The International Farmers' Café on Saline Agriculture

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"We have 70 percent pasture that is 'god given'.

And this good land is brought to us by the salty sea.

And it was full of salt and the years came and the salt went away.

So every square meter of good farmland was North Sea in former times.

So we live with salt and salinization.

(…)

It takes time to go from sea to good farmland.

And only time can give us good farmland.

And the best farmland is what we take from the North Sea."

Quote from a German farmer in the International Farmers' Café

on Salinization and Saline Agriculture

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1. About the International Farmers' Café on Saline Agriculture

1.1 The SalFar project

The International Farmers' Café on Saline Agriculture is part of the Interreg North Sea Region project Saline Farming (SalFar). The project researches and promotes the cultivation of salt-tolerant crops, known as (bio)saline agriculture, in order to (re)use degraded farmland and to reduce fresh water consumption. The project develops 10 open field labs in the North Sea Region, providing space for experimentation with salt-tolerant crops.

Saline agriculture, however, is not a purely bio-technical challenge. There is to some extent a taboo on saline agriculture; either salinization is not seen as a genuine urgent challenge or the concept of saline agriculture is dismissed as undesirable. Thus, there is much work (at regional level and at North Sea level) to be done on awareness raising, capacity building and governance and agriculture along the vulnerable coastal districts of the North Sea Region. **SalFar aims to develop support for the concept of saline agriculture through the interactive engagement of stakeholders** at local level, including farmers, crop developers, retailers, water and agricultural policy workers.

As part of this interactive process, the SalFar project organized the International Farmers' Café on Saline Agriculture. The event facilitated international discussions on salinization and saline agriculture by farmers and other practitioners from various parts of the North Sea Region. Moreover, they provided the opportunity for a visit to one of the SalFar test sites on saline agriculture.

1.2 The Saline Futures conference

As part of the SalFar project, the Waddenacademie organized a conference on saline agriculture, with the support from Van Hall Larenstein, ICBA and all SalFar partners. This conference was called '*Saline Futures conference. Addressing Climate Change and Food Security and building a community of science and practice on saline agriculture'* and took place from Tuesday the 10th until the Friday the 13th of September 2019 in Leeuwarden, the Netherlands. The conference addressed a wide range of research topics related to saline agriculture, including policy and management of saline agriculture, innovation in salt-tolerant crops, and the geography and biology of salinization. More information can be found on https://www.waddenacademie.nl/salinefutures.

The International Farmers' Café on Salinization and Saline Agriculture was integrated into the Saline Futures conference. Both events took place at the same location thus facilitating interactions between the participants of the academic conference (researchers from across the world) and the participants of the farmers' café (practitioners from the North Sea Region). Both groups enjoyed common coffee breaks, had the same Saline Dinner, and visited the island of Texel together.

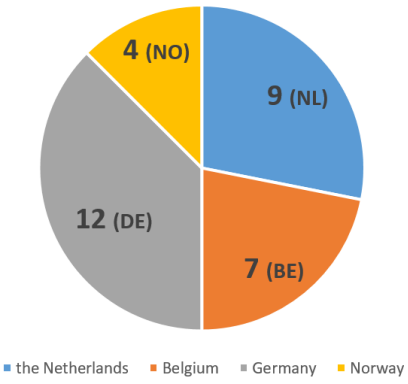
Impressions from the Saline Futures conference (© Waddenacademie)

1.3 Goals

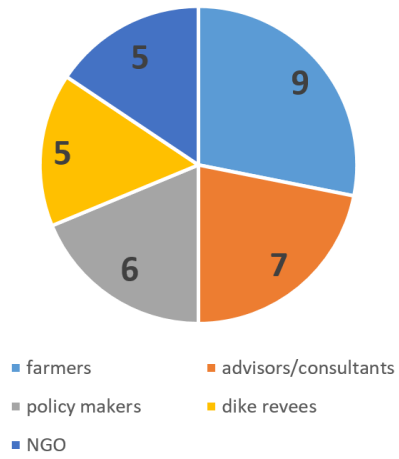
The International Farmers' Café on Saline Agriculture had multiple objectives:

- **Inform** about salinization and salt-tolerant crops. Throughout the event, all participants were informed about the aggravating challenge of salinization in the North Sea Region as well as the concept of saline agriculture.
- **Visit** the SalFar test site on saline agriculture in Texel. The participants got the opportunity to participate in an excursion to the Salt Farm Foundation and the Salt Farm, located on the Dutch island of Texel.
- **Discuss** the future of (saline) agriculture in the North Sea Region. The farmers' café facilitated discussion amongst the participants about the occurrence and threat of salinization as well as the potential of saline agriculture.
- **Exchange** knowledge on saline strategies across borders. Throughout the event different types of expertise and experiences were shared.
- **Feedback** into the research of SalFar and the Saline Futures conference. The main results of the farmers' café were communicated at the closing session of the Saline Futures conference by representatives of the farmers. Moreover, their input will feed into the future research of the SalFar project.

1.4 Who participated?



The International Farmers' Café on Saline Agriculture was open to farmers, agricultural advisors, policy workers, and all other stakeholders. Besides 3 organizers/moderators and 3 presenters/inspirers, a total of **32 practitioners participated in the event**. The participants came from four countries of the North Sea Region: Germany (12), the Netherlands (9), Belgium (7) and Norway (4). The diagram on the left provides a helpful overview.



These participants represent a wide range of stakeholders, including farmers (9), agricultural advisors and consultants (7), policy makers/workers (6), dike reeves (5), and employees of a NGO (5).

1.5 The components of the farmers' café

The program of the International Farmers' Café on Saline Agriculture can be found in annex 7.1. In general, it comprised four major components. The event started with a plenary session on salinization and saline agriculture. Next, two consecutive rounds of parallel sessions were organized. In workshop 1, entitled *'The impact of salinization on soils, plant growth and agricultural livability*', the participants discussed the current and future occurrence of salinization in their agricultural region. In workshop 2, entitled *'The salt-tolerance of agricultural crops and the potential of saline farming in the North Sea Region'*, the participants could discuss the salt-tolerance of various crops. The next day, about two thirds of the participants visited the Salt Farm and the Salt Farm Foundation, located on the Dutch island of Texel. **The following sections of this report will clarify the goal, the approach, the results and the evaluation of each these four components.**

2. The plenary session on salinization and saline agriculture

2.1 The goal

The plenary session provided a kick-start to the International Farmers' Café on Salinization and Saline Agriculture. This first component of the event had the following objectives:

- To **bring** all participants **together** and to welcome them to the Saline Futures conference
- To **clarify the goals** of the farmers' café
- To **provide some key information and concepts** about salinization and saline agriculture, thus creating a framework for the discussions. To this extent, the plenary session included a video on the SalFar framework on salinization processes, a brief presentation about the impact of salinization on soils (by Åsgeir Almås (NMBU) and Iain Gould (Lincoln University) and short introduction the the Salt Farm Foundation by Marc van Rijsselberghe
- To **position the strategy of saline agriculture** in the range of climate adaptation possibilities. Clarifying the difference between mitigating salinization and adapting to salinization. To this extent, Tineke De Vries (Potato Valley) presented the current strategies on salinization in the Dutch farming community.

