Contact
Robert Stunt
Senior Policy Advisor
T +31 (0)70 378 5055
M +31 (0)6 2890 9755
F +31 (0)70 378 6153
r.a.stunt@mineleni.nl
European Agricultural Policy & Food Security/Agro-Economy Team
Pr Clauslaan 8 | 2595 AJ The Hague
PO Box 20401 | 2500 EK The Hague, Netherlands

Authors
Silke Hemming
Wim van Driel
Kees van der Vaart
Rubert Konijn
Robert Stunt
Carla Boonstra
Onno Louis
Yuko Saito
Analytical Mission to Sendai, Japan.
Prospects for Greenhouse Horticulture

Summary & conclusions *

From 23 to 29 February 2012 an analytical mission of horticultural experts visited Japan (Tokyo, Sendai and Rikuzentakata) to explore the potential for developing multidisciplinary glasshouse horticulture in the Sendai Plain. More specifically, the objective of the mission was to:

1. explore the area in terms of land consolidation and water resources;
2. identify possibilities for the development of large-scale glasshouse horticulture;
3. assess and survey the needs and interests of Japanese partners in the joint development with Dutch partners a large-scale multidisciplinary glasshouse horticulture project

The analytical horticultural mission can be seen as a one-time opportunity for two reasons. First, it is highly unlikely that reconstruction on such a scale will start from scratch again. Second, as part of the reconstruction efforts of the central government, the Sendai Plain will be designated as a special area in which various exemptions in the field of both regulations and taxation will apply, which makes it easier to get specifications for greenhouses approved.

In view of the current discussion on the need to restructure the Japanese agricultural sector to maintain a sustainable sector for the future, as well as Japan’s possible participation in the Transpacific Partnership Agreement and bilateral Free Trade Agreements (similar to those with EU and Australia), the application of Dutch greenhouse technology in the Japanese horticultural sector offers great potential with substantial spin-offs across the boundaries of Miyagi Prefecture.

In Sendai Plain (Miyagi Prefecture), the focus area of the analytical mission, about 37% (3,032 ha) of the farmland was flooded and because of the tsunami, agricultural land is affected by salinity problems.

The Sendai Plain is located east of the city of Sendai along the Pacific Coast. It is one of the major agricultural production areas in the Miyagi Prefecture. The main crops produced were rice and fruit (strawberries). It is especially suitable for new large-scale agriculture and intensive greenhouse horticulture because of its geographical characteristics (flat land) and excellent logistical connections (airport, harbour, road infrastructure). This is also acknowledged by the city of Sendai, as agriculture is an integrated part of its reconstruction plan.

This report reflects the findings of the mission and describes the possibilities for developing a large-scale horticulture project in the Sendai Plain, the specific needs of the Japanese partners in developing a large-scale horticulture project in the Sendai Plain and the interests of Japanese partners in working together with partners from the Netherlands to develop a large-scale horticulture project in the Sendai Plain. It concludes with recommendations on how to follow up on the mission.
Conclusions/recommendations

Greenhouse Technology

The Dutch methodology for greenhouse horticulture systems based on an adaptive greenhouse design can be followed to help the Sendai area decide on the best systems for greenhouse horticulture.

This design could include technologies such as geothermal heating, co-generation, CO2 from other industries, substrate culture and water recycling, use of ICT that is commonly used in Dutch horticulture, climate computers, ICT for data collection on climate, water, nutrients, crop growth and labour.

Following the Fukushima nuclear disaster Japan decided to reduce its dependency on nuclear energy and has since shut down a number of its nuclear plants. The Netherlands meets 15% of its household energy needs from greenhouse energy production, which is an interesting option for meeting Japanese energy needs.

Agriculturalists in Japan are an ageing group. The average age of a farmer is over 66 years. The younger generation has a negative image of farming. Greenhouse horticulture represents an attractive income-generating opportunity for the young job-seeking generation. It is associated with cutting-edge production technologies, high yields from relatively small areas, a clean image in terms of energy generation, and a strong association with many of the benefits of high-tech ICT.

As a result of the destructive effects of the tsunami and of radioactive pollution, there is a strong interest in food safety and food quality in products originating from the disaster area. Horticultural production, not soil-based but on substrates, can help create agricultural products with a safe and clean image.

Japan is currently negotiating a free trade agreement in the Pacific Region. There are considerable vested interests in the food safety aspects. This in turn creates a need for the development of an efficient and internationally competitive agriculture sector in Japan.

The Japanese Ministries of Agriculture, Forestry and Fisheries (MAFF) and of Economy, Trade & Industry (METI) are promoting investments in agriculture from different perspectives. MAFF focuses its support measures mainly on farmers who are aiming to modernise production and branch out into processing, sales and distribution (so-called sixth industrialization of agriculture), whereas METI endeavours to strengthen collaboration between agriculture, commerce and industry as well as to support modern technological developments such as those related to plant factories. A modern horticultural sector, not hidebound by farmland ownership restrictions, will offer an excellent opportunity for the two ministries to collaborate and achieve synergy.

A process of land consolidation / land exchange will have to be developed in parallel with initiatives for glasshouse complexes.

Land and water use functions and (de)salination

An integrated water management and salinity removal plan is advised:

- To make an extensive salinity (and sodicity) assessment of the whole affected area, distinguishing between various salinity and sodicity classes.
- To analyse whether it is really necessary to remove the thicker layers (> 30 cm?) deposited by the tsunami, as is currently being recommended for food safety reasons.
- The current pilot research projects should be extended to each of the salinity (and sodicity) classes in order to determine the most effective and efficient means of salt removal.
- Extra attention should be paid to the drainage system: the drainage levels might have to be adapted and the drainage capacity increased due to the seismic soil subsidence. Repairs and upgrading of the drainage facilities should be given priority.
- If not already in place, an extended survey of the groundwater reserves (quality and quantity) should be undertaken and the impact of groundwater extraction for horticulture evaluated.

Training

- In combination with the above activities, a tailor-made training course on water management, and more specifically on drainage and desalination, could be organised on location.

Miscellaneous recommendations:

- Consider whether the severely damaged areas along the coast could be given a different function, for example forest (buffer for flooding, recreational value).
- Aquaculture (salt, fresh, brackish) along the coast could also be an attractive alternative to agriculture.
- Saline agriculture is another option: experiments with brackish-water agriculture are currently being undertaken in the Dutch Delta.
- Consider the construction of an inland levee to mitigate flooding.
- An integrated planning strategy for the ‘Special Zone’, including all stakeholders, is advised.
- The Japanese agricultural sector is small in scale and subsistence-oriented, and is not geared to large-scale, efficient production. Properties measure 1 or 2 hectares on average. The current post-disaster period offers opportunities for upsampling land areas and substrate-based horticulture to avoid production from contaminated soils.

* The full report in English (electronic file in PDF format) is available at the Embassy of the Netherlands in Tokyo. Email: tok-inv@minbuza.nl
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Analytical Mission to Sendai, Japan
Prospects for Greenhouse Horticulture

From 23-29 February 2012 an analytical mission of horticultural experts visited Japan (Tokyo, Sendai and Rikuzentakata) to explore the potential for developing multidisciplinary glasshouse horticulture in the Sendai Plain. More specifically, the objective of the mission was to:

- explore the area in terms of land consolidation and water resources;
- identify possibilities for the development of large-scale glasshouse horticulture;
- assess and survey the needs and interests of Japanese partners in the joint development with Dutch partners a large-scale multidisciplinary glasshouse horticulture project.

