

INDUSTRY ARTICLE

August 2019

Climate change smells like grapefruit

It is and remains an uncomfortable truth: climate change is real. For Germany's hop growers it means having to grapple with more heat and less water, for example. In this context, there is a need for technology, government policy, and last but not least, the goodwill of brewers and beer drinkers. In the BrauBeviale Forum on the morning of the last day of the fair on 14 November 2019, renowned industry players will discuss the possible impact of climate change on malting barley, hops and water resources.

So what's going on here? These days, when Lukas Locher looks at his hop fields, which are literally in full bloom and reaching magnificently into the blue skies above Tett nang, then it's a question that really needs to be asked. So what was all that about record-breaking heatwaves and horrific droughts, 21st-century aridity, crop failures and terrible times for agriculture? Not this year at least: "If I could just book the summer of 2019 just as it was for the next ten years I would sign the contract immediately," says the young hop grower. But naturally, he also knows that the summer of 2019 was mere chance. And he remembers the summer of 2018 very clearly: "At this same point in time then we were shaking in our boots." It was so hot for so long. And no rain in sight. "To be honest, even this year in spring, when it was unusually dry, we got pretty anxious." But then came the showers, moderate thunderstorms and beautiful steady rain. Weather just as it should be. And, Lukas Locher is sure, what it won't be like in the long term. Climate change, which is increasingly bringing extreme weather even to where he is in the Lake Constance area, is an undeniable fact. And for him, a young hop grower at the beginning of his career, probably the greatest challenge.

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Measurable changes call for new methods

The German Meteorological Service reports that the average annual temperatures in German hop growing regions have risen by 1.5 degrees since the end of the 19th century and are set to rise by another 1 to 1.5 degrees by 2050. In addition, there is a trend towards more infrequent but heavier rainfall. Dry soil cannot absorb heavy rains, and this adversely affects the hops. At present, about 20 percent of all hop fields in Germany are irrigated. Industry experts estimate that in the medium term, some 80 percent may need this. The solution is not to be found in technological advances alone. Industry associations and policy-makers are already wrangling about water resources. However, the challenges could be mastered with a good choice of varieties and predictive cultivation – but to do this the brewers and ultimately beer drinkers too, would have to play along. In times of ongoing climate change, beer will taste different to the way it did 20 or 30 years ago.

Since the beginning of the year, there has been a shortfall of about 30 litres of water per square metre in the Hallertau region compared with the long-standing average. This is according to observations by the German Meteorological Service. Although this is only a minor deviation of less than 10 percent of the usual volume, and could be offset in the short term by a rainy week, if you add all of 2018 there has been a shortfall of around 80 l/m² since January 2018. Moreover, in this period it was much warmer and sunnier than average, which is associated with a higher evaporation rate. “At the moment, the soil in the northern Hallertau in particular is much dryer than usual,” says Andreas Brömser, expert in agricultural meteorology at the German Meteorological Service. “But at this time of year, much lower soil moisture values have been calculated since 1981.” In this respect, you cannot refer to extreme drought in 2019. As a long-term average, you get around 700 mm in the north of Hallertau and around 900 l/m² in the south per year. This makes the northern area towards the Danube one of Bavaria’s dry regions.

And this is exactly where Johannes Lechner has his farm. On an offshoot of the Danube around the village of Ilmendorf he has 25 hectares of hops that he has been irrigating since 1976. Over time he has used a wide range of irrigation methods but since 2004 has been relying on modern drip irrigation. A tensiometer continuously measures the soil moisture. If it drops too low the irrigation system kicks in. Given the soil that he has, Lechner had no other option. "To be able to exploit the potential of my soil I need extra water," says the hop grower. The light soil cannot store rainwater well and the hops quickly hit a layer of Danube gravel with their roots. Farming here is no piece of cake, says Lechner, and many other farmers have long since given up. Above all, it's the hops that keep him in business. His two or three hectares of rye and corn are more or less just a hobby. This is because you can still earn something from a speciality crop like hops with the help of irrigation. "If I were a crop farmer at this location I would already be working at Audi."

Irrigation systems gaining ground

Hop cultivation is very labour-intensive. If you take the A9 from Munich to Ingolstadt you will see that hops do not simply grow in the fields by themselves, there's a lot of work involved for the grower. So it is actually a bit of surprise to learn that there is one thing that the very needy hop doesn't get from the grower, and that's water. With its strong root system that is several metres deep, the hop plant can make good and long use of the water supply in the soil. It can also handle water stress relatively well. It does not tend to ripen prematurely like grain, nor does it curl up its leaves like corn. In addition, as the "green gold", hops are traditionally cultivated in very good locations with high water storage capacity. Just around a fifth of all German hop plants are artificially watered. This makes Germany relatively unique, because in other hop-growing countries irrigation is the norm. In the USA almost 100 percent of all hop fields are irrigated. And even in Slovenia, for example, the figure is 75 percent.