2.2 The approach

The plenary session was organized in a conventional way: a series of presentations with the occasional questions and answers. The plenary session was kept short to allow for maximum time for interaction (see section 3 and 4). In total it took 1 hour. Detailed information on the timing of the plenary session can be found in annex 7.1.

2.3 Photo report

From left to right:

Welcoming of the farmers by prof. Pier Vellinga (© Wim Van Isacker)

Video on the SalFar framework on salinization processes by Jeroen De Waegemaeker (© Wim Van Isacker)

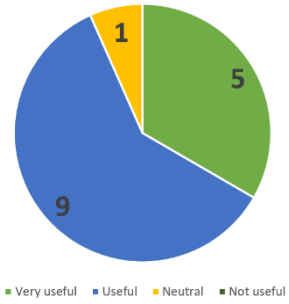
Presentation on Dutch salinizaton strategies by Tineke de Vries (© Wim Van Isacker)

Brief introduction to the impact of salinization on soils by Åsgeir Almås (© Wim Van Isacker)

2.4 Evaluation by the participants

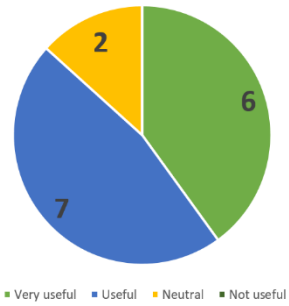
In the aftermath of the International Farmers' Café on Salinization and Saline Agriculture an evaluation form (googledocs) was send to all thirty-two participants. This evaluation form was translated to Dutch, German and Norwegian in order to get maximum response. After a reminder a total of 14 persons have responded. Hence there was a response rate of 44 percent.

With regards the plenary session the evaluation form asked the following questions:



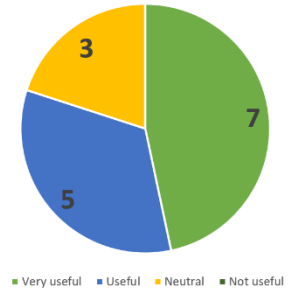
How would you rate the presentation 'Salinization: a challenge for farming' by Tineke de Vries?

The results show that this presentation was highly appreciated by the participants. Nearly all participants found the presentation to be useful or very useful.



How would you rate the presentation 'The ABC of saline soils' by Åsgeir Almås and Iain Gould?

The results show that this presentation was highly appreciated by the participants. Nearly all participants found the presentation to be useful or very useful.



How would you rate the presentation 'Forty years of saline farming in Texel' by Marc van Rijsselberghe?

The results show that this presentation was highly appreciated by the participants. Many participants found the presentation to be useful or very useful.

3. Workshop 1: The impact of salinization on soils, plant growth and agricultural livability

3.1 The goal

The aim of the workshop was to bring together farmers and agricultural advisors who could exchange experiences on issues with salinization in their region, to share information about the impact of salinization on soils and plant growth and give them the opportunity to raise concerns and questions they would like to discuss.

3.2 The approach

The participants were divided in four groups with 8-10 participants in each group. There were two groups per session as per the photo report below, and each session lasted 45 minutes. Two senior researchers, Åsgeir Almås (NMBU) and Iain Gould (Lincoln University) led the discussions, and had prepared a set of questions beforehand. They provided explanations and shared their knowledge on the impact of salinization on soils with the farmers and agricultural advisors when questions and issues were raised.

3.3 Photo report

Impressions from workshop 1 (© Wim Van Isacker)

3.4 The results of the workshop

The farmers and agricultural advisors were actively participating in the discussions. In the first sessions there were also three regional policy makers and consultants who participated and in the second session there were several dike reeves and NGO workers.

A Belgium farmer, who is a dairy farmer and grows grass, maize and grains on heavy clay soil practicing crop rotation, shared issues related to his farm being partly below sea level. Areas of his land are located zero to half a meter below sea level, and he relies on rainwater. Some of his neighbors irrigate their lands taking some fresh water from the ditches when there is less precipitation, but when they see there is too much salt water in the water, they stop. There are regulations with regards to taking fresh water out of the ditches. The farmers can irrigate to a certain extent, but when the water has gone too low, they have to stop. There is a small river in the area, but there is a lot of activity related to the cultivation of potatoes for which water is taken from the river. Some farmers have their own fresh water source. The Belgium farmer says they may be facing salinity but there is not much experience about this issue, and they are interested to understand if there is a problem in their area. Two tubes were placed on and adjacent to his farm (12 km). One indicated normal results and the other showed that the salt water level was higher than normal; salt water is normally found two meters below ground level. There is a thin layer of 1 ½ meter of fresh water.

The question was raised if salt water infiltration is something that the farmers think about, and the farmer responded that the farmers' main concern is that weather is drier. They did not have enough rain in 2018, the rainfall was close to 750 mm while in a normal year it is 850 mm. In the winter, in January 2019, they started with low rainfall and by mid-September it was only 500 mm. The farmers see that there is less grass for the cattle, and in other regions with lighter soils, (in his region the clay keeps the moisture in the ground), the maize burned and the potato harvest was lower due to dry and warm summers. With the dry summers and the drought stress experienced by the farmers, it was questioned whether this could also be related to salt stress. The Belgium farmer responded "*no, because, in this region the ground is clay, and for the moment the corn harvest is good. It is the region with lighter soils farther away from the sea, that has problems. Climate change is a bigger concern for people than salinization, we are more aware of the drought, and the problems with extreme weather than we are talking or thinking about salinization".*

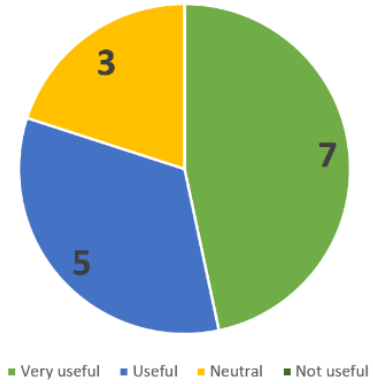
3.5 Evaluation by participants

In the aftermath of the International Farmers' Café on Salinization and Saline Agriculture an evaluation form (googledocs) was send to all thirty-two participants. This evaluation form was translated to Dutch, German and Norwegian in order to get maximum response. After a reminder a total of 14 persons have responded. Hence there was a response rate of 44 percent.