This report reflects the findings of the mission and describes the possibilities for developing a large-scale horticulture project in the Sendai Plain, the specific needs of the Japanese partners in developing a large-scale horticulture project in the Sendai Plain and the interests of Japanese partners in working together with partners from the Netherlands to develop a large-scale horticulture project in the Sendai Plain. It concludes with recommendations on how to follow up on the mission.
Preamble

The Great East Japan Earthquake of 11 March 2011 and the subsequent tsunami ravaged most of the north-eastern region of Japan. To make matters worse, the looming threat of nuclear radiation became a reality when most of the nuclear reactors at the Fukushima Dai-ichi nuclear power plant were compromised due to these natural phenomena. These events not only resulted in the loss of more than 15,000 lives, but also profoundly disrupted the lives of those who still remain in the affected areas. Agriculture and thus farmers have been hit particularly hard. These are difficult times for the farmers and the sector in general, but at the same time offer an opportunity to restructure and revamp the ailing Japanese agricultural sector. There could be a role for the Netherlands in the reconstruction of the area, as the Netherlands is well known throughout Japan for its highly efficient agriculture, and in particular its advanced greenhouse technology.

In the light of this, this analytical horticultural mission can be seen as a one-time opportunity for two reasons. First, it is highly unlikely that reconstruction on such a scale will start from scratch again. Second, as part of the reconstruction efforts of the central government, the Sendai Plain will be designated as a special area in which various exemptions in the field of both regulations and taxation will apply, which makes it easier to get specifications for greenhouses approved.

What is more, in view of the current discussion on the need to restructure the Japanese agricultural sector in order to maintain a sustainable sector for the future, as well as Japan’s possible participation in the Transpacific Partnership Agreement and bilateral Free Trade Agreements (similar to those with EU and Australia), the application of Dutch greenhouse technology in the Japanese horticultural sector offers great potential with substantial spin-offs across the boundaries of Miyagi Prefecture.

A one-time opportunity to restructure agriculture
Background

The agriculture and fisheries sectors were disproportionately hit hardest of all economic sectors by the Great East Japan Earthquake of 11 March. Out of the total of 46 prefectures, 17 suffered or are still suffering from problems in relation to agriculture, and the figure rises to 28 when we include the fisheries sector, either directly as a result of the earthquake and subsequent tsunami or indirectly as a consequence of the nuclear crisis at the nuclear plant in Fukushima. The earthquake and subsequent liquidification damaged land, facilities and irrigation systems. The tsunami not only washed away livestock and agricultural areas, but also left behind a subsided and saline soil. The radioactive fall-out left areas highly contaminated, rendering agricultural produce unsaleable. Because of the contamination, the image of Japan as a producer of safe food has been tainted, both in Japan and overseas. Damage to and disruptions in the supply chain, aggravated by an immediate energy shortage, meant that animals were left without feed and fresh products could not be stored cool or transported. Moreover, the triple disaster exposed the structural flaws in the agricultural and fisheries sector in general.

According to figures from the Japanese Ministry of Agriculture, the total damage to the agricultural, forestry and fisheries sector amounted to JPY 2,426.8 billion. Agriculture accounted for almost 40 per cent of this total, or JPY 950 billion, affecting 18 thousand farms. Over 23,000 ha of agricultural land were flooded, reducing the land area available for agricultural production by 19,000 ha in 2011. In contrast to other economic sectors in the stricken Tohoku area, it will take much longer to rebuild the agricultural, fisheries and forestry sectors because of the problems with soil quality and contamination, leaving many farmers without a means of production or an income. The prefectures of Iwate, Miyagi and Fukushima, which are nearest to the epicentre of the magnitude 9.0 earthquake, bore the largest burden, almost 90% of the total damage.

In Sendai Plain (Miyagi Prefecture), the focus area of the analytical mission, about 37% (3,032 ha) of the farmland in was flooded and almost everything was washed away, including houses, facilities and part of the infrastructure. Furthermore, because of the tsunami, agricultural land is affected by salinity problems. Although the plain is located only 100 km north-east of the Fukushima II Nuclear Plant, the problems of radioactive contamination are negligible.
The Sendai Plain is located east of the city of Sendai (about 500 km north-east of Tokyo) and is situated along the Pacific Coast. It is one of the major agricultural production areas in the Miyagi Prefecture and is within reach of major highways and railways. It also has a major port and an international airport. The main crops produced were rice and fruit (strawberries). The Tohoku region, of which Sendai is part, is considered to be the agricultural backyard of the greater Tokyo metropolitan area. To date however, agriculture in Japan and the Tohoku area has been fairly small-scale (average 1 ha per farm) and has been carried out in a quite conservative way (high skills, low technology). The Sendai Plain is especially suitable for new large-scale agriculture and intensive greenhouse horticulture because of its geographical characteristics (flat land) and excellent logistical connections (airport, harbour, road infrastructure). This is also acknowledged by the city of Sendai, as agriculture is an integrated part of its reconstruction plan. Land property rights are currently critical since plots measure approx. 1 ha per owner. Labour in Japan is extremely expensive and agricultural labour is mainly carried out by farmers over the age of 65. Agriculture is not considered to be an attractive form of employment.

Against this background a mission was organised by the Dutch Ministry of Economic Affairs, Agriculture & Innovation to examine the potential for greenhouse horticulture in support of Japan’s efforts to reconstruct the tsunami-stricken areas.

The members of the delegation were as follows:

**Delegation from the Netherlands**
- Silke Hemming  WUR Greenhouse Horticulture
- Wim van Driel  WUR/Alterra
- Kees van der Vaart  Government Service for Land & Water Management (DLG)
- Rubert Konijn  Greenport Holland International
- Robert Stunt  Ministry of Economic Affairs, Agriculture & Innovation

**Netherlands Embassy in Japan**
- Carla Boonstra  Agricultural Counsellor to Japan
- Yuko Saito  Agricultural Assistant
- Onno Louis  Third Secretary
Method

In order to obtain a clear picture of the situation, the delegation held meetings with relevant partners from or affiliated to central and local government, farmers, business and academia, visited the Sendai area and Rikuzentaka on a fact-finding tour and participated in a workshop organised by the Netherlands Embassy in Tokyo on ‘Horticulture – The Dutch Integrated Approach’ as well as in a symposium to ‘Support the Reconstruction of Agriculture in the Stricken Areas’.

Meetings & discussions

Meeting with the Reconstruction Agency, Tokyo

The Reconstruction Agency was officially inaugurated on 10 February 2012 as a successor to the Reconstruction headquarters in response to the Great East Japan Earthquake. The Agency is headed by the Prime Minister himself and its mandate is to plan and coordinate national policy measures for reconstruction, and to support the efforts of afflicted local governments for reconstruction and serve as a ‘one-stop-shop’ for local authorities. The Agency also approves the establishment of ‘Special Reconstruction Zones’ with tax exemptions, and allocates subsidies to local governments. The Agency has a budget of roughly JPY 15 trillion. As both instruments are also crucial for developments in the Sendai area, the Reconstruction Agency is an important player.

