**Appendix 7 Opportunities & barriers to cranberry cultivation in the Netherlands – English translation**

***Opportunities and difficulties for the cranberry – can there be a role for cranberry picking or cultivation in the intended Amsterdam Wetlands?***

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**Reading tip:**

On pages 1 to 4 you will find Purpose, general conclusions, the cause, research questions and results of the field research.

On pages 5 to 12 I describe the field research, in order to substantiate the results/the vision of the future

On p. 13 to 16 there are thoughts about the future of cranberry on peat, based on the results.

After page 16 according to six appendices with description, visit to the Krimpenerwaard and Terschelling and various background articles.

*Gin met cranberry*

**Purpose of the field study**

Gain experience with cranberry cultivation on peat, as one of the possibilities for wet cultivation on peat (paludiculture), especially relevant if the plans go ahead to rewet the peatlands around Amsterdam as 'Amsterdam Wetlands'. Also interesting for other peat meadow areas that are thinking about rewetting.

**General conclusion of the field study**

Cranberry can grow well in the Netherlands, we already knew that from the Wadden Sea, but it is much less known that it also grows (too) well in the Ilperveld. The results of this field research show that naturally grown cranberries that grow wild in the Ilperveld in combination with peat moss can be sod-down and replanted. Peat moss seems to be the ideal combination, because moisture is well retained all year round. Even in the ridiculously dry summer of 2018, the peated plants survived and there was even some harvest (albeit minimal). 2

Strangely enough, this seems to be at odds with the results of other cultivation experiments, there is no successful large cranberry company anywhere yet. The most common complaint in cultivation attempts is 'weed pressure', on Terschelling 'overgrowth', which means the same thing. On Terschelling, the cause of this seems to be succession: the soil becomes too dry and nutrient-rich, so that stronger species, especially grass species but also trefoil, get the cranberry 'underneath'. They try to do something about this by cutting off and starting over, in Peat Meadow area this does not seem like a good option to me.

For livestock farmers from the peat meadow area around Amsterdam and in the Green Heart, cranberry cultivation may be too complicated and too commercially uncertain. However, I certainly see opportunities, because it is more than cattail or other paludiculture that is very appealing to city dwellers, who live near the intended 'Amsterdam Wetlands', which allows for a relatively high yield through self-picking. In that case, however, the province must make land/land available where nature and cultivation can go hand in hand. Combating the cranberry as an undesirable exotic species is now standing in the way of this. Economic thinking is also a problem. Thinking in terms of kilos per hectare and adjusting the lease price and business operations accordingly.

**In short**: I see every reason for further and larger-scale experimentation with cranberries in the 'Amsterdam Wetlands' region.

**The reason**

In September 2017 I started the 'Urban Agriculture' course at the Warmonderhof in Dronten and part of it was an internship at the fruit farm with Wil and Lisan Sturkenboom in Amsterdam West. Interns were paired with a fruit crop and I chose blueberries and cranberries, mainly because I really like the berries and everything that is made from them.

It soon became clear that I had chosen an outsider, since both crops require a low PH and can therefore only be grown on the farm in containers with special (acidic) soil. When I went to inspect the containers (Sept 2017) it turned out that the five containers with cranberry only contained a dead mat, remnants of what were once strong plants. Elsewhere in the orchard (less wind/more shade/irrigation) the cranberry was still alive in the tanks, but the tanks themselves had completely fallen apart (more moisture/less wind). In all containers (dead or alive) the cranberry was overgrown by weeds, which may be another reason that the cranberry was not doing so well on the roof. My conclusion was: cranberries cannot survive if the top soil is too dry and lose out to grass and other strong growing weeds. I became more and more curious and started looking for cranberry cultivation in the Netherlands. This didn't really seem to exist on a large scale outside of the Wadden Islands. This is remarkable, because I found a WUR publication from 2007 on the internet, http://edepot.wur.nl/18257 in which the possibilities were judged very positively. I also found a test farm in Friesland and test tanks in Zegveld and a cultivation manual from Aeres from 2008, http://edepot.wur.nl/134070.