With regards the plenary session the evaluation form asked the following questions:

How would you rate workshop 1 with inspirers Åsgeir Almås and Iain Gould?

The results show that this first workshop was appreciated by the participants. Many participants found the workshop to be useful or very useful.



4. Workshop 2: The salt-tolerance of agricultural crops and the potential of saline farming in the North Sea Region

4.1 The goal

The goal of the second workshop was twofold. Firstly, the workshop aimed to assess for which crops the participants request more information with regards to the salt-tolerance. Via a sticker exercise (see 4.2) the workshop prioritized those agricultural crops that multiple participants found interesting and that, as a consequence, could benefit from a transnational discussion. Secondly, the workshop aimed to gather input from the farming community to research on saline agriculture, and the SalFar project in particular. The workshop aims to uncover key questions about salinization and saline agriculture. Hence the workshop can signpost opportunities and barriers in the further development of saline agriculture in the North Sea Region.

4.2 The approach

The workshop took 45 minutes and was and comprised three phases:

- *Phase 1 (10min): Assessment of the crops that need to be discussed.*
  All participants got 3 round stickers to indicate on a series of A0-posters about which crops they want to know more vis-à-vis salt-tolerance. The exercise attempts to assess for which crops there is a need for information. There were two types of colors: yellow stickers for farmers and farmer advisors and red for all other participants. There was also the possibility to write down specific questions on post-its. The blank squares marked 'other' provided the possibility to indicate crops that are not on the poster. Figure 4.2.1 and 4.2.2 showcase the results of this sticker exercise.

- *Phase 2 (30min): Discussion on the salt-tolerance of the crops.*
  Based on the sticker exercise (phase 1) the salt-tolerance of crops, and that of specific cultivars is discussed. Marc van Rijsselberghe, pioneer in saline agriculture and founder of the Salt Farm Foundation, was present as an inspirer' and thus provided his knowledge and experience.

- *Phase 3 (5min): Small summary of the session.*

The workshop was audio-recorded with the written consent of all participants in order to supplement the notes of the moderators. The description of the results is based on those notes and the audio-tapes that were made.

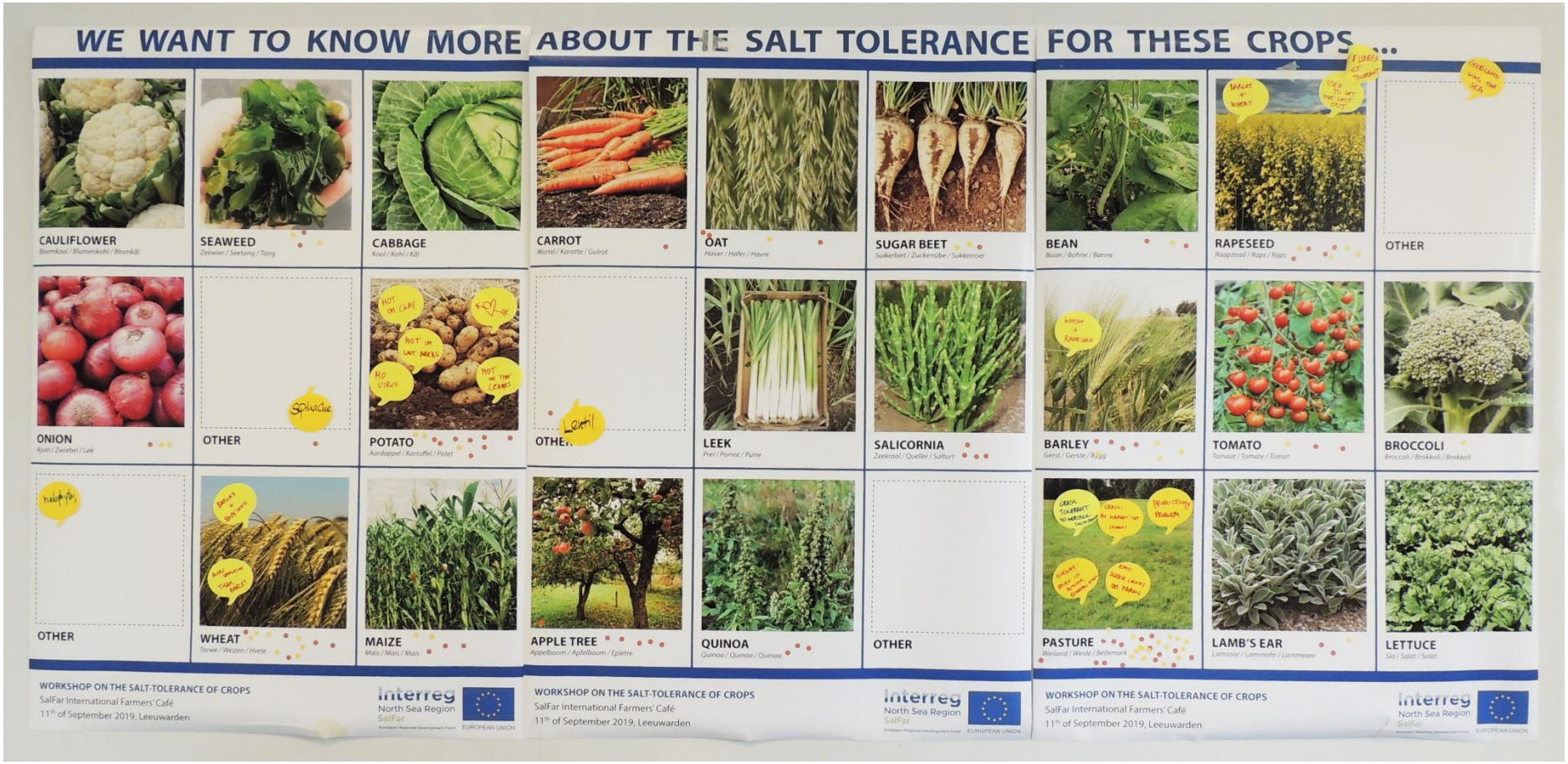


Figure 4.1.2: the results for workshop 2 in the first session (© Jeroen De Waegemaeker)