The ‘Special Zones’ are laid down in the ‘Basic Guidelines for Reconstruction’, and offer special arrangements for deregulation, including land use restructuring, and reduced procedures as well as support in terms of tax, budget and finance, with the objective of providing secure housing and employment and stimulating regional/local development. Both prefectures and municipalities can submit applications for Special Zones and/or grant projects. Private companies – national or foreign – can submit their plans through the local authorities. The Reconstruction Agency, in consultation with the relevant ministries, will assess and decide on the approval of plans submitted; depending on the proposal, this may take as little as two weeks. The budget for the Special Zones is provided by central government, although private investments may be involved in the construction of the Zones (Kagome is for example interested in the case of Sendai).
The Reconstruction Agency confirmed that Sendai City has submitted and received approval for a Reconstruction Acceleration Plan (‘Agriculture and Food Frontier’) which includes the designation of a Special Zone of about 3,000 hectares for intensive horticulture and agriculture on the Sendai Plain. The majority of that area (70-80%) will be dedicated to growing rice and the remainder will be used for intensive vegetable growing. Desalination has the highest priority, followed by elevating previously inundated, subsided areas. The costs of these activities will be borne by the Ministry of Agriculture, Forestry and Fisheries (MAFF). According to the representative of the Reconstruction Agency, the Sendai proposal was partly based on private initiatives.

Discussions between MAFF and local authorities are ongoing to convert small-scale farming into large-scale farming. Farmers are also being encouraged to work together.

Observations:
• The Reconstruction Agency itself does not draft plans. The initiative is being carried out at the level of the prefectures and municipalities. This means that in order to gain access to the developments, it is important to identify and talk to the right people at local/regional level.

Recommendations:
• Map the relevant parties in the target areas
Meeting with representatives of the Ministry of Agriculture, Forestry & Fisheries (MAFF), Tokyo

As the Ministry of Agriculture, Forestry & Fisheries has a big finger in the pie when it comes to agricultural development, both centrally and at regional/local level via its MAFF Regional Offices (including in the Tohoku area), it is important to talk to MAFF and keep it informed. The meeting with MAFF was therefore intended primarily to inform the ministry of the intentions of the Analytical Mission. MAFF took the opportunity to learn more from the Dutch greenhouse horticulture sector.

The Dutch delegation explained that horticulture in the Netherlands is basically a sector that operates without subsidy, but is innovative and competitive. This is partly due to the following factors: 1) growers are able to negotiate a lower gas price; 2) money is allocated for research and development; 3) a reduced VAT rate of 6 per cent applies for horticultural products; 4) the government encourages Dutch farmers to innovate; 5) loans are easy to obtain; 6) several energy-related and company-specific subsidies are applicable, such as the subsidies for Stimulating Sustainable Energy Production (SDE) or Market Introduction of Energy Innovations (MEI); and lastly, 6) green label greenhouse systems offer tax reductions for energy-saving greenhouses.

From the ensuing discussion it became clear that in Japan, farmers who build new greenhouses are eligible for subsidies and that it is the government that invests in research and development. At the same time, human resource development is promoted. The rules on establishment of greenhouses were discussed. For the construction of simple, plastic (tunnel) greenhouses on agricultural land, special permission from the local authority is generally not required. For larger greenhouses, the picture is more complex. Permission may be required for glasshouses, as they are normally classed as buildings and are therefore subject to regulation under the Building Standards Act. Strict building regulations then apply and the local authority may want to confirm that the building meets the requirements. Practice does however vary from one municipality to another. Where greenhouses are built on non-agricultural land, the Buildings Standards Acts applies in principle. Following the tsunami of 11 March 2011, salinity is currently regarded as a huge problem, and greenhouses based on hydroponics are seen as a solution.
MAFF took great interest in the energy-saving methods that are applied in greenhouses in the Netherlands, such as the use of natural sunlight, high levels of insulation, growing strategies, co-generation, sustainable energy sources such as geothermal energy and semi-closed greenhouses.

The Japan Greenhouse Horticulture Association points out that they are organising the GPEC (Greenhouse Horticulture & Plant Factory Exhibition/Conference) in July 2012.

Observations:

• MAFF considers modern, hydroponics-based glasshouse horticulture as a possible solution for the problems with which the Japanese agricultural sector is struggling in the wake of the Great East Japan Earthquake, and in particular takes a great interest in the energy-saving methods/technology applied in Dutch greenhouses.

Recommendations:

• Keep MAFF (and the Japan Greenhouse Horticulture Association) informed about developments in Dutch glasshouse horticulture.
• Engage MAFF (and the Japan Greenhouse Horticulture Association) in a ‘Japan-Netherlands Horticultural Dialogue’.
Meeting with representatives of the Ministry of Economy, Trade & Industry (METI),

In addition to the Ministry of Agriculture, Forestry & Fisheries, the Ministry of Economy, Trade & Industry is the second major governmental player in stimulating modern greenhouse horticulture and agriculture in Japan, including in the stricken areas of the Tohoku region through its Regional Office. As the areas of activity of METI and MAFF overlap somewhat, cooperation between the two ministries is intensifying. The main difference between MAFF and METI is that MAFF is responsible for horticulture/agriculture developed on farmland and spends most of its available budget for the horticultural sector on subsidies to help farmers build new greenhouses. By contrast METI, as part of regional policy, promotes new economic activities in agriculture in general, and horticulture on non-farmland in particular, and invests more in research. METI expressed an interest in modernising Japanese agriculture, especially in the areas hit by the tsunami.

METI has shown a genuine interest in recent years in the (historical) development of Dutch agriculture and horticulture through policy input from the Netherlands Embassy, study tours to the Netherlands, etc. The ensuing discussion on the present situation/advantages and the history of the clustering of Dutch horticulture (including the Greenport Holland initiative) and the role of the government in this process, as well as the establishment and value of Dutch study clubs in the past, energy delivery to horticultural greenhouse areas by centralised energy plants, and the clustering of logistics of farmer groups was therefore a natural continuation of earlier contacts. In addition, METI was interested to learn more about the negative side-effects of glasshouse horticulture and the role of the government in tackling these effects. In this context, the rules on water and emission management in Dutch greenhouse horticulture, the handling of light emission and reduction of energy consumption in Dutch greenhouses were discussed.
Observations:
• METI is very eager to stimulate a modern style of agriculture as part of its regional policy and takes the Netherlands as a reference.

Recommendations:
• Keep METI informed about developments in Dutch glasshouse horticulture.
• Engage METI in a ‘Japan-Netherlands Horticultural Dialogue’.

Courtesy call to the municipality of Sendai

The municipality of Sendai plays a pivotal role in developing and facilitating a new vision for the reconstruction of the Sendai region as laid down in the ‘Sendai City Earthquake Disaster Reconstruction Plan’. Agriculture is an integral part of this plan (Agricultural and Food Frontier Zone), and a meeting with the mayor and other city officials was therefore a first priority. It was the municipality that took the initiative in creating the Earthquake Disaster Reconstruction Plan, which supplements the Sendai City Basic Plan. The Dutch Minister of Foreign Affairs, Uri Rosenthal, had already announced the visit by the of the Horticultural Analytical Mission when he met the mayor of Sendai.

City officials explained that the removal of debris in Sendai had been completed. A quarter of the farmland has been desalinated and agricultural activities can be resumed. A reconstruction plan for the Sendai area has been finalised and an application for Special Zone status has been submitted to the Reconstruction Agency. The city of Sendai also supports the development of a large-scale, modern horticultural sector.

Observations:
• It became clear that agriculture is an integral part of the reconstruction plan of the city of Sendai and that the aim is to reform the sector rather than replicate its previous state.