At the Institute for Crop Science and Plant Breeding in Wolnzach, part of the Bavarian State Research Centre for Agriculture (LfL), research into the irrigation of hops has been going on since the 1990s. But with varying intensity, as Johann Portner, Head of the Hop Growing Project Group, admits. The years 1990, 1992 and 1994 were dry, and this is when the

topic started to garner a lot of attention. A dry year, Johann Portner explains, is where there isn't enough precipitation in June, July and August, the months that really matter for hops. Around 100 l/m² are ideal. "That's when we get the best harvests," says Portner.

This was followed by years that tended to have a lot of rain, and the first field tests did not produce any ground-breaking results. A project launched in 2011, and a follow-up project starting in 2017 with the title "Improving the nutrient uptake of hops through irrigation systems with fertigation", were the first to deliver useful data in the hot and dry years 2013, 2015, 2017 and of course 2018.

Yield and alpha acid – two mutually dependent factors

Even if hops are supposed to have fearlessly defied heat and drought to date, this does not mean that German growers haven't been incurring losses for a long time due to lack of water. In 2015, which was a dry year, 1,590 kg per hectare of hops with an average of 8.9 percent alpha acid were harvested in the Hallentau region. In the following year, which was not a dry year, the average yield was 2,300 kg with 11.2 percent alpha acid across all varieties. Success and failure in hop growing is measured against two factors. "When we have a loss of yield in kilograms then the ingredients also suffer more," says Johann Portner. "If the yield is now already decreasing by 20 percent and the alpha acid content is also 20 percent lower, the effect is multiplied. We have double the losses, so to speak." A simple approach to a twofold problem: "We can protect ourselves in two directions using irrigation and stabilise both yield and alpha acid content to a certain degree."

And that's exactly what Johannes Lechner in Ilmendorf is doing. And it pays off. Sort of. Because of course, a hop grower using irrigation has higher production costs. They are paying for water and equipment. The payoff takes several years. "Because I am adding a little bit of water every second or third day my stocks are very consistent. They are not as good as in a good year but not as bad as in a bad year either. So if we have a very high price for free market hops then that's very good for me. In a low price phase for free market hops, however, my profitability is not so good. However, I have done quite well in the last few years."

Now of course, this calculation can be applied to the world market for hops, where the No. 1 producer and Germany's strongest competitor, the USA, has been able to achieve consistently good harvests with completely irrigated fields, whereas Hallertau, which is largely dependent on weather and/or rainfall fluctuations, has sometimes more and sometimes less to offer, and earns accordingly. "We think that the return on an irrigation system ought to be quick," says Johann Portner from the LfL. "Hops have a very high added value with an average market income of EUR 15,000 per hectare. So a 20 percent yield loss has a significant impact amounting to several thousand euros. At irrigation costs of EUR 700-800 per hectare per year, depending on how difficult it is to obtain water, it would take an increase in yield (or yield not lost by the grower) of 1 to 1.2 decitonnes to make the irrigation worthwhile."

Irrigation also has its limits

To this extent, the use of irrigation systems is not directly responsible for making the hops expensive. "Irrigation is just one factor that can make hops expensive," explains Johann Portner from the LfL. "The same applies to statutory restrictions of fertiliser use in what are known as "red zones". We also do not know how energy prices are going to pan out. Another major problem is the availability and costs of labour. So there are a lot of other cost drivers that make hops expensive. It's not just climate change."

However, there is another side to the coin: irrigation is a one-way street. "The hop plant is a bit like a junkie," says Lechner. Once it has had a hit from drip irrigation it finds it hard to give up. It doesn't put down such deep roots and gets used to the extra water it is getting. "For me there's no going back. If I don't have any more irrigation tomorrow then the day after I am no longer a farmer."

Currently, the relevant water management authority has allowed Johannes Lechner 1,000 cubic metres of water per hectare and year. But it's getting increasingly scarcer. Last year, this amount had been used up by mid-August. "I don't believe that we'll get below 1,000 cubic metres again in the next few years. Not at our location."

And what then? "The biggest problem I see for Bavarian agriculture in the near future is: where do we get the water from and how do we distribute it

fairly,” says Johann Portner from the LfL. For Bartholomäus Obster, these questions have nothing to do with the future; they are something he has to deal with on a daily basis. The hop grower, who has 54 hectares of hops in Aiglsbach, is highly committed to the issue of communal irrigation – “because otherwise things look bleak for my son as the successor to the farm.” Without irrigation they would not be able to continue to grow hops.

“I always look very closely at the climate data specifically for our region and I can tell you that in the last six years there was only one year that reached the 50-year average of 100 litres per month in July and August. That was 2016. In the other years it was only about half this. Naturally this has an impact on yields and alpha acid.”