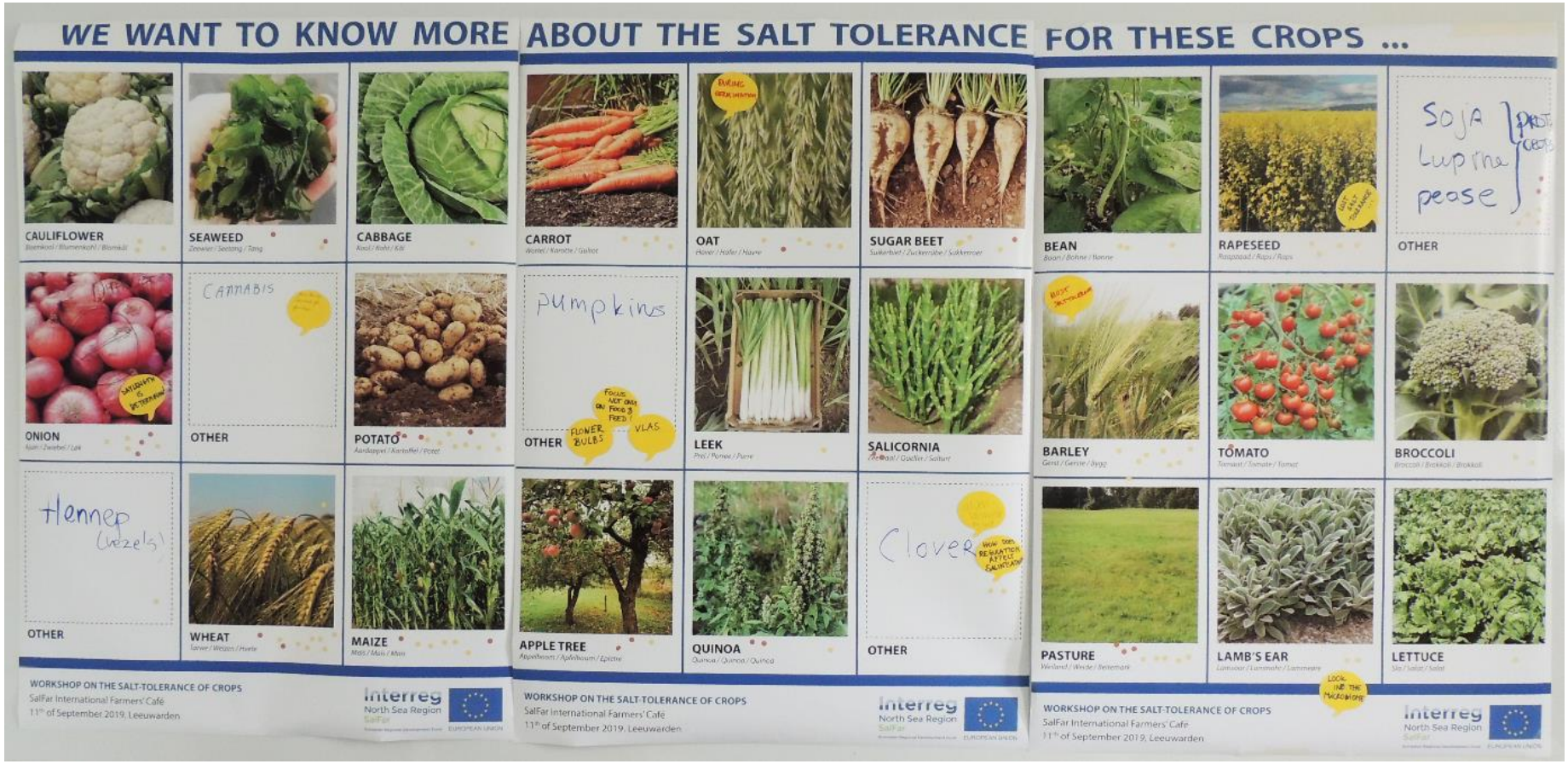


Figure 4.2.1: the results for workshop 2 in the second session (© Jeroen De Waegemaeker)

4.3 Photo report

Impressions from workshop 1 (© Wim Van Isacker)

4.4 Results

The results of the workshop are twofold. Firstly, we evaluate which agricultural crops were selected by the participants and, as a consequence, discussed throughout the workshop. Hence, the workshop answers the question: What saline crops must be developed for the North Sea Region?

Secondly, the workshop uncover farmers' and practitioners' concerns about saline agriculture. Thus the workshop feeds back into the SalFar research project and defines guidelines for research on saline agriculture, within the SalFar project, follow-up projects and other research projects.

What saline crops must be developed for the North Sea Region?

The results of both sticker sessions (figures 4.1 and 4.2) has been summarized in table 4.3, see next page. This section summarizes the discussion on the various crops in both sessions. Firstly, the exercise illustrated **a broad range of saline crops**. The participants indicated that they had an interest in the salt-tolerance of many different crops. Hence, the concept of saline farming can't be limited to the cultivation of a few salt loving crops such as Salicornia and Lambs' Ear. Instead, it encompasses a wide spectrum of possible salt-tolerant crops, from conventional to innovative crops.

We want to know more about the salt tolerance for these crops… (number of stickers per crop)			
	Farmers	**Non-farmers**	**Total**
Pasture	21	18	39
Potato	11	12	23
Wheat	14	7	21
Barley	12	4	16
Maize	7	5	12
Rapeseed	8	4	12
Oat	6	4	10
Onion	6	4	10
Apple tree	1	8	9
Sugar beet	6	2	8
Salicornia	0	7	7
Seaweed	3	4	7
Bean	4	2	6
Quinoa	1	5	6
Carrot	4	1	5
Lamb's ear	3	2	5
Tomato	1	3	4
Broccoli	3	0	3
Cauliflower	3	0	3
Cabbage	1	0	1
Leek	1	0	1
Lettuce	1	0	1
OTHER CROPS (added by the participants to the matrix of agricultural crops)			
Lentil, Spinach, Cannabis, Hemp, Flower bulbs, Flax, Clover, Pumpkin, Lupine, Soya			

Table 4.3, Summary of the discussion in both sessions

Secondly, the exercise highlighted an **enormous interest for the salt-tolerance of pastures**. Far more than any other agricultural crop, participants were interested in information about salt-tolerant grass varieties. This interest for the salt-tolerance of pastures originates from different salinization processes, both natural as well as man-made causes. Some examples to clarify this variety. The Norwegian coast, for example, is subjected to the deposition of droplets of seawater, a natural process known as aerosol salinization. In the German coastal region Ostfriesland, on the other hand, mankind creates saline conditions by adding alluvial mud to the pastures.