Recommendations:
• Keep them updated
Visit to Tohoku Regional Advancement Centre and Tohoku Economic Federation

The Tohoku Regional Advancement Centre and the Tohoku Economic Federation were the co-organisers of both the workshop on ‘Horticulture – The Dutch Integrated Approach’ and the symposium to ‘Support the Reconstruction of Agriculture in the Stricken Areas’, in which members of the Mission actively participated. As a think tank that conducts research, including in the field of agriculture, and helps to stimulate local industry to further advance the region in the aftermath of the disaster, the insights of the Centre are helpful in obtaining a better general picture of the situation in the Tohoku area and the ongoing and planned reconstruction and advancement efforts.

The officials from the Tohoku Regional Advancement Centre explained the purpose and structure of the Advancement Centre and it became clear that its efforts to carry out research projects to help revitalise the region have intensified since the disaster. Five or six projects are currently being undertaken in Miyagi, Fukushima and Iwate prefectures. The Tohoku Regional Advancement Centre considers rebuilding the agricultural and fisheries industries to be its most important task. The prefectures of Iwate, Miyagi and Fukushima were hit hardest by the tsunami and the earthquake. In Miyagi Prefecture alone, more than 15,000 ha of land was inundated, most of it rice paddies. On the Sendai Plain, farms and pumping stations were severely affected. Officials from the Advancement Centre made clear that it is not in Tohoku’s best interests to return to the situation as it was before the disaster, and the aim is therefore to apply wide-ranging innovative principles. Desalination efforts are ongoing and the pumping station situated on the Sendai Plain has been partially repaired. Inland farming is expected to commence later this year, while coastal farming is expected to recommence in around 2014. The area around Sendai City is planned to be reused as farmland, but also for intensive horticulture (Natorigawa District). The salt removal on the least affected land is effected through repeated ploughing, irrigation, puddling and diffusion of the salt from the soil to the water layer and drainage, until the salinity levels have reached acceptable values. These methods seem to be effective for areas that have not been inundated for long periods of time; land that has been inundated for longer periods of time is likely to require more drastic measures. The affected farmland and the reconstruction that is planned for it has been divided into five categories. A farming resumption plan has been drawn up and most of the farmland should be recovered by the 2014 financial year. For some areas where levee failure or severe ground subsidence permitted the long-term influx of seawater, a specific approach needs to be adopted. It is interesting to note that the influence of Dutch engineers in the region in past centuries, such as Johannes de Rijke and Cornelis Johannes van Doorn, is still very evident.
Observations:
- The proposed ideas regarding the reconstruction of agricultural land, with the inclusion of intensive horticulture, seem to be a step in the right direction for the Tohoku area. However, given that the agricultural industry is conservative and does not seem to welcome change, the question remains as to how many innovative solutions can actually be implemented.

Recommendations:
- The Tohoku Regional Advancement Centre and the Tohoku Economic Federation are important players which need to be kept involved in the promotion of the (Dutch) horticultural approach. Cooperation between these two organisations and key Dutch partners in the field of agricultural research is recommended, as the Advancement Centre has added increased importance to this research field.

Visit to METI regional office

METI and MAFF have offices in the regions that serve as to guide, shape and implement the input from national government to local governments. In turn, the local communities’ wishes and ideas are communicated to central government through these regional offices. These offices thus play a vital liaison role between Tokyo and the municipalities. The purpose of the horticultural mission to Sendai and the Dutch participation in the workshop and seminar on 27 February were briefly explained. METI officials explained plans to stimulate industrial activities in the Sendai region. They made it clear that agriculture is also considered an industrial activity and should be developed in collaboration with MAFF. They furthermore pointed out that the timing of the Mission and the workshop was very opportune, as many new views on agriculture in the region are under discussion. METI officials showed an interest in the entrepreneurial Dutch approach to agriculture, and especially horticulture, and displayed a willingness to learn from the Netherlands. The absence of smooth coordination in Japan between key partners as seen in the Netherlands might contribute to this willingness.

Observations:
- METI officials explained that they previously did not focus on agricultural reconstruction and reform. Since linking up with MAFF it has become a stronger focus. This is due in part to their wish to increase the revenue share of the ailing Japanese agricultural sector, which currently accounts for approximately 15% of all revenue generated in the country, and approximately 2.7% in the Tohoku region.

Recommendations:
- Keep them updated and link up where possible.
Visit to MAFF regional office / tour around Sendai Plain by car

With seven regional offices serving six prefectures, MAFF is very much present and involved in the Tohoku region. The ministry is therefore in a position to provide more insight into the damage and reconstruction of agricultural areas in the region. Furthermore, considering the nature of the visit, and that both METI and MAFF are active in the region, both branches needed to be visited.

During this short meeting, the mission to Sendai and the workshop and seminar on 27 February were discussed. MAFF officials in turn explained the purpose of the regional offices and their tasks. The offices are charged with gathering regional information, which at present is mainly information related to the disaster, and reporting back to the Ministry. A land improvement specialist proceeded to discuss the reconstruction efforts being undertaken to rebuild the agricultural facilities in the region. This explanation was followed by a video of amateur footage which showed the damage done to the immediate surrounding area, to enable the group to gain a better understanding of the damage that Sendai has been subjected to. An opportunity to see the damage at first hand arose during a tour around the Sendai Plain. During this tour detailed explanations were given by MAFF officials about the extent of the damage.

Visit to Sanichi Farm

Sanichi Farm is interested in greenhouse technology and is eager to learn from Dutch experience. Discussions provided the group with an idea of what innovative Japanese farmers are trying to achieve and a clearer insight into what role they might be able to play.

San-ichi Farm is carrying out pioneering work with regard to agriculture and is trying to incorporate innovative solutions. Before the disaster it mainly engaged in open field cultivation, but the company now wishes to switch to greenhouse cultivation. Sanichi Farm is currently constructing a greenhouse (3 x 2,000 m²) on the Sendai Plain near Sendai International Airport. The project involves an investment of about JPY 300-350 million, 50% of which is being provided by central government subsidies, plus an additional subsidy from Miyagi Prefecture. Estimated sales in the second year of production amounted to JPY 110 million and a contract with a large restaurant chain has already been signed. Different varieties of lettuce, in addition to other crops such as tomato, arugula, spinach, qing-geng-cai and potherbs are planned. The technology used in the Venlow-type greenhouses will be based on hydroponics, combined with heat pumps with a root-zone cooling system and conduction tubes in water. Rainwater will be collected under the greenhouse. Recycled plastic tables will also be used to collect the rainwater. The estimated annual yields per crop
are extremely high. Even though highly innovative greenhouse technologies are used, the owner has no experience with this combination of technology. As the growers were rice growers before they attempted greenhouse horticulture, this new venture carries a potentially high risk of failure.

A discussion followed on Dutch horticulture and how the Netherlands was able to become the second largest exporter of food products in the world. A discussion of the need for year-round production, the importance of guaranteed quality in a highly controllable production environment and the advantages of high efficiency and large-scale production provided insights for both parties. Growers in the Netherlands are used to sharing knowledge and the research infrastructure is well developed.

The total area of Japanese greenhouse horticulture is 50,000 ha ground area and 62,500 ha floor area. Tomatoes account for 7,500 ha, spinach 5,000 ha and strawberries 4,600 ha. These figures include greenhouses and rain shelters but exclude low tunnels.

Observations:
• The ambition in venturing into highly innovative greenhouse technology is high, but carries a potentially high risk of failure as growers may lack sufficient knowledge.