I then went to Zegveld to have a look, talked to a number of people who were researching cranberries as a possible cultivation on wet peat. These experiments are the result of the discussion about the water level in peat meadow areas, which causes about 1 cm of the peat to literally disappear into the air (as CO2) every year, one meter per century. That is why people are diligently looking for alternative crops to grass/pasture. In addition to being a cranberry lover, I am also a climate coach, so the combination really appealed to me. Moreover, I live in Amsterdam in the middle of the peat meadow area: the Waterland to the north of the city and south of the city of Amstelland, 't Gein and below that the rest of the Green Heart. During my visit to the peat meadow innovation center (VIC and KTC) I got into a conversation with someone who told me about wildly growing cranberries in the Ilperveld and a project in the Krimpenerwaard that was overgrown by grass and other weeds. The test plots in Zegveld were not so successful, cranberry was not really seen as an option for wet cultivation on peat. The only 'successful' trial plot was cranberry planted in foil. 3

But in the Ilperveld it worked, automatically. He didn't know the ins and outs of it and was curious about the circumstances. So did I, and I decided to investigate it further as part of my internship in fruit cultivation and reported to the Ilperveld.

**Research questions (partly formulated in advance, partly during the field research)**

- Are there any examples of successful organic cranberry cultivation in the Netherlands?

- Why is cranberry cultivation moderately successful in the experiments I know, or is that yet to come?

- Why does the cranberry apparently grow spontaneously on the Wadden Sea and the Ilperveld?

- Is 'natural cultivation', making use of the natural environment where cranberries do grow, an option for cranberry cultivation in peat meadow areas?

- Is it possible to sow the 'Ilperveld cranberry' and use it as planting material to grow cranberry on wet peat?

- How wet can it be, will the sods survive a high water level?

- Are carrots cut out sods sufficient?

- Are there runners?

- Do you already have berries in the first year with this method?

- Are these good quality berries?

- How many weeds grow at different water levels (and how much time did it take to remove them)?

- Is it better to work with cultivated and well-known varieties of cranberry, as recommended in the WUR report, or can it be done just as well with the 'wild' material from the Ilperveld?

- Is there any information about the best time to sod?

- What pests/diseases threaten the cranberry?

- Is there a revenue model for the Ilperveld, the Fruittuin van West or a new entrepreneur/company somewhere in the a.s. 'Amsterdam Wetlands?

- Is cranberry cultivation a possible contribution to the rewetting or even raising of the peat?

**Test tanks in the Ilperveld and the results**

In the Ilperveld, I received permission and cooperation to sod and plant 'wild-growing' cranberries at two locations in four test plots that had previously been constructed for an experiment with the cultivation of peat moss. At the same time, I collected the surviving cranberry from various containers at the Fruittuin van West.

The sodging of wild cranberry from the Ilperveld is easy to do, whether this can also be done on a large scale/machine has not been researched by me. The peat moss that lasts by itself offers perfect protection for the roots and a fantastic 'sponge' that keeps the crop moist. Planting is even simpler, I just put it on the bare peat bottom. Because I have planted and followed different containers with different soil/weeding and mowing management/planting material (see diagram below) and have been able to compare them with the containers with cranberry at the fruit garden of west, it has become clear what the **success factors** are:

- Start on moist bare peat soil (in my case at the beginning of December, after the harvest)

- PH 5.5 or lower (Ilperveld 5.5 compared to Fruittuin van West 5 in the containers)

- High water level (up to ground level or 10 cm below), both in winter and summer

- Little competition from grass or other strong growing weeds

- Symbiosis with peat moss seems to be a big plus: retains moisture and suppresses weeds. Then the conditions must also be optimal for the cultivation of peat moss, for example, watering can only be done with rainwater, ditch water quickly has too high a PH.

- Reeds are not a problem, but must be mowed and removed (2x per year)

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The transplantation of cranberries into the 'turf containers' in the Ilperveld was quite successful. I put the moss/cranberry pollen on the black peat, where only pitrus and reeds grew. Partly I left this, partly I pulled out some piles of reeds and pitrus to make room. The cranberry pollen has become nice and thick and green in the summer, the first berries could be harvested after the summer (a handful per container), the cranberries made runners and the peat moss made beautiful green pollen.