"Especially when we have seeded the grass in the autumn, then it is dead in the winter.

We have to renew it in the spring. It is too close to the sea."

Quote 4.1 - Norwegian farmer

"We have a problem with the mud in our river, the Ems.

We want to take the mud and put in on our land, on our ground.

That can create problems in the future."

Quote 4.2 - German farmer

Besides the various causes of the salinization in pasture areas, the participants of the farmers' café clarified the expectations of salt-tolerant grass varieties. **New grass varieties shouldn't just be able to grow in saline conditions, but they need to maintain a high level of productivity and digestibility.** It is for this reason that the grass species that currently grown in the North Sea Region's natural marshes can't be directly used for the development of saline agriculture. Hence, there is need for research on the salt-tolerance of grass varieties. The next section highlights some important guidelines for such research.

Secondly, there was **a lot of interest** amongst farmers as well as non-farmers **for the salt-tolerance of conventional arable farming crops**, including potato, wheat, barley, maize, rapeseed, oat and onion. Noteworthy, some of these crops, e.g. wheat and maize, are to a great extent used as fodder. This list of crops closely resembles the predominant agricultural crops of the North Sea Region. Hence, the sticker exercise showcased that most participants conceptualized saline agriculture as an incremental substitution of the current agricultural production by salt-tolerant cultivars rather than the cultivation of new, unknown crops.

"Why we are interested in the salt-tolerance of onions? We are growing them!

And we would like to keep them. They are already in our system."

Quote 4.3 - Dutch farmer

Thirdly, there was **less interest for the salt-tolerance of vegetables**, e.g. Tomato, Broccoli, Cauliflower, Leek and Lettuce. This probably results from the fact that few participating farmers currently produce such vegetables in open air. Moreover, the clay soils of the North Sea Region are less favorable for the cultivation of such crops.

Fourthly, there was equally **less interest for halophytes** such as Salicornia and Lambs' Ear, especially amongst farmers. The main reason mentioned was a lack of consumers' demand. Moreover, they argued that halophytes should only be grown if the cultivation of other, conventional agricultural crops is no longer viable. In other words, Salicornia and Lamb's Ear remains something for the future, when extreme salinization can no longer be mitigated.

"But it [Salicornia] *is a crop that you can grow under extreme wet conditions.*

But then you are going to sacrifice that land. You are not going to grow any potatoes anymore.

Or whatever crop you want to grow there. It is end of story.

It is the last crop that I would advise you to grow.

Only if the market is there and if you have enough salt water to spray it."

Quote 4.4 – Marc van Rijsselberghe (Salt Farm Foundation)

Finally, there was from time to time **a difference between the farming community** (the farmers and their agricultural advisors) **and the other practitioners** (the water managers and the policy makers). The latter, for example, indicated an interest in the salt-tolerance of new, developing crops such as Quinoa. This difference between farmers and non-farmers is most likely due to divergent motivations and expectations. While farmers and agricultural advisors predominantly reflected about the business potential of saline agriculture, the other participants mostly participated out of curiosity and personal interests.

"It is a small crop. Nobody wants it. (…)

It think it is a niche market for the moment.

It is always the same: if it works [referring to a success story about quiona]*, it works because a niche.*

You can get a good price only because it is a niche."

Quote 4.5 – Belgian farmer

"I like cooking very much and I thought 'Where to get lentils in our area?'.

Here, they are not used to produce lentils. And where to get spinach?

The stickers [on the posters] *are not only related to the salt-tolerance."*

Quote 4.6 – German participant

Guidelines for research on saline agriculture

Throughout the workshop on salt-tolerant crops, participants communicated their concerns on saline agriculture. This practice-oriented discussion uncovered important barriers and opportunities. Here, this discussion is summarized in guidelines for research on saline agriculture.

Guideline 1: A need for research on (local) salinization!

Although session two concentrated on the saline agriculture rather than the occurrence of salinization, the latter was frequently discussed. Participants stressed that they currently experience only a minor level of salinization. Contrary to other climate challenges such as droughts and floods, they have no experience with salinization. In short, the workshop clarified that salinization is not an acute problem in many parts of the North Sea Region. Hence, participants frequently mentioned the need to know more about salinization in their area.

"Climate change is for the moment a bigger issue than salinization.

We don't know for the moment because there is not much experience in it.

Does it have an impact on our way of farming?

I think that climate change is something that we feel, that we experience.

Salinization is something that comes but that we don't feel directly. (…) It's a slow thing."

Quote 4.7 – Flemish farmer

Guideline 2: Salinization is not an acute problem, but research on the saline solution is urgent!

The first guideline, however, mustn't be interpreted as an argument to postpone the research on saline agriculture. Throughout the workshop the participants frequently cited that the development of new salt-tolerant varieties is slow. Hence, research on the salt-tolerance of crops is urgent although the salinization is not acute. In particular, the participants expressed that the road from the laboratory to the field is long. The development of saline agriculture in the North Sea Region isn't limited to academic research on salt-tolerant crops. Once such crops have been developed, they must be commercialized by the seed industry.

"And we have to ask the breeders of the grasses to look into it. We have to shout otherwise….

It takes a lot of time to develop. If we don't ask it now, we don't have it when we need it."

Quote 4.8 – Marc van Rijsselberghe (Salt Farm Foundation)

Guideline 3: Research on salt-tolerant crops that is specific to the North Sea Region.

The farmers' café was integrated in the international Saline Futures conference and, as a result, there were a lot of possibilities for interactions with researchers on saline agriculture from across the world. Some participants, for example, joined sessions of the academic conference and other ones came in contact with the researchers during the coffee breaks. Hence, multiple participants were aware that saline agriculture is a research topic in many parts of the world. They acknowledged that a lot can be learned from this growing international field. They added, however, that there is a need for research

that is specific to the North Sea Region. That research must be oriented to the regional characteristics, including the soil structure of the North Sea Region, its' climate, the day length, and the current local agricultural activities. Moreover, such area-specific research must be undertaken in close cooperation with stakeholders such as seed producers in order to ensure the transposition from theory to practice.