Recommendations:
• It would be advisable to invest in the (re)training and support of farmers who switch from rice farming to greenhouse cultivation.
Visit to JA Miyagi Watari

JA is the Japanese Agricultural cooperative. It has 6,000 members nationwide and is a source of information for growers. JA is financially supported by MAFF (no support from METI) and runs small projects financed by the Ministry of Health, Labour and Welfare (MHLW).

After the tsunami JA gave its members JPY 50 million, JPY 35 million of which was spent on buying useful products for members such as pesticides, nutrients, and so on. JA used its own rice stores to feed members directly after the disaster. One of the first projects undertaken by the organization in the Sendai area was to reinstate the destroyed strawberry farms. The recovery status is currently 19.2 ha, planned to rise to 85 ha in 2015 (i.e. 89%).

JA is not seeking money from external sources such as large non-agricultural companies, as it has not had positive experiences with this practice. It prefers to rely on traditional members promoting new technologies. The cooperative vehemently opposes the TPP (Trans Pacific Partnership) and wants to develop farms in the region towards large-scale farming (currently the average is 2 ha; in the future this will be 20 ha). It also hopes to introduce new labour-saving technologies.

A discussion of the possibilities for using geothermal heating systems followed. JA does not endorse this type of technology as it is too costly. JA pointed out that oil prices are the biggest worry for its members.

Observations:
Although JA seems to acknowledge that scaling up farming is inevitable, there is resistance among its often elderly members to deviating from the known pathways.

Recommendations:
Every plan/design for modernising the agricultural sector should take into account the existing resistance of farmers and vested interests and include a strategy to keep the farmers involved.
Visit to Butai Farm

Butai Farm is the driving force behind a very ambitious project to build a vegetable factory covering around 20 ha, the nation’s largest, in the Sendai Plain, in partnership with IBM Japan Kagome and others. Electricity from a yet-to-be-built mega-solar farm and heat generated from biomass will be used for hydroponic cultivation and food processing. IBM Japan will provide a system to raise energy-efficiency.

Butai Farm is the largest farm in the Tohoku area, with around 700 ha of land. Its roots date back 350 years. Its market in Miyagi Prefecture comprises 2.3 million people and the farm provides for around 1.5 million people in the Sendai area. In Sendai City alone, approximately JPY 30 billion worth of fruits and vegetable are consumed on a yearly basis. Intensive farming is needed to fulfil market demand and possibly to serve Tokyo markets as well. Butai Farm has a contract with 7/11 (a convenience store chain) for the supply of fresh products for sandwiches, rice for sushi and rice balls and packaging for bananas. In collaboration with MAFF, Butai Farm also set up a ‘farmers market’ which helped to provide and distribute food to locals directly after the tsunami.

According to Butai Farm, the Sendai region is ideal for large-scale production because of its flat coastal topography and good logistics (highway, High Speed Rail, harbour and airport). Agriculture still seems to be an unattractive sector for most young people, however. The average age of practising farmers is also rather high.

The owner and representatives of Butai Farm explained and commented on their future plans. The idea is to develop an area of 3,000 ha of land (78% of all agricultural land in Sendai City) for the production of rice, vegetables and fruits. In order to do so, Butai Farm, together with Sendai City, has developed and submitted a Special Zone ‘food and agriculture frontier’ plan to the Reconstruction Agency. This plan entails investing in large-scale hydroponic farming, linking up with investors such as Kagome (processing and production of tomatoes) and IBM (ICT support for database collection) and offering food education to children and restaurants. Promotion of smart farming is also important to Butai Farm. It hopes to achieve this by using wind and solar energy and the co-generation principle to change the image of a dirty, dangerous and non-profitable agriculture sector into an attractive, high-technology industry. This will in turn hopefully increase productivity and yield (from the current 100 ha rice = JPY 100 million to 20 ha = JPY3 billion.) and attract a new and younger workforce to the area.
Future crops under consideration are tomato, paprika, cucumber, strawberry, eggplant and all other crops that consumers accept as being grown in water. The growing method is relevant for consumers because of anxiety about radioactive contamination, and also pesticides. It is equally important for the processing industry in relation to the weight of certain products. The ways in which the Netherlands can support these plans include a feasibility study and G2G cooperation in education/training and image campaigns for the horticultural sector (similar to the ‘Kom in de Kas’ campaign in the Netherlands).

**Observations:**
- It seems that Butai Farm is well aware of the (most) pressing issues and it is trying to use innovative methods (promotion of smart and clean agriculture, dissemination of best practices, linking up with the private sector, and the large-scale approach) to help rejuvenate the sector. The group welcomed the specific ideas that Butai Farm has for Dutch support/participation.

**Recommendations:**
- Maintaining relations will be important in order for the Netherlands to stay involved.

**Visit to Saizeriya Company, production facility in Sendai**

Saizeriya is a Japanese chain of Italian family-style restaurants with over 888 outlets all over Japan, serving about 140 million customers a year and a turnover of JPY 99 billion. Saizeriya is increasingly looking to source its vegetables from contract farming. In 2011 it supported the construction of the Saizeriya Tomato Hydroponic cultivation farm in Sendai. The facility comprises four greenhouses with a total floor area of 12,000 sq.m. The initial investment was JPY 100 million, or EUR 1 million, and production began in December 2011. Total output is estimated to reach around 100 tonnes in July 2012, the first year of operations, rising to 300 tonnes the following year. Because of the favourable financial and regulatory conditions thanks to the Sendai Plain being designated a Special Zone, Saizeriya is an active player in the region.

A tour of the facility helped provide an insight into the technology used. The greenhouses sport a multi-span plastic construction covered with plastic film, are equipped with roll-up ventilation in the roof (approx. 1/3 of each roof can be opened) and have black shading netting on the inside. They also feature thick insulating white energy cloths (imported from Korea), black ground cover, drip irrigation and recirculation of water in foam gutters covered with black film. The tomatoes are grown on Cultilene blocks on coir mats. Some of the Cultilene blocks rest on substrate-filled bags with an open water system that is heated by an oil-fired boiler and distributed through transparent tubes on the ground. Heating and
cooling is performed by a heat pump located on one side of the greenhouse and the distribution is through transparent tubes on the ground. A ‘heating pipe’ is situated beneath the gutters next to the rows of crops and is placed beside bags for warming up irrigation water and the root zone of the crop. The other greenhouse has a gas-fired boiler and a CO2 application is envisaged for the future, but no cooling capability.

Although these are innovative trials for Japanese conditions, the question remains as to whether the right technology has been chosen. The decisions regarding investment and technology were made based on the principle of keeping the investment – and therefore the risk – low (enough to reach 20 kg tomato production in order to be economically viable). Information was collected in the United Arab Emirates (Dubai region) and later Japanese technology was tested. It was eventually decided to opt for a combination of relatively low-tech Korean, Chinese and Japanese technology to keep the risks low. As regards the labour force, there is a need for 11 full-time and 10 part-time workers. These are all trainees and no trained workers are available. Labour costs are around EUR 3,000 per month per employee, which is relatively high.

Observations:
• The yield has thus far not been enough to justify the initial investment and it is questionable whether the chosen approach can pay dividends. There is great drive in evidence, but if the technology does not match the cultivation method, climate and geographical characteristics, there is a high potential for disappointment.