In June 2018, it turned out that the cranberry that was planted in containers with a top layer of clay and a lower water level did much worse. The peat moss with which it had been peated was dead. Grass and thistles won out, even in the tank that had received the most care (watering and weeding). There are now (March 2019) only a few blades left.

The peat and transplanted cranberry at the Fruittuin van West from the deep containers to (shallow) leaf trays went fine, but there was a lot more weeding and watering needed (weekly), Unfortunately they didn't get any attention after I left there in July 2018 and the plants dried up and ran into weeds. In August 2018, they were piled up and put in a parking lot without any kind of care. Funnily enough, this has made it clear what is needed: the lower containers dried out and the cranberry died, the upper ones remained wet and despite the increasing weed pressure, live plants can still be found there.

**Other outcomes**

During the period of the field research I also visited other places where cranberries grow and spoke to people there, including at the VIC in Zegveld, at three places on Terschelling (a nursery, a wild place, a place where they try to promote the growth of cranberry through management) The company in the Krimpenerwaard, a farmer near Wilnis under Amsterdam (who also came to have a look at the test tanks in the Ilperveld and on the field itself. I also attended a meeting in Feb 2019 in Broek in Waterland about the future of the peat meadow area and 'Amsterdam Wetlands'. In June 2018, the plan was already published to transform the area north of Amsterdam into 'Amsterdam Wetlands', 12000 hectares of nature and wet crops.

This provided insight into the dilemmas that play a role and that may also be an obstacle to further cranberry cultivation. It seems that the revenue model in a traditional agricultural setting is difficult. It requires years of investment and – more importantly – water management, which is very difficult or even impossible in our country. Nature-inclusive cultivation, or picking in a nature reserve (such as on Terschelling) is problematic because the cranberry is classified as an exotic species, because it only entered the Netherlands after 1492. It is certainly not an invasive exotic, but land managers or farmers receive negative advice from the province when it comes to cranberry, especially in areas that are interesting in terms of natural value (open, moist/wet, poor soils) the cranberry also does well. On Terschelling, the Forestry Commission and the pickers are working together, but that is becoming increasingly problematic. The cranberry is mainly preserved because of its cultural history and a local economy that has existed for more than a hundred years. 5

**Properties of the cranberry that are important for this research**

Quite a few Dutch people think that cranberries are a typical dune plant that grows on sand, but that is not the case. Cranberry grows well on acidic and soggy peat, with a low PH (5.5, preferably lower). On Terschelling, you will find these conditions in fens at the foot of the dunes. Plants take about 3-4 years before the first berries can be harvested: first cuttings have to be taken from existing plants, the first year after transplanting these cuttings will make 'runners': long shoots that each take root on their own. The following year, runners grow on the runners, which bloom a soft purple in June and start to form berries in July, from September (depending on the species also later) the red berries are ripe. They remain fresh and harvestable for more than a month when ripe on the bush. Only after a few years does the mat deliver optimal yields. The advantage is that plants can stay in the same area for a long time. Fertilization on peat does not seem necessary, poor soil is even better (so that is an advantage of the poor dune soil as a substrate). It is recommended to sprinkle some sand over the plants every year, which is especially necessary as a weed suppressant and to allow new runners to take root. It seems that this is not necessary if there is a combination with peat moss on wet peat.

Sufficient water is especially important because the plants have shallow roots. A permanently damp surface is necessary. The cranberry can even be completely submerged between picking and flowering. This does not seem necessary for the plant, the advantage is that many competing weeds do not survive and the cranberry does.

Originally from the US, the berry is larger than comparable cranberry or lingonberry from Europe, making it more interesting to grow. In the US and Canada it is an industrial crop and entire fields are flooded to harvest the berries on a large scale, it can also be done on a smaller scale/dry with a comb.

Cranberry seems to be easy to propagate, I heard that in Latvia or Lithuania, where a lot of cranberry grows, it is propagated by chopping the cranberry with soil and all and this chopped soil with pieces of cranberry plant in it is simply spread in new places. Logical, because the runners quickly form roots.

