Andries Richter.

Ad 2. Corné Kempenaar has presented the experiences of WUR on:
Exchange of experiences in big integrated project teams
The identification of business opportunities
Exchange of students
Research in big programmes
Cooperation with the private sector.

Ad 3. Cooperation already exists for years. It has been agreed to elaborate further cooperation on:
the mushroom metabolism.
Testing the immune system of Zebra Fish and the cost effectiveness of the growing system
Professor + student from Thailand to the Netherlands (Harrie Wichers)
Development of tests on suitable food for elderly people
Continuation of exchange/internships or PhD positions for KU students at the lab of Leonard Sagis.
Appointment # 7: Continuation cooperation NL-Thailand. Contact persons: Harrie Wichers & Leonard Sagis.

5.4 Conclusions

In his reflection upon the visit, Huub Löffler, Director Wageningen International, concluded that a lot had been done and agreed upon (good ideas for further research, finding suitable partners to become involved and promising funding entities). Huub emphasized that the e-mail exchange will be very important for validation of the results and making it work. Concerning the possibility to sign a MOU, it was explained that for WUR an MoU is not required for any kind of cooperation. However, if for specific activities and or access to funding, KU requires an MoU WUR can consider this. Any MoU should be as detailed as possible. A further elaboration of proposals will be done during the visit of the WUR-delegates to Thailand in October.

Annex 2 Program WUR visit to Thailand
(10th – 12th October 2016)

Delegation

Dr. Arjo Rothuis	Manager International Cooperation – Asia
Dr. Greet Blom	Senior Scientist - Plant Science Group
Dr. Corné Kempenaar	Senior Scientist – Precision Agriculture
Mr. Sarawut Chantachitpreecha	*Sr. Agricultural Officer*
Mr. Arie Veldhuizen	*Dutch Agricultural Counsellor (only 12 & 12 Oct)*

Mon 10th Oct

Meeting with Thailand Research Fund (TRF), Meeting Room 1, 14th FL., SM Tower Phaholyothin Rd., Sam-Saean Nai, Phayathai, Bangkok 10400 (www.trf.or.th)

Participants (TRF):

Dr. Prapaporn Khopaibool	Director – Agricultural Department
Dr. Sompong Klaynongsruang	Director – Academic Department
Prof. Dr. Aran Patanothai	Khon kaen University
Prof. Dr. Nuntavan Bunyapraphatsara	R&D - Herbs
Prof. Dr. Attachai Jintrawet	R&D - Precision Agriculture
Prof. Dr. Jingtair Siriphanich	R&D - Fruit
Ms. Paemala Udtanut	Policy Officer (Academic)
Ms. Yothaka Puchcha	Policy Officer (Agriculture
Ms. Chananchida Singkamanee	Policy Officer (Agriculture)

Objectives:

1.To discuss the academic / technical collaboration with Wageningen University and Research focusing on agriculture (plant, fisheries, animal), water management, agro-food industry, agricultural economics etc.

2.To formulation joint collaborative research and innovation program between Thailand and Netherlands.

Meeting with Mitrphol Group, Add. 2, Ploenchit Center Building, 2nd FL., Sukhumwit Rd., Klongtoey, Bangkok 10110 (www.mitrphol.com)

Participants

Khun Krisda Monthienvichienchai, CEO and President

Dr. Klanarong Srirod (Vice President for Research) etc.

Assoc. Prof. Klanarong Sriroth, Ph.D. Director

Assoc. Prof. Chiradet Ousawat, Ph.D. Director

Prof. Pavinee Chinachoti, Ph.D. Consultant

Khun Pravit Prakitsri, Chief Operating Officer – Renewable Energy Business Group

Asst. Prof. Sansanalak Rachdawong, Ph.D. Senior Manager - Bio-Based Chemicals and Energy

Dr. Thomas Christopher Aurand, Expert – Innovation Sourcing

Mr.Bernold Kemperink, Sector manager Agro-Food, Clean tech & Renewable Energy, East Netherlands Development Agency (Oost NV)

Mr.Bram Geertsema, Project Manager, East Netherlands Development Agency

Ms.Pantipa Sutdhapanya, Senior Economic Officer and NFIA representative, Embassy of the Netherlands

Meeting with FrieslandCampina (Thailand) PCL, Add. 6th FL., S.P. Building, 388, Paholyothin Rd., Samsen Nai, Phayathai, Bangkok 10400,

