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The Netherlands, Seaweed

The Netherlands: Part from meat to discover the weed

Our planet will count approximately 30 percent more inhabitants in the year 2050. (Editors (1)) This means we will have to feed more than nine billion people. (Lenskens, 2017) Because the average consumption increases, the production of food must rise with 70 percent in order to account for this increasing need of food. (Voeselek, 2016) According to researchers, we will have a serious issue in 40 years from now. These researchers state that food production on a global level will be limited by a deficiency of available land, water and energy for the first time in history. Therefore, new methods to meet the global food demand must be established with a focus on sustainability.

The issue regarding the global shortage of food hinges on protein. The quantity of meat consumed by western countries has the biggest impact. Meat is an important part of the western diet. (Boom, 2016) Many important nutrients can be found in meat, e.g. protein, essential fats, minerals and vitamins. Currently, average western meat consumption will not only have a great impact on the global food shortage, but also carries some serious health risks. Examples of these risks are higher chance of getting cancer, bird flu and swine flu

Since the world population keeps increasing rapidly, food production will have to adapt accordingly. (Den Braber, 2017) This is, however, far from easy, considering the increased land usage by a larger population. When increasing the food production on land is no longer a feasible option, there are in essence two options to consider: either start using vertical space or use the most unused space on earth: the ocean. Seaweed is considered one of the various solutions for the global food shortage. It contains high values of protein and can be cultivated in a sustainable manner. Seaweed can grow perfectly fine in oceans and seas, where no competition for scarce agricultural lands exists. The question now is: 'Is seaweed actually sufficiently nutritious and are consumers willing to make it part of their diets?'

The main requirement for seaweed to be able to grow, is the availability of salt water. One of the countries that is connected with kilometres to the sea, is the Netherlands. The first thing that comes in mind is probably a small, rich country. Circa 17 million people live on 41.543 sq km in the Netherlands. The country is a constitutional monarchy since 1815 and also a parliamentary democracy since 1948. (Editors (2)) The Netherlands is a world leader in agriculture: It's the globe's number two exporter of food as measured by value, second only to the United States, which has 270 times its landmass. (Viviano, 2017). The major exports of the Netherlands are fruits and vegetables including potatoes. 50 percent of Dutch farms are under 20 hectares. You can compare this to 30 soccer fields. The Netherlands has a mild, maritime climate. Summers are generally warm with colder, rainy periods. Winters can be cold, windy, with rain and some snow. Hot weather and extreme cold are rare.

The average family size in the Netherlands is clearly lower than in other countries. In the Netherlands size of an average household was 2.16 persons in 2017. (Editors, 2018) Families get their food in the supermarket. Breakfast usually consists of sliced bread with toppings such as cheese, cold meats, jam, chocolate spread of sweet sprinkles. Lunch consists of a sandwich with brown bread and the same toppings. Many families eating dinner as early as 5 or 6 pm. The meal often consists of meat, two vegetables and potatoes. Dinner is often followed by a dessert or fruit or yoghurt. Most people drink some milk at breakfast and lunchtime and some water at dinnertime. The Netherlands has an excellent healthcare system available to all. The standard of medical care is high.. The country is home of some of the world's biggest multinational companies such as Heineken, Unilever, Philips and Shell.

The global food problem consists of the lack of food provision for the earth's population. (Editors (3)) By 2050 there will be at least 9 billion people on the planet so the production of food must rise with 70 percent. Many Dutch people do not consume their recommended weekly portion of meat, but much more. The difference between plant and animal products is high. (Editors (4)) Fruits, vegetables and potatoes have a 4 percent share in total land use and 20 percent in greenhouse gas emissions. Beef causes 70 times more greenhouse gas emissions than the same weight in carrots. Because of the scarce farmland in the world food will become more expensive and over meat consumption causes health risks such as cancer, bird flu and swine fever.

It is obvious that something has to change. Considering the nutritional values of seaweed, it makes for an excellent replacement for meat. Seaweed contains an average of 13.6% protein, a substance now mostly acquired from meat. However, before seaweed can be consumed on large scale, the production needs to be optimized and expanded. Research has to be done in order to be able to achieve this optimization. Examples of factors influencing production efficiency are light intensity, temperature and wavelengths, which determine the colours of the light used to grow the seaweed.

For our research, we did an experiment and divided the experiment in three parts. We studied *Ulva Lactuca*, a seaweed specie, because this specie is a great substitute for meat and *Ulva Lactuca* grows in our homeland The Netherlands. We let *Ulva Lactuca* grow by different temperatures, light colours (red, blue and white) and light intensities. We observed our seaweed for 21 days. The conclusions of our experiment were that the surface growth of the samples was the biggest by the light intensity of 14 kilolux. By the experiment with different temperatures. There was no clear conclusion because most of the samples died. The temperature in the water bath was too high. By the experiment with different light colours was the conclusion that light with a wavelength of 690 nm, red light, is the best option for the maximum growth of the seaweed samples.

To integrate seaweed into the diet of western people, different aspects should be taken into consideration: consumption and production. When the demand of seaweed increases, the production should also increase. But first the consumers. It is necessary to make the consumer conscious of the problems/challenges we are facing in the world. The world population keeps increasing rapidly, so the demand of food production too. It is important that people adjust their diet and keep in mind that the next generation needs enough food too. There are different initiatives to solve the food problem, for example eating insects and city farming. These are wonderful initiatives, but not enough yet. Seaweed contains a large quantity of proteins and it grows very fast and easy. The highly decreased need for usage of agricultural land is the main advantage of seaweed compared to other sources of food.

It is important to create a positive perception among consumers about the consumption of seaweed. Then the consumer will accept seaweed as meat substitute into its diet. There must be a change within the diet of the western people. Seaweed should have a bigger role in this western diet, which is currently based around 'non-sustainable' foods like meat. This change in habit can be supported by chains of supermarkets and restaurants. Also, the media can be an active participant in promoting seaweed as being a favourable dietary option. A small article in a popular magazine can make a difference. It provides more knowledge about the product and it decreases the threshold to give seaweed a try. Enthusiasm about the product is meaningful and can be distributed between different people. The first step is not difficult and it is everyone's responsibility. The first step can still be made today. The only thing you have to do is go to the local supermarket, pick up the product and put it in your shopping basket. It is that easy to eat sustainable products.

If the demand for seaweed increases, the production will have to adapt accordingly. It is of uttermost importance that the production is conducted in a safe and sustainable manner, to prevent the marine ecosystems from being harmed. Therefore, solid regulations must be implemented with strict supervision, to ensure the production is executed in the appropriate way. Besides this, the government must stimulate young professionals, who are interested in starting a business in seaweed. The current legislation will have to be changed so it becomes more easy to start up a business. Subsidies will have to be granted for these young professionals. These subsidies makes it more attractive to start a

business in seaweed. The government must realize how major the benefits of seaweed are. It is important to educate entrepreneurs about seaweed, so they can optimize the production of seaweed and guarantee food safety. The first step is in hands of the government, which has to reserve more money for and invest more in this modern sector. It is time to take action now before it is too late.

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