- https://nl.wikihow.com/Cranberry%27s-kweken

- https://www.besnederland.nl/teelt-oogst/

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*Cranberry harvest in the U.S.*

**Why grow cranberry on peat?**

* + - Current agriculture on the peat meadow areas is seen as unsustainable. In most areas, meadows are mowed or grazed. To make this possible, the water level is kept artificially low. The peat settles and oxidizes, which causes enormous CO2 emissions. I have even heard cattle breeding on peat meadows referred to as 'a dead end'. The proposal for the climate agreement on agriculture and land use (10 July 2018) includes the rewetting of peat meadows. Innovation and the search for alternatives is therefore very topical. o https://www.veenweiden.nl/portfolio-view/veenweiden-en-klimaat/
	+ The https://www.boerderij.nl/Home/Achtergrond/2017/12/Boer-moet-aan-de-slag-met-veen-220402E/
	+ The https://www.trouw.nl/opinie/c02-reductie-vergeet-het-veen-niet~a6b25dc4/
	+ The https://www.landschapnoordholland.nl/sites/default/files/download/onderzoek%20%26amp%3B%20databeheer/rapport%20vernatting%20voor%20veenbehoud.pdf
	+ The https://www.klimaatakkoord.nl/landbouw-en-landgebruik/documenten/publicaties/2018/07/10/hoofdlijnen-landbouw-en-landgebruik
	+ The http://www.b-ware.eu/sites/default/files/publicaties/Fritz%20et%20al%202014%20Paludicultuur%20VNBL.pdf
	+ - Cranberry is a tasty and healthy 'superfood' for which there is more demand than supply in the Netherlands, as a tour of the organic fair among the sellers of cranberry products shows.
	+ - Cranberry is still very rarely grown organically (only 5% of the total), so there are certainly opportunities there: oh http://www.biojournaal.nl/artikel/27160/VS-Kansen-voor-cranberry-telers-na-magere-oogst-in-Canada
	+ The https://www.biokennis.org/nl/biokennis/showdossier/Cranberryteelt-biedt-perspectief-1.htm
	+ - In the Ilperveld, the cranberry has spontaneously started to grow on the wet peat, possibly released or berries have ended up there by birds. Opinions are still divided on whether or not birds eat cranberries. There are now two large fields of cranberry, which are considered an unwanted, invasive species by the owner, Noord-Hollands Landschap, which does not contribute to the ecosystem. However, control is difficult. (This has been published) It is possible that there are different types of berries. What is certain is that the species(s) that have caught on are doing extremely well, too well, it is not easy to control.

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**Experiences elsewhere in NL**

**Zegveld:** In October 2017 I visited the trial fields in Zegveld. These were relatively small sections (approx. 10-20 m2) cut out into existing meadows. Experiments were carried out on how to deal with weed pressure. There was actually only a field grown on agricultural plastic that could be called successful. However, this does not seem to me to be a solution for cranberry cultivation, because the runners will not be able to root. However, it was the only way to counteract weed pressure without constant manual weeding. Berry formation wasn't there (yet?) anyway. The test fields were at least high and not very wet, stuck out in the meadow. There had also been experiments in barrels with different water levels. I don't know the outcome, but the cranberry is not seen in Zegveld as a good option for wet cultivation on peat, weed pressure is too great and time to first harvest is too long.

**Texel:** In Texel, Jan Buijs of Crantex is busy with the cultivation, I have been in contact a number of times, but due to personal circumstances he had to cancel a planned visit to the company this spring.

**Krimpenerwaard:** On April 24, 2018 I visited the Krimpenerwaard, where Bart Crouwers of Cranberry Company is working on organic cultivation on 10 ha of peat meadow land, he has planted 400,000 plants (cuttings and cultivated for him by IBN (https://www.ibn.nl/kwekerijen/ ) and is in his second year. He hopes to have a modest first harvest this year (report attached), he has a lot of contact with a university in the US, who find organic cultivation very interesting. This is mainly because the frequent use of pesticides is making it increasingly difficult for cultivation in the US, planting material is contaminated and diseases and pests are becoming increasingly difficult to control.

**Terschelling:** I only went to Terschelling in March 2019 and I was immediately able to study cranberry in three places and I spoke to several people, report in the attachment.