Marco Bertaca, CEO and Khun Vachiraporn Sukmanee , Corporate R&D Manager - Friesland Campina Thailand (*www.foremostforlife.com, www.frieslandcampina.com)*

Meeting King Mongkut's Institute of Technology Ladkrabang (KMITL), President Office Building, (www.kmitl.ac.th)

Participants

Dr. Monthon Ganmanee, Dean of Agricultural Technology

Dr. Praphan Pinsirodom, Dean of Agro-Industry

Asst. Prof. Dr. Supan Tungjitkusolmun, Senior Executive Vice President for Academic Affairs (Provost)

Asst. Prof. Dr. Chaiyan Jettanasen, Vice President for International Affairs

Asst. Prof. Dr. Chanathip Thammakarn, Assistant dean, Faculty of Agricultural Technology

Dr. Prapatpong Upa, Vice dean, Faculty of Architecture

Aj. Poon Khwansuwa, Lecturer, Faculty of Architecture

Dr. Vasu Udompetaikul, Vice Dean, Faculty of Engineering

Assoc.Prof.Dr. Uma Seeboonruang, Assistant Dean, Faculty of Engineering

Assoc.Prof.Dr. Praphan Pinsirodom, Dean, Faculty of Agro-Industry

Asst. Prof. Dr. Tongchai Puttongsiri, Vice dean, Faculty of Agro-Industry

Asst. Prof. Dr. Naphatrapi Luangsakul, Vice dean, Faculty of Agro-Industry

Asst. Prof. Dr. Soisuda Pornpukdeewattana, Assistant dean, Faculty of Agro-Industry

Tue 11th Oct

Meeting East West Seed Group, Add. 50/1, Moo 2, Sainoi – Bangbuathong Rd., Amphur Sai Noi, Nonthaburi (www.eastwestseed.com)

Mr. Simon Jan De Hoop

And others

Working lunch with Mr. Bernhard Kelkes, The Netherlands Embassy, Soi Ton Son, Ploenchit Rd., Bangkok

Meeting Chulalongkorn University, Add. Phayathai Rd., Pathumwan, Bangkok 10330 (www.chula.ac.th)

- Department of Food Technology
- School of Agricultural Resources

Wed 12th Oct

Meeting Food Innopolis, Add. Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani

Participants

Dr. Akeanong Jangbua, Acting Assistant Secretary General, STI

Mr.Stephen Golsby, Internatinal Adviory Committee of Food Innopolis

Dr.Akeanong Jangbua, Acting Assistant Secretary General, STI

Miss U-sarat Bunnag, Senior Director - Marketing and Cluster Promotion Division, TSP

Dr.Pranpreya Sriwannawit Lundberg, Policy Developer, STI

Miss Manunya Chunhavuthiyanon, Policy Developer, STI

Miss Pattira Kuakim, Policy Developer, STI

Mr. Marut Chalotorn, Chief Operating Officer, Food Innopolis

Miss Sutheera Arjcharoen, Business Development Manager, Food Innopolis

Miss Chotika Noothong, Business Development Executive, Food Innopolis

Meeting National Science and Technology Development Agency, Add. Thailand Science Park, Pathumthani

Participants :

The National Science and Technology Development Agency (NSTDA)

Prof. Dr. Morakot Tanticharoen, Chairwoman, Agriculture and Food Cluster, Cluster and Program Management Office (CPMO)

Ms. Viraporn Mongkolchaisit, Executive Vice President and Director of Agricultural Technology & Innovation Management Institute

Ms. Siriporn Wattanasrirungkul, Rice Program Director, Cluster and Program Management Office (CPMO)

Ms. Kunchana Dumrongchai, Analyst, Cluster and Program Management Office (CPMO)

Areas of interest proposed by the Netherlands's side:

- Agriculture (animal & plant science)
- Agro-industry & food science
- Agricultural economics
- Fisheries
- Water & irrigation management

Meeting National Center for Genetic Engineering and Biotechnology, Add. Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani

Participants

Dr. Sithichoke Tangphatsornruang, Director of Genome, Technology Research Unit

Dr. Anan Jongkaewwattana, Director of Virology and Antibody Technology Research Unit