Recommendations:
• Carry out an assessment to see where improvements can be made in the cultivation so as to achieve optimum yields.
Dinner with Prof. Kazunuki Ohizumi, Miyagi University

Professor Ohizumi was the person who in May 2011 established the first contact with the Embassy of the Kingdom in the Netherlands about Dutch-style agriculture. Professor Ohizumi is member of the Reconstruction Council of the municipality of Minami-Sanriku but also acts as an advisor to the municipality of Sendai and Miyagi Prefecture. Even before the East Japan Great Earthquake, professor Ohizumi was already a member of the Council to Promote the Revitalization of Food, Agriculture, Forestry and Fisheries, an advisory body to the Japanese Minister of Agriculture, Forestry and Fisheries. Professor Ohizumi is known to be a great advocate of large(r)-scale agriculture as a panacea for developing Japanese agriculture into a sound, viable and sustainable sector.

In the view of Professor Ohizumi there is a need for large-scale horticulture in the Sendai area with scope for a high production value of greenhouse horticulture. Several ideas were discussed about MSc student exchange in relation to land consolidation and desalination, as well as the role and approach of METI and MAFF for the horticultural sector. Professor Ohizumi was not aware of any research being carried out on the desalination of the flooded areas. He said he would enquire among his colleagues at his universities. The possibilities of organising a tailor-made training programme on drainage and desalination were also discussed.

Observations:
- There is a clear need for the exchange of knowledge and know-how in the field of land consolidation, drainage and desalination

Recommendations:
- Further discuss with Professor Ohizumi the possibilities for the exchange of MSc students on land consolidation and desalination.
- Study the possibilities of organising a tailor-made training programme on drainage and desalination.
Interview with The Japan Agricultural News (Silke Hemming)

The following issues were discussed:

- A methodology for designing greenhouse systems for the Sendai region. The Dutch approach of adaptive greenhouse design can be used to help the Sendai area decide on the most suitable system for greenhouse horticulture.
- Geothermal heating, co-generation, utilising CO₂ from other industries, substrate culture and water recycling, use of ICT commonly used in Dutch horticulture, climate computers are widely used, ICT for data collection on climate, water, nutrients, crop growth and labour.
- The Netherlands as the second largest exporter of agricultural products; the longstanding tradition in trade, the Dutch innovative horticultural sector and food industry, investment in R&D, high efficiency through large-scale production and guaranteed delivery of year-round products with high quality.
- Horticultural systems with low environmental impact, such as use of natural sunlight for crop growth and energy supply to the greenhouse, use of integrated pest and disease control with a very low usage of chemicals but high usage of biological control agents, low water consumption and high nutrient saving by recycling systems in greenhouses, use of waste CO₂ from the oil industry for horticultural production.
- The recent developments in greenhouse technology, covering materials and traditional approaches for glass greenhouses in the Netherlands. Glass greenhouses have a high light transmission which may be particularly useful for Japanese conditions.
- The value of diffuse light and the latest research results such as allowing more light for shade-loving crops by simultaneously controlling the other growth factors such as temperature, humidity and CO₂ on a higher level.
- Latest developments in greenhouse systems, the approach by Wageningen UR Greenhouse Horticulture: the Concept of Venlow Energy Greenhouse with double glazing, the new crop-growing concept and dehumidification technology.
- Development and adaptation of New Growing Strategies for several crops, knowledge exchange with groups of growers in all research projects.
Field visit to the areas struck by the tsunami

A field visit was made to the coastal area that was struck by the tsunami. In most places the sea defence levees are still more or less intact. It is clear that the waves must have been at least twice as high as the levees. The damage is enormous and complete villages have been washed away. All the debris has already been removed, piled up in massive heaps and separated according to type. Several large installations are used to incinerate the debris. Measuring salinity levels in ditches did not yield high values, but this is only because rainwater has diluted the water. It is likely that the soil is in fact heavily salinated and only deep vertical drainage can reverse the situation. There may also be sodicity issues. Agricultural recovery will take time and pilot research projects might be needed to discover the most efficient and effective means of salt removal.

This situation is worsened by the seismic soil subsidence of 70 to 100 cm. For this reason the drainage level needs to be adapted and the drainage capacity increased. Although not visible in the field, reports suggest that large areas are below sea level. Salt water seepage from the sea might become a new threat to agriculture. It is therefore proposed to develop an integrated water management and desalination plan for the entire Sendai Plain. Many pools caused by erosion and/or liquidation were observed in the coastal areas.

Workshop: ‘Horticulture - The Dutch Integrated Approach’

The Embassy of the Netherlands, in close co-operation with the Tohoku Regional Advancement Centre and Professor Ohizumi of Miyagi University and with the nominal support of the Tohoku Keidanren, MAFF Tohoku Regional Office, METI Tohoku Regional Office, and the Municipality of Miyagi, organized a workshop entitled ‘Horticulture - The Dutch Integrated Approach. A contribution from the Netherlands to the discussion on the reconstruction of the agricultural sector in Tohoku region following the Great Eastern Japan Earthquake’; the workshop was moderated by Professor Ohizumi.

In the workshop, Silke Hemming from Wageningen UR/Glasshouse Horticulture gave a presentation on ‘Sustainable Greenhouse Production’ in which she focused on the concept of ‘Adaptive greenhouse’ design, i.e. designing greenhouse systems which combine (economic) production efficiency with minimal input of energy, water and nutrients for different regions in the world.
In his presentation ‘Desalination: Adaptation or Mitigation’, Wim van Driel from Wageningen UR/Alterra shared with the audience his first observations on what he had seen in the field, and advised the drawing up of an integrated water management and salinity removal plan.

Given the fact that farmland in Japan is still very fragmented and that agricultural land policy and the sensitivity of land ownership form a serious impediment to the necessary economies of scale, Kees van der Vaart from the Government Service for Land & Water Management (DLG) spoke about ‘Developments in Land Consolidation in the Netherlands’.

The workshop was attended to the maximum capacity of about 100 people representing farmers, private companies (from the IT, finance and food sectors, among others), consultancies, research institutes, government officials and press not only from Sendai and its surroundings but from Hokkaido to Aichi Prefecture. There were questions from the audience on the optimum use of CO2, optimum growing conditions, costs of the initial investment in glasshouses, the strength of the Dutch greenhouse horticulture sector, how to hedge against poor harvests in the event of specialization, co-generation, crops used in the Netherlands to prepare soil for farming after land reclamation projects, use of fertilizers to remove salt from soil, the fate of villages and farmers in the event of land consolidation projects and the issue of food security when the number of farmers declines.

Observations:
- There is a general and broad interest in more large-scale farming, but there are many concerns as well (costs, vulnerability in the event of specialization, food security, farm communities).
- There is a technical interest in glasshouse horticulture (use of CO2, optimum growing conditions, saving energy)
- There is a technical interest in land consolidation and desalination

Recommendations:
- Organize a number of workshops/presentations on some of the above issues.
- Further elaborate the concept of ‘Adapative Greenhouse Design’.
Symposium to Support the Reconstruction of Agriculture in the Stricken Areas

The Tohoku Regional Advancement Centre organized a symposium 'Support the Reconstruction of Agriculture in the Stricken Areas'. Rubert Konijn of Greenport Holland International was invited to speak on 'Greenports .... An Integrated Approach in Horticulture'. In the ensuing discussion it became clear that in Japan the change of mindset from producing only for local consumption towards a more export-oriented approach still has a long way to go.

Discussion with Minoru Ookawa, MAFF, about pilot research project on desalination

(Wim van Driel)

Mr. Ookawa spoke about the implementation and results of a pilot research project on desalination in rice paddies and strawberry fields. The experiments were carried out in the least affected areas.