"There are some solutions. But the question is not addressed for Europe.

The question is addressed for the warm climate countries.

They have elephant grass, or buffalo grass, or whatever kind of varieties that we don't want to grow here.

(…) *There are of course quit a few large seed firms.*

If we all ask them to give us a salt tolerant grass, they go: "euhhh…".

Then they start to think about it, and then they select it. It is about getting your question over to them."

Quote 4.9 – Marc van Rijsselberghe (Salt Farm Foundation)

Guideline 4: Salt-tolerance within losing other characteristics.

At multiple occasions the participants stressed research on saline agriculture mustn't lose sight on the other characteristics of crops. Indeed, multiple crop parameters define a farmer's choice, not just the crop's salt-tolerance. Examples are the productivity and digestibility of a variety, the variety's use to improve soil quality and the taste of a variety. As such, the improvement of the salt-tolerance of crops must be balanced against a wide array characteristics. Moreover, the participant highlighted that some characteristics are linked. In particular, they wondered about the link between a plant salt-tolerance and its' soil microbiome.

Guideline 5: Go back in history. Look at the old varieties.

Participants pointed towards history in order to find salt-tolerant varieties. It was often cited that the crops of passed times provide a useful good gene pool. In other words, the old varieties could provide the salt-tolerant genes that are needed in the future. What is more, it was frequently suggested that the salt-tolerance of crops had been lost along the 20th century as breeders focuses on other parameters.

"If we want to have rapeseed again in order to clean the soils and to get rid of the salt.

We have to find the old varieties back. It has to do with a substance that was in the oil.

We breaded that one out and probably we lost the salt-tolerance."

Quote 4.10 – Marc van Rijsselberghe (Salt Farm Foundation)

Guideline 6: Think about crop rotation! We need not one but many salt-tolerant crops.

The participants highlighted at different occasions that the implementation of saline agriculture in the North Sea Region requires the development of 'saline crop rotations'. In other words, researchers need to define sequences of salt-tolerant crops. The farmers stressed that crop rotation is essential in order to avoid overexploitation. For example, the participating arable farmers alternate the cultivation of seed potatoes year 1 with the cultivation of wheat in year 2 and the cultivation of onions or sugar beets in year 3. Likewise, vegetable farmers are bound up by crop rotation, alternation cauliflower, cabbage, leek, etcetera.

"There is a reason that there is rotation. It fits.

It has a reason that you put that (particular) *crop at that* (particular) *time after that* (particular) *crop.*

And it difficult to break that sometimes.

Because some crops you take out of the field much earlier or else you have bad structure.

Or you put them to recover (the soil)*. It always has a reason why you put that crop after that crop."*

Quote 4.11 – Belgian farmer

Guideline 7: Research on the timeframes of the salt tolerance of crops.

The participants mentioned at several occasions that salinization in the North Sea Region is a seasonal rather than a continuous process. In addition, the salt tolerance of a crop or a variety differs greatly throughout the year. Salinization during the germination period can, for example, have a much higher impact on the crops' productivity than salinization during the maturing period. The farmers stressed that such temporal aspects need to be integrated in the research on saline agriculture. They provided the following illustration of timeframes in terms of salinization. Norwegian farmers explained that they sow grass after the summer's harvest. The grasslands near the sea must be sown anew after winter due to aerosol salinization. Hence, they look for a grass variety that is salt-tolerant throughout the winter. Some Belgian farmers, on the other hand, cultivate oats as a secondary crop. These oats are sown at the end of summer, a moment in time that the risk of seepage salinization is particularly high. They are looking for oats that are salt-tolerant in August and September, the germination phase.

Guideline 8: What about animal farming in saline conditions?

Within the North Sea Region there is a high amount of animal husbandry. Many of the NSR farmers currently produce meat or dairy and, as a consequence, future research on saline agriculture must address issues related to animal farming in saline conditions. That includes botanic research on the salt-tolerance of pastures (see section 4.4.1) and the salt-tolerance of fodder crops such as maize. The challenge of animal farming in saline conditions requires the inclusion of animal sciences to explore issues such as the digestibility of saline fodder and its' impact on animal welfare. Many participants voiced concerns about the effect of high salt concentration of fodder on the health of livestock.

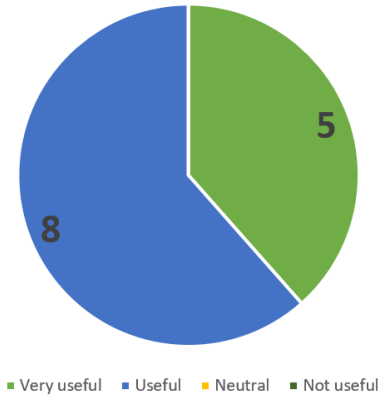
Guideline 9: What about the cultivation of flowers, fertilizer, fuel and fibers?

Building on guideline four, the participants stressed that the concept of saline agriculture mustn't be limited to the production of food and fodder. In the sticker exercise the participants indicated an interest for the cultivation of seaweed and the need for more information on its' potential use as a fertilizer. To a lesser extent, there was an interest for the salt-tolerance of fiber crops such as hemp and flax. The latter is currently an important crop in Belgium. In addition, the participants stressed that farming within the North Sea Region exceeds the cultivation of food and feed. For example, many farmers grow rapeseed to cover the fields during winter. The resulting harvest is processed as an oil or a fuel. In the Netherlands, the cultivation of flowers is an important agricultural sector.

4.5 Evaluation by the participants

In the aftermath of the International Farmers' Café on Salinization and Saline Agriculture an evaluation form (googledocs) was send to all thirty-two participants. This evaluation form was translated to Dutch, German and Norwegian in order to get maximum response. After a reminder a total of 14 persons have responded. Hence there was a response rate of 44 percent.

With regards the plenary session the evaluation form asked the following questions:



How would you rate workshop 2 with inspirer Marc van Rijsselberghe?

The results show that this workshop 2 was highly appreciated by the participants. All participants found the workshop to be either useful or very useful.

5. Excursion to the SalFar test site(s) on the island of Texel

5.1 The goal

The SalFar project develops multiple test sites on saline farming in the North Sea Region. Besides the research activities, the test sites provide an opportunity to demonstrate the potential of saline farming. To that extent, NSR farmers and practitioners are welcome to visit the SalFar test sites and to get some hands-on experience with saline agriculture. The objective of the excursion to the SalFar test site on the island of Texel provided such practice-oriented experience.