Dr. Sirawut Klingbunga, Director of Animal Biotechnology Research Unit

Ms. Pajaree Wichienmanee, International Relations Officer, International Cooperation and Public Relations Division

Ms. Mueanfan Taengtang, International Relations Officer, International Cooperation and Public Relations Division

Annex 1 **Seminar at KU,** 13th October 2016

(KU, Bangkok Campus)

09:00-09:05	Project Background (Vice President Assoc. Prof. Dr. Siree Chaiseri)
09:05-09:10	Welcome Address by KU President (Dr. Chongrak Wachrinrat)
09:10-09:15	Address by Mr. Arie Veldhuizen, Dutch Agricultural Counselor for Thailand, the Embassy of the Netherlands
09:15-09:20	Speech by Dr. Arjo Rothuis, Account Manager Asia, WUR
09:20-09:30	Souvenir Presentation and Group Photo Session
09:30-09:50	Agricultural Practices and Management under Drought Conditions at WUR (Dr. Greet Blom, WUR)
09:50-10:10	"Integral Physiology of Oil Palm and Plant Water Relations Study" (Prof. Dr. Suntaree Yingjajaval, Center for Agricultural Biotechnology, KU)
10:10-10:30	Precision Agriculture in Wageningen Univ. (Dr. Corne Kempanaar, WUR)
10:30-10:50	"Agricultural Forecast : The Ways We are Paving for ….." (Assist. Prof. Dr. Sukhet Nakasathien, Dean of the Faculty of Agriculture, KU)
10:50-11:10	Research Activities Related to Water Conservation and Management at Kasetsart University (Assoc. Prof. Dr. Bancha Kwanyuen, Dean of the Faculty of Engineering, Kamphaeng Saen Campus, KU)
11:10-11:30	"Making the Most of Public-Private Partnership" (Dr. Simon de Hoop, the East West Seed Company)
11:30-11:50	"Advanced Cytogenetic Technologies for Plant Breeding" (Dr. Hans de Jong)
12:00-13:30	Lunch hosted by Kasetsart University
13:30-16:00	On-going activities between WUR and Kasetsart University : Project formulation: Precision Agriculture, Water Management, Etc.

Annex 2 Visit to Kasetsart University, Kamphaeng Saen Campus (KU-KPS), October 14th 2016

Hosts: Faculty of Agriculture at Kamphaeng Saen
Faculty of Engineering at Kamphaeng Saen
Center of Agricultural Biotechnology (CAB)

Time	Activity	Venue	Contact person
08:00 – 10:00	Depart from Bangkok to Kasetsart University, Kamphaeng Saen Campus, Nakhon Pathom		
10.00 – 11:00	Faculty of Agriculture at Kamphaeng Saen: Discussion on precision agriculture projects	Faculty office/Meeting Room 1	• Chainarong Rattanakreetakul • Sukanya Rattanatubtimthong
			• Attasit Wongmaneeroj • Napat Kamthornsiriwimol • Ratiya Pongpisutta • Thammasak Thongket and team
11:00 – 11:30	Rice science innovations	Rice research center	• Apichart Vanavichit • Chanate Malumpong
11:30 – 12:00	Future animal nutrition and feed	Animal science learning center	• Yuwares Ruangpanit and team
13:00 – 16:00	Faculty of Engineering at Kamphaeng Saen: Discussion on water management projects	The Faculty of Engineering KPS (Building 9, 3rd Floor, Meeting Room 1)	• Bancha Kwanyuen • Wanrat Abdullakasim • Somchai Donjadee • Ronnarit Rittiron
16:00 – 17:30	Center of Agricultural Biotechnology	CAB building	• Julapark Chunwongse and team

Corresponding address for this report:
P.O. Box 16
6700 AA Wageningen
The Netherlands
T +31 (0)317 48 07 00
www.wur.nl/plant-research

Wageningen Plant Research Report

The mission of Wageningen University and Research is “To explore the potential of nature to improve the quality of life”. Under the banner Wageningen University & Research, Wageningen University and the specialised research institutes of the Wageningen Research Foundation have joined forces in contributing to finding solutions to important questions in the domain of healthy food and living environment. With its roughly 30 branches, 5,000 employees and 10,000 students, Wageningen University & Research is one of the leading organisations in its domain. The unique Wageningen approach lies in its integrated approach to issues and the collaboration between different disciplines.