**Friesland** 'De Cranberryhoeve' in Hoeve, Friesland. This is a pilot farm that worked closely with WUR on the 2009 report and is also working with Bestberry (Dalfsen), which supplies planting material. Getting in touch with this company was extremely difficult and was ultimately limited to a phone call in September 2018. From that I understood that the dry summer had caused a lot of damage and there was nothing to see. Remarkable, because Terschelling had a bumper harvest in September 2018.

The conversation revealed that people in Friesland thought that the cranberry should grow on (dry) raised bogs or on sandy soil. The WUR's 2009 cultivation manual also states that the cranberry should not be too wet, because the rooting will then become too shallow. A strange idea in my opinion, when you see how the cranberry in the Ilperveld thrives on moist peat moss. This idea may have blown over from the US, where the weeds are simply sprayed to death. 8

**Start project Ilperveld december 2017**

At the beginning of December 2017, NH-landschap (Jelle Abma) will make 4 3x3 cultivation sections available at the visitor centre in the Ilperveld, numbers 26, 28, 13 and 16

- Two plots with a high water level (13 and 16), where sphagnum moss and cattail also grow, which must continue to grow there, water level 10 cm below ground level or higher. Never completely submerged.

- One plot with a changeable water level (26), we start with high water level and see if it is necessary to lower the water level in the summer.

- One plot (28) with a low water level (20-30 cm below ground level, top layer of clay), it is expected that a lot of weeds will grow there.

Planting material: cranberry pollen (cranberry plants in peat moss) has been harvested from two locations, 'The third grove' where they make large pollen, between tall growing reeds (in the scheme 'pollen'). We did this with shovels, which was very heavy. Then with the 'chop' cranberry I ploughed in the second bunch (in the scheme called 'turf'). This was a part where the cranberry had been mowed, the cranberry had also been 'shaved'. With the heel, sodging was quick and easy. The question was whether this would be at the expense of growth, because more roots might be damaged. There were still berries on pollen and sods.

**Soil**

PH measured in all plots on the Ilperveld with a simple test (tablets garden center) According to this test, PH is between 5 and 6, suitable for cranberry

Suddenly, 13 and 18, the subsoil is black peat and damp, flattened, therefore below ground level, in adjacent similar areas healthy peat moss grows here and there

Suddenly, 26 and 28, the subsoil is not flattened, clayey, ground level, dries quickly. Watered with rainwater that has been collected locally. First only in plot 28, later also in plot 26.

Ilperveld: soil in the containers (specially purchased for blueberry cultivation) has a pH of around 5, in the marshy reed bed, which would be very suitable in terms of humidity and subsoil (black/peaty), 7 or higher.

*Ilperveld plot 26 manually flooded* 9

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| **Overview of the results per plot:** path  | Plot 26: 50% pollen/50% mowed field A lot of weed (grass/pitrus/field thistle) Watered regularly and flooded, but the water level drops immediately due to draining compartments. May 21, and July 2, mowed all weeds at about 15 cm. Then stopped mowing/weeding July 16: sphagnum moss dead/cranberry almost gone; soil dry. Sept 2018 – March 2019: ditto  |
| Plot 28: 100% pollen Lots of grass, also other weeds Lightly weeded (grass/pitrus/field thistle) Left alone on May 21, watered 2 July: cranberry still alive in two places, peat moss appears to be dead; soil dry. Sept 2018 – March 2019, soil moister, cranberry seems to be recovering slightly  |
| Plot 13: 100% garments May 21 not mowed Stays moist, even on May 21st. No grass, but reeds and pitrus. Lightly weeded (field thistle/pitrus) July 16: large healthy pollen; Peat moss and cranberry are doing well, a large part has flowered, occupation. Ground still soaking wet Sept: Handful of berries harvested, especially at the bottom of the bushes. It looks like berries at the top have been eaten by birds. Soil well wet. March 2019: Healthy shrubs and healthy green sphagnum moss  |
| Plot 18: 80% pollen/20% sods Mowed on May 21 at about 15 cm No grass, but reeds and pitrus Lightly weeded (field thistle/pitrus) July 16: large healthy pollen; Peat moss and cranberry are doing well, a large part has flowered, occupation, but all a little less than in plot 13 Ground still soaking wet. September: harvest of a smaller hand than plot 13. Plants and moss healthy, possibly a little less than plot 13 March 2019: healthy shrubs and healthy green peat moss  |