In rice paddies two methods have been tested:
1. Ploughing, irrigation, puddling, settling to allow diffusion of salts, drainage of top water layer.
2. Similar method but with additional mole drains connected to a permeable trench with a pipe drain.

For the upper soil layer (0-5 cm), in almost all cases one repetition was enough to reduce the salt content to an acceptable level. For the deeper layer (20 cm), two repetitions were necessary. The mole drainage had a positive effect on the reduction of the salt content, especially in the lower layer.

The strawberry field beds of 20 cm in height were prepared and leached with:
1. Only rainwater
2. Rainwater and irrigation.

As may be expected, the impact of irrigation was clearly visible, although this did not play a crucial role in achieving acceptable levels of salt content.

In some of the plots gypsum was also applied, but appeared to have no influence on the results.
A further study of the experimental set-up and the results would be needed to fully understand and analyse the outcome of the pilot research. This would require translation of the documents. Mr. Ookawa indicated that it was only a pilot and that more research (including in other areas) would be needed.

**Dinner with Kagome and IBM Japan**

On the evening of 27 February 2012, the members of the Greenport delegation had dinner with Mr Taizo Sano and Mr Yoshitaka Odaira of Kagome Co. and Mr Kunihiro Yamanaka of IBM Japan in Seidai. Kagome and IBM Japan are key players in a large-scale horticultural project currently being developed in the Seidai Plain. A group of large Japanese companies are involved in this project, including convenience store and supermarket chain operators and a local electricity company. Kagome is providing know-how on hydroponics, while IBM Japan is providing advice on IT solutions in this project. There was a lively exchange in which potential collaboration between Dutch and Japanese companies was discussed. Although there was no clear indication on the part of Kagome regarding how Dutch horticultural technologies could be used in the Sendai project, Mr Sano in particular suggested the establishment of a voluntary working group of Japanese and Dutch companies to facilitate an ongoing exchange of information and collaboration.

*Recommendation:*
- Set up a Netherlands-Japan Horticulture Dialogue

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*Japanese-Dutch working group for the exchange of information, and collaboration*
Visit to Rikuzentakata

The effects of the earthquake and the tsunami are still clearly visible in Rikuzentakata. On 11 March 2011 the tsunami reached areas up to eight kilometres inland, the coastline subsided by approximately 1.5 meters, outflow from the river was no longer possible the salt tongue in the river was extended several kilometres further inland, railways were almost completely destroyed; part of the agricultural land remains below sea level and covered with salt water, and the top soil has been washed away or is covered with a thick layer of sand and mud. First impressions of the area in which Rikuzentakata once stood are humbling.

On a hill approximately one kilometre from where the city hall previously stood a new, temporary city hall has been erected. The mayor of Rikuzentakata explained what had happened to the city by means of satellite images dating from before and after 11 March. He underlined the importance of agriculture in rural areas and explained that the agriculture sector in Rikuzentakata was already facing four major problems before the disaster: 1) lack of effectiveness; 2) too small scale; 3) no influx of young(er) farmers; and 4) inflexible land ownership regulations. He understood that (closed) horticulture might help in rejuvenating the unattractive image of agriculture for young people and at the same time help solve two immediate concerns, namely soil salinity and radioactivity.

A tour of what remains from the city followed. Officials from the city hall said that most of the 400 ha of agricultural land that was available before the disaster will be restored to its previous condition for rice cultivation. Approximately 100 ha of that land is reserved for upscaling and enlargement through land consolidation. Infrastructure will be improved and modern glasshouses will be constructed.

Following the tour, the deputy mayor shared plans for eight new glasshouses. These plans were drawn up in consultation with a consultant and the Japanese company Granpa. Local farmers are involved in the project and will provide a workforce. These glasshouses are circular in shape, with a diameter of about 30 metres. They will be used mainly to grow tomatoes using a kind of hydroponic system (although it was mentioned that consumers are not keen on the taste of the end products) together with a sprinkler system that
moisturises the roots from below. The cost to construct the glasshouses was not provided, but based on the available information and a rough calculation, the price for about 3,000 square metres is estimated to be more than EUR 2 million.

It was also stated that there is resistance to a new, more high-tech approach from the local farming community.

**Observations**
The scale of devastation is daunting and full attention will be required for quite some time in order for the people of Rikuzentakata to resume a more normal life. This, coupled with concerns about coordination of support between central, local and foreign governments, meant that the group left the city without a clear vision of how the Netherlands can best provide support.

**Bilateral Meetings**
In the margin of the programme there were many requests from private companies for bilateral meetings with the representatives of Greenport Holland International and Wageningen UR/Glasshouse Horticulture.

It was interesting to note that even among major Japanese companies which already have activities in the field of horticulture, there is a growing understanding that merely building a greenhouse is not sufficient to build a successful business case. Designing greenhouse systems which combine (economic) production efficiency with minimal input of energy, water and nutrients adapted to different world regions and environments will make or break the economic success of a greenhouse.
Observations

General

• The extent to which municipalities have developed concrete plans/visions on the reconstruction of their areas differs. The city of Sendai has concrete ideas and plans on how to reconstruct and revitalise its agricultural sector, as laid down in the ‘Sendai City Earthquake Disaster Reconstruction Plan’ (Agricultural and Food Frontier Zone). Rikuzentakata, by contrast, seemed to be more at a loss as to where to start.

• It has become clear that the initiative to develop plans/visions lies at the level of the prefectures and municipalities and that the role of central government (in the form of the Reconstruction Agency) is to plan and coordinate national policy measures for reconstruction, to support the reconstruction efforts of the local governments and to approve special reconstruction zones with accompanying tax breaks, subsidies and deregulation measures.

• There seems to be concern about the coordination of support between central, local and foreign governments.

• There seems to be consensus on the view that greenhouse horticulture may be a solution to the problems caused by the triple disaster. However, views differ on what scale is required and on the involvement of private companies.

• The first initiatives towards glass greenhouse horticulture are encouraging, but still carry a (high) risk of failure as the technology does not match the cultivation methods, or farmers have not yet adjusted to new cultivation methods.
Land and water use functions and (de)salination

- Villages will be relocated to higher locations.
- Temporary repairs of the draining pumping stations has been given priority.
- Starting with the least affected areas is the most efficient approach.
- Gradually (2012-2014) moving downward towards the ocean to resume agricultural activities in the more affected areas; this gives these areas more time to (partially) desalinate thanks to the higher precipitation.
- Salt removal by repeated ploughing, flooding, soil puddling and drainage is a good method for soils in which only the topsoil is salinated.
- Repairs to the irrigation and drainage system are in hand.
- It is difficult to make an assessment of the current salinity situation.
- To our knowledge, no extensive assessment has been carried out of the degree of salination in the various areas flooded by the tsunami.
- Measurements in surface water in drains and on the fields revealed relatively low salinity levels, due to dilution by recent precipitation. These measurements do not give a good indication of the salinity of the soil. Time and the scope of the mission did not allow us to take and analyse soil samples.
- Areas which have been ponded for a long time with seawater will need special attention.
- A systematic survey of soil salinity is needed.
- Sodicity (causing poor soil structure) could become a problem.
- Seepage of saline seawater due to soil subsidence is likely.
- Drainage capacity might have to be increased.
- Use of groundwater reserves
- Greenhouses make use of pumped groundwater. Substantial expansion of greenhouses might impact on the quantity and quality of the groundwater reserves.
- Salinity research.
- There seem to be few research activities focusing on optimum desalination under various circumstances.
- Limited pilot research is being carried out on relatively less affected soils.
- During the mission we did not meet any experts in water management and (de)salination
Land consolidation

- It is almost impossible in Japan to buy land to enlarge farms and/or enlarge plots. There is no properly functioning land market with enough mobility of land or a system of land-loan. Ownership and use of land hardly changes; land is inherited by family.
- A properly functioning land market is a requirement for both land consolidation and realisation of glasshouse projects.
- Although there is a common understanding of the need to modernise agriculture, not many initiatives or plans were shared during the Mission. The available plans (Sendai, Rikuzentakata) were provisional spatial plans without a structure and/or the necessary instruments for implementation.
- The availability of sufficiently large areas of land is an important requirement for sustainable glasshouse complexes. A process of land consolidation/land exchange will have to be developed in parallel with initiatives for glasshouse complexes.