5.2 The approach

The excursion took place on Thursday the 12th of September 2019. Apart from the Dutch participants, all participants of the International Farmers' Café (11/09) visited the SalFar test site on the island of Texel. The excursion of the NSR farmers and practitioners merged with the excursion of the researchers that participated in the Saline Futures conference. All farmers got an EC measuring tool, enabling them to measure the salinity level of surface waters as they visited the island. The outline of the excursion can be found in annex 7.2.

5.3 Photo report

Impressions from the visit to the demonstration site of Salt Farm Foundation (SFF) at its' headquarters 'De Boet' (© Wim Van Isacker)

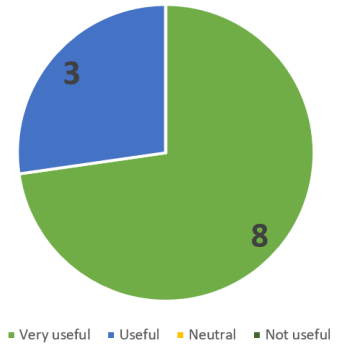

Impressions from the visit to the test facility located at the commercial company Saline Farming (© Wim Van Isacker)


Impressions from the visit to the Prins Hendrikpolder (© Wim Van Isacker)


Farmers measured salinity levels in surface water by using an EC measuring tool (© Wim Van Isacker)

5.4 Photo report

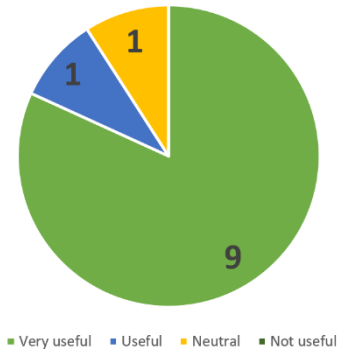
In the aftermath of the International Farmers' Café on Salinization and Saline Agriculture an evaluation form (googledocs) was send to all thirty-two participants. This evaluation form was translated to Dutch, German and Norwegian in order to get maximum response. After a reminder a total of 14 persons have responded. Hence there was a response rate of 44 percent.



With regards the plenary session the evaluation form asked the following questions:

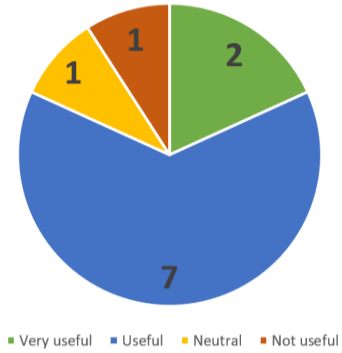
How would you rate the first part of the excursion: visit to the Salt Farm Foundation (the little shed called 'boot' with the small saline garden)?

The results show that this first part of the excursion was extremely high appreciated by the participants. A big majority of the participants found this part of the excursion to be very useful.



How would you rate the second part of the excursion: visit to the test facility of the commercial company Saline Farming?

The results show that this second part of the excursion was extremely high appreciated by the participants. A big majority of the participants found this part of the excursion to be very useful.



How would you rate the third part of the excursion: exploration by bus the island of Texel?

The results show that this third part of the excursion was appreciated by the participants. A big majority of the participants found this part of the excursion to be very useful or useful. Only one participant indicated that this part of the excursion was not useful.

Moreover, we asked the participants a few open questions. These were some of the answers:

Any remarks about the excursion to the test site in Texel? Any suggestions?

"It was really great! The exchange, the whole program, the food, it was really great.

I learned a lot and took a lot home with me. Everyone was very friendly and open.

Thank you very much for your hospitality!"

[translated from German]

"The food on Texel was really wonderful. And that even with the salt plants growing there.

A good idea to draw people's attention to the salt plants and their potential."

[translated from German]

"Too bad I can't speak English, but thank you for the translation."

[translated from Dutch]

"The visit to the test fields was not really oriented towards the different types of plants.

They did explain how the trial was set up, but more information about which plants are better equipped to grow in saline conditions was desirable.."

[translated from Dutch]

"Super good, a lot of exchanges, a lot to see."

[translated from Dutch]

6. Evaluation

In the aftermath of the International Farmers' Café on Salinization and Saline Agriculture an evaluation form (googledocs) was send to all thirty-two participants. This evaluation form was translated to Dutch, German and Norwegian in order to get maximum response. After a reminder a total of 14 persons have responded. Hence there was a response rate of 44 percent.

We asked the participants a few open questions in order to evaluate the event. These were some of the answers:

Why were you interested in participating in this Farmers' Café?

What information did you hope to get out of it?

"Because they have installed measuring instruments at my farm and that gave rise to my interest.

In the polders there has been a ban on irrigation and pumping. Now the reason why has become clearer."

[translated from Dutch]

"As a farmer and a representative for the agricultural sector I am very interested in salinization.

I want to learn how we can counteract or slow down the effects of salinization and preserve freshwater for as long as possible.

Climate change will cause salinization to increase."

[translated from Dutch]

"Even though our coastal region is not yet directly affected by the problem,

I wanted to know what possibilities already exist for managing saline soils.

I also wanted to know to what extent climate change could accelerate the problem."

[translated from German]

"As a dike revee I have to manage the inland waters and I noticed an increasing salination.

I wanted to know how this could happen."

[translated from German]

Did the Farmers' Café satisfy your needs?

"Yes, it was an exciting exchange and it was great to get to know farmers and their experiences in their countries."

[translated from German]

"Yes. A lively exchange was possible. It turned out that many different points of view had to be taken into account."

[translated from German]

"It was insightful to talk to people from another region/country about their specific situation.

For me this is of great added value. It is good to be able to talk about specific problems on a practical level."

[translated from Dutch]

"It was well organized in an interactive way.

Especially the conversations with the other farmers during the day brought new insights.

For me the 'cafe' was mostly a vessel for networking."

[translated from Dutch]

Were the goals of the International Farmers' Café clear to you?

"Yes, I understood that a bridge had to be built between theory and practice.

And that the café wanted to hear why farmers are interested in the subject of salinization."

[translated from German]

"Not really. But that wasn't bad, because I came to Leeuwarden with completely open expectations."

[translated from German]

"Yes. Discussing and learning about salinization."

[translated from Dutch]

"A Dutch explanatory text would have been helpful to me."

[translated from Dutch]

Have you learned anything about salinization? If yes, can you please elaborate?

"How salinization affects the soil structure.