The problem? Getting the water

So where is the water for irrigating the hops supposed to come from? Basically, all that is available is surface water and near-surface groundwater. Drinking water from the deeper layers is taboo. Ten years ago, Obster joined with other farmers from the community to apply to drill a well. Permission was granted but only to a specific depth, and they did not find any water there. “So we took it down again,” says Obster. “But we are not giving up.” Another process has been initiated and Obster and the other hop growers are now waiting on a new approval decision. They will then engage an engineering firm that undertakes investigations and engineering in this area to determine whether water collection is possible and what it would cost. We then might be able to irrigate by 2022 at the earliest. Provided everything goes really well.”

Of course, searching for water for irrigation is not just a matter of concern to Obster, but also to the Bavarian Ministry of the Environment itself in partnership with the Ministry for Agriculture. Funding has been made available for pilot programmes to encourage community irrigation groups to produce irrigation concepts that are sustainable and environmentally compatible. Feasibility studies about where the water comes from and how much can be used for special crops like hops, have been commissioned. The issue is about how to distribute water, for example from around the less dry southern Bavarian region to the dry Franken area. Or also about

how rainwater can be collected during strong downpours for subsequent use.

Alternative strategy: the “right varieties” instead of water dependency

For Lukas Locher, irrigation is not an issue at present. “This is because we have our fields spread out across Tettwang. It only makes sense to drill a well if you have a lot of hops in one field,” says the young hop grower. “Our philosophy now, and just for us here at Hop yard No. 20, is to rely on a healthy soil structure and as a result, in combination with the right varieties of hops, to be able to manage the hot spells up to a certain point.”

A higher proportion of humus in his soils improves their water balance. With careful soil management it ought to be possible to achieve something here. “But to establish soil life and humus is a process that takes many years,” says Locher. “However, if it does go well, irrigation is no longer so crucial.” For him, the “right varieties” are above all flavour varieties. “We have had good experience with our product varieties that contain Mandarina and Hüll Melon, i.e. hop varieties that have Cascade in their genes.”

It can be taken for granted that American flavoured hop varieties and all newcomers and (new) breeds of hops developed from Cascade are very heat resistant and general cope with less water. And it’s actually not so surprising. The Yakima Valley, the home of these varieties, is almost completely protected from rainfall by the Cascade mountain range in the west. It is nearly always very dry here and the local varieties have learned to cope with this over the centuries.

“I began relatively early using flavour varieties with American genes,” says Johannes Lechner, “as they do incredibly well with the heat!” The cold in May would also have had little impact on them and they are also virtually mildew resistant! The problem however is that the market dictates that we don’t need these varieties.” Instead what are in demand are Herkules, Hersbrucker and Perle. And I had to treat my Herkules hops 12 times last year for mildew.” But it doesn’t help: “The market dictates what varieties are cultivated,” says Johann Portner from the LfL by way of conclusion. And the market demands Perle. Alpha beats flavour. The figures confirm this.

So whereas Johannes Lechner is therefore planning to take the flavoured hops back out again, Locher is going to stick with them for the time being. He wants to give them a little more time: "What happens with new varieties," he says, "is that a plant needs to flower for the second year, which really takes a lot of time, until a new variety is accepted by the brewers." And he continues: "To be able to approach the new challenges we need breweries to work with us in this area, brewers who are prepared to try out new varieties that can adapt better to climatic conditions and to see how they could fit into their recipes. The old regional varieties should continue to have their place but it would be nice to combine them with new flavoured varieties.

Climate change and its consequences also a topic at BrauBeviale

The key platform for the international beverage industry will naturally cover the issue of climate change. This topic dominates the morning of the last day of the fair in the BrauBeviale Forum. Under the heading: "Future risk climate: developments and consequences for raw brewing ingredients", renowned industry players will discuss the possible impact of climate change on malting barley, hops and water resources. For more information go to: www.braubeviale.de/en/events

About BrauBeviale

BrauBeviale is one of the most important capital goods trade fairs for the beverage industry worldwide. During this three-day event at Exhibition Centre Nuremberg, international exhibitors showcase a comprehensive range of solutions for the entire beverage production process chain, including raw materials, technologies, logistics and marketing ideas. Visitors come from the technical and commercial management segments of the European beverage industry as well as from the retail and catering sectors. The product display is rounded out by an attractive supporting programme that explores and discusses the trending issues in the industry. The main topic is the future viability of the beverage sector. Other highlights include the BrauBeviale Forum, Craft Drinks Area and numerous themed pavilions. The usual relaxed atmosphere will make BrauBeviale the No. 1 meeting place for the industry. Private Brauereien Bayern (Bavarian Association of Private Breweries) is the honorary sponsor of BrauBeviale.

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