Greenhouse energy production to meet daily household energy needs
Conclusions/recommendations

Greenhouse Technology

• The Dutch methodology for greenhouse horticulture systems based on an adaptive greenhouse design can be followed to help the Sendai area decide on the best systems for greenhouse horticulture.
• This design could include technologies such as geothermal heating, co-generation, CO2 from other industries, substrate culture and water recycling, use of ICT that is commonly used in Dutch horticulture, climate computers, ICT for data collection on climate, water, nutrients, crop growth and labour.
• Following the Fukushima nuclear disaster Japan decided to reduce its dependency on nuclear energy and has since shut down a number of its nuclear plants. The Netherlands meets 15% of its household energy needs from greenhouse energy production, which is an interesting option for meeting Japanese energy needs.
• Agriculturalists in Japan are an ageing group. The average age of a farmer is over 66 years. The younger generation has a negative image of farming. Greenhouse horticulture represents an attractive income-generating opportunity for the young job-seeking generation. It is associated with cutting-edge production technologies, high yields from relatively small areas, a clean image in terms of energy generation, and a strong association with many of the benefits of high-tech ICT.
• As a result of the destructive effects of the tsunami and of radioactive pollution, there is a strong interest in food safety and food quality in products originating from the disaster area. Horticultural production, not soil-based but on substrates, can help create agricultural products with a safe and clean image.
• Japan is currently negotiating a free trade agreement in the Pacific Region. There are considerable vested interests in the industry. However, it seems reasonable to assume that the defensive interests of the agricultural sector will prevail. This in turn creates a need for the development of an efficient and internationally competitive agriculture sector in Japan.
• The Japanese Ministries of Agriculture, Forestry and Fisheries (MAFF) and of Economy, Trade & Industry (METI) are on a par, but take different views on agriculture. Whereas MAFF operates in the interests of small farmers, METI focuses on modern technological developments. Japan has a powerful agricultural lobby, often related to heavily subsidised rice production. However, a modern horticultural sector, not hidebound by land ownership restrictions, could overcome these differences and bridge the gap between MAFF and METI.
• A process of land consolidation/land exchange will have to be developed in parallel with initiatives for glasshouse complexes.
Land and water use functions and (de)salination

An integrated water management and salinity removal plan is advised:

• To make an extensive salinity (and sodicity) assessment of the whole affected area, distinguishing between various salinity and sodicity classes.
• To analyse whether it is really necessary to remove the thicker layers (> 30 cm?) deposited by the tsunami, as is currently being recommended for food safety reasons.
• The current pilot research projects should be extended to each of the salinity (and sodicity) classes in order to determine the most effective and efficient means of salt removal.
• Extra attention should be paid to the drainage system: the drainage levels might have to be adapted and the drainage capacity increased due to the seismic soil subsidence. Repairs and upgrading of the drainage facilities should be given priority.
• If not already in place, an extended survey of the groundwater reserves (quality and quantity) should be undertaken and the impact of groundwater extraction for horticulture evaluated.

Training:

• In combination with the above activities, a tailor-made training course on water management, and more specifically on drainage and desalination, could be organised on location.

Miscellaneous recommendations:

• Consider whether the severely damaged areas along the coast could be given a different function, for example forest (buffer for flooding, recreational value).
• Aquaculture (salt, fresh, brackish) along the coast could also be an attractive alternative to agriculture.
• Saline agriculture is another option: experiments with brackish-water agriculture are currently being undertaken in the Dutch Delta.
• Consider the construction of an inland levee to mitigate flooding.
• An integrated planning strategy for the ‘Special Zone’, including all stakeholders, is advised.
• The Japanese agricultural sector is small in scale and subsistence-oriented, and is not geared to large-scale, efficient production. Properties measure 1 or 2 hectares on average. The current post-disaster period offers opportunities for upscaling land areas and substrate-based horticulture to avoid production from contaminated soils.
Persons interviewed

Netherlands Embassy in Tokyo, Japan
Nienke Trooster  Minister Plenipotentiary
Carla Boonstra  Agricultural Counsellor
Merei Wagenaar  Economic Affairs Counsellor
Paul op den Brouw  Science and Technology Counsellor
Onno Louis  Third Secretary
Yuko Saito  Agricultural Assistant

Reconstruction Agency, Tokyo
Yoshio Ando

MAFF, Tokyo
Hirokatsu Watatani  Director, Flower Industry and Greenhouse Horticulture Promotion Office
Ryuichi Tosa  Deputy Director, Horticultural Crop Division
Yuuichi Katou  Flower Industry and Greenhouse Horticulture Promotion Office
Makiko Imai  Flower Industry and Greenhouse Horticulture Promotion Office
Natsuko Arai  Flower Industry and Greenhouse Horticulture Promotion Office
Akio Yamamoto  Flower Industry and Greenhouse Horticulture Promotion Office
Higashide Tadahisa  Senior researcher, National Institute of Vegetable and Tea Service
Toru Totani  Japan Greenhouse Horticulture Association

METI
Takeo Geshi  Deputy Director Regional Economic and Industrial Policy Group
Nakagami Hideakzu  Regional Economic and Industrial Policy Group
Rie Sugita  Assistant Director

Municipality of Sendai
Mr. Ohtusuki
Mr. Kikuchi

Tohoku Regional Advancement Centre and Tohoku Economic Federation
Tetsuo Sekuguchi  Senior Managing Director,
Toshiaki Sakamoto  Senior Managing Director,
Tatsuji Tomisawa  Managing Director, Secretary,
Yuichi Shoji  Managing Director,
Tsukasa Koizumi  Managing director secretary General,
Takashi Myiasone  General Manager Surveys & Research
METI Regional Office
Hiroshi Sato Director-General for Industry Department

MAFF Regional Office
Hirofumi Kugita Deputy Director-General,
Manabu Masuo Engineering Service Centre

Sanichi Farm
Seiichi Seto President
Kazuo Hirayama Deputy-director Business Management
Yoko Takimoto Recycle One
Sueo Nakabayashi Sassoh Industry Company Tokyo, constructor

JA Miyagi Watari
Mr. Kunio Iwasa Chairman

Butai Farm
Nobuo Hariu Director
Kato Yoshikazu Manager

Saizeriya Company, production facility, Sendai
Yutaka Ogawa General Manager R&D Planning Division
Sayaka Uchimura, Public Relations Department
Mr Watanabe MAFF Regional Office

Miyagi University
Prof. Kazunuki Ohizumi

MAFF
Minoru Ookawa

The Japan Agricultural News
Hana Saito

City of Rikuzentakata
Futoshi Toba Mayor
Takashi Kubota Deputy Mayor