That salinization will become an ever-increasing problem and that research can offer a solution to it now and in the future."

[translated from Dutch]

"That this is a very specific problem for the coastal regions.

That we, as farmers, do not sufficiently recognise this as a problem so far.."

[translated from Dutch]

"Salinization affects many regions for which special solutions have to be found because the situations are very different."

[translated from German]

"That salinization is a serious problem from a global point of view. There is a worldwide interest in the topic and still a lot of research to be done.."

[translated from German]

Have you adjusted your views on possible salinization strategies? If yes, can you please elaborate?

"The necessity for salt-tolerant crops strongly differs per region.

There is a need for more bridges between knowledge, regulations, entrepreneurs.

And an overarching approach is desirable.."

[translated from Dutch]

"This is the story of someone who is looking for solutions to this problem.

It is an opportunity to turn a bad situation into something good.

We shouldn't be longing for it, but let's say that we experience it ourselves in all its intensity,

then there is the chance to still develop an alternative business management.."

[translated from Dutch]

"That with modified plants agriculture is possible in the future in such saline places."

[translated from German]

"We must prepare ourselves for the increasing salinization and come to terms with its effects, e.g. on plants.

In addition, we must also see the positive aspects of salinization, e.g. that some plants taste even better as a result."

[translated from German]

Where do you see (potential) opportunities or barriers to applying what you learned to your company?

"The supply and demand will play an important role in the breakthrough of saline crops.

Promotional campaigns may help to develop saline farming."

[translated from Dutch]

"We grow on clay soils and the loose their structure as a result of salt.

This doesn't occur in sandy soils. We are working on the 'fresh on salt' programme

and we see this as an opportunity to take a proactive approach to salinisation."

[translated from Dutch]

"I see obstacles in making people understand at an early stage that the issue of salination needs to be addressed.

I see opportunities in the new water filter machines that we saw at Texel."

[translated from German]

"The issue of salinization is not yet a real one in Europe.

The conference and the broad participation will raise awareness of the forthcoming problem."

[translated from German]

7. Annexes

The program of the International Farmers' Café on Salinization and Saline Agriculture

Wednesday, Sept 11th – Introduction to saline agriculture and workshops Applied University VHL in Leeuwarden (Agora 1, 8934 Leeuwarden), Room S.110	
13.00 - 14.00	**Lunch**, an occasion to get to know farmers, agricultural advisors, policy workers and other practitioners from across the North Sea Region
14.00 - 14.20	**A word of welcome and practical information** - A word of welcome by prof. Pier Vellinga (chair of the Saline Futures conference) - Practical information on the international farmers cafés by Jeroen De Waegemaeker (ILVO) - Video on the SalFar framework on salinization processes
14.20 - 14.40	**Salinization: A challenge for farming.** - Presentation by Tineke De Vries (Potato Valley, the Netherlands) - Q&A with the audience
14.40 - 15.00	**Food for thought**! Two brief presentations (10min) on salinization and saline agriculture prior to the interactive workshops - '***The ABC of saline soils***. *And introduction to the impact of salinization on soils.'* by Åsgeir Almås (NIMBU, Norway) and Ian Gould (Lincoln University, the United Kingdom) - '***Forty years of saline farming in Texel***. *Learning from mistakes and successes throughout the years.'* by Marc van Rijsselberghe (Salt Farm Foundation, the Netherlands)
15.00 - 15.30	**Coffee break**
15.30 - 17.30	**Interactive workshops on salinization and saline agriculture.** Two consecutive rounds of two parallel sessions Round 1 (15:30-16:20) and round 2 (16:30-17:20) Session 1 – **The impact of salinization on soils, plant growth and agricultural livability.** Inspirer: Åsgeir Almås and Ian Gould Session 2 – **The salt-tolerance of agricultural crops and the potential of saline farming in the North Sea Region**. Inspirer: Marc van Rijsselberghe
17.30 - 18.30	**A message from the farming community to science.** At the closing session of the Saline Futures conference, farmers and practitioners get to communicate their main concerns about salinization and their expectations for saline farming to the world of science.
19.30 - 22.00	**Saline dinner**

Thursday, Sept 12th – Excursions to the SalFar test sites Salt Farm Foundation (Mokweg 41, 1797 SB Den Hoorn Texel)	
08.00 - 17.00	**Salt Farm Foundation** (SFF) is established for sharing knowledge on saline agriculture with small-scale farmers worldwide, in an effort to find solutions to salinization and to improve food security, with minimal impact on already scarce fresh water supplies **Located on the Dutch Waddenisland of Texel**, the organization invites you to visit sites related to saline agriculture.

Outline of the excursion to the SalFar test site on the island of Texel

The text below summarizes the outline of the excursion to Texel. It was provided to all participants of the excursion, both the farmers and practitioners as well as researchers:

Salt Farm Foundation (SFF) Texel is established for sharing knowledge on saline agriculture with small-scale farmers worldwide, in an effort to combat salinization, save freshwater supplies, and improve food security. Located on the island Texel, the organization invites you to visit sites related to saline agriculture. You will visit the headquarters of SFF at "De Boet", a former sheep shed. To start with, we will show you the demo field, where different plants are growing on clay soil, irrigated with salt water. Secondly, you will visit the test facility located at the commercial company "Saline Farming b.v.", where research is being done on various aspects of salinization and salt water irrigation related to growth and quality of crops and halophytes. At the open-air lab, fresh water and seawater can be mixed into any desired salt concentration. Root zone salinity is carefully monitored by means of sensors and frequent sampling. In this way, it is possible to (re)define the salt tolerance of crops and identify salt tolerant varieties. Their scientists will guide you around the recent experiments conducted on the field. Then we will take you to the Prins Hendrikpolder where you will see an innovative concept of reinforcing dikes. Sand dunes, mud flats and salt marshes form a new natural landscape as a barrier between the land and the sea. Surrounded by the Northsea, the island Texel fully depends on rainwater and seepage from the dunes. Long periods of drought forced the inhabitants to look for new solutions, like the so called fresh weir, designed to hold fresh water and drain brackish and salt water. Following the old dike, you will pass through the fishing village and historical maritime port of Oudeschild and inland bird reserves, on the way to the Polder Wassenaar in the north of the island. At this site, a tunnel in the dike allows the seawater to come in, tests conducted with farming shellfish inland showed that they grow twice as fast as compared to their usual habitat. The model can be replicated to cultivate shellfish and seaweed in areas where there is no possibility to get freshwater for growing crops.