Mycotoxin Matters Episode #26

**SPEAKERS**

Gordon Marley, Martin Minchin

**Martin Minchin**

Hello everyone, and welcome to our second mycotoxin matters episode of 2023. This month we are going to turn our attention to the importance of forage in ruminant diets and how crucial good management is in delivering a quality crop. To discuss today's topic, we're delighted to be joined by Gordon Marley, a well-known face to many across the agricultural industry, and in particular to those involved in the area of silage inoculants. Academically Gordon specialized in microbiology, and for over two decades since then, he has travelled to all corners of the world, working on the development of silage inoculants, bacteria production, product formulation and training in the effective use of inoculants. In early 2022, Gordon joined Alltech as a global silage support lead, supporting the recently introduced EGALIS range of silage inoculants. Gordon, you've had a busy schedule, as EGALIS has been launched around the world. So it's great to have you with us today, and thanks for taking the time to join us.

**Gordon Marley**

Thank you ever so much, Martin, for inviting me. It's a pleasure to be here.

**Martin Minchin**

Gordon, let's get straight into I guess just forage quality in general and how the whole topic of quality has become such an important topic globally, as beef and dairy producers have sought to increase animal productivity and make more use of total mixed rations or TMRS. And I guess it's probably a topic that is even more relevant now as feed prices have been pretty elevated for the last few years.

**Gordon Marley**

Entirely, Martin, there's been enormous economic pressure on the price of protein, on the price of energy, and even the delivery and the availability of protein and energy crops. So the more the farm can produce for itself, then the more efficient and the more, the better return on investment that the farm's going to achieve. Equally over the last 10,15 years, there's been a progressively greater challenge from climate change. And we've seen that in the amount of rain that's come the peak temperatures, the droughts that we've had, and that has led to challenges in production of forages. So, the more we can maximize and optimize the volume and the quality of our forages and transfer that into high quality silage and TMR the better the farm will do.

**Martin Minchin**

You wrote a really good article recently Gordon on the topic of soil, its quality and preparing for harvest. And you talked a lot in that about the potential losses at each step in the forage production process. Can you give some more detail on that and maybe quantify what that actual loss may look like in total?

**Gordon Marley**

For sure. Losses always occur when we're making silage. Silage by definition is a loss-making process. Boriarni in 2021 wrote a very nice article where he defined the losses that can occur. If we have direct ensiling, then we're going to lose a bare minimum of 1% dry matter during that direct ensiling period. And then as we move through the different stages, we lose increasing volumes. So, from fields curing and respiration, whereby we've put the forage in the field and we're allowing it to wilt, we're going to lose a minimum of 4% dry matter losses. And then we move it into the bunker, and we have the fermentation and irrespective of using a silage additive, and using the highest quality barrier plastic, there's always going to be a degree of inefficient bacteria present. And in the perfect conditions, then the in silo respiration, the fermentation and the effluent that's produced is going to account for another 5% losses. And then we start to feed out and again, even in optimal conditions, whereby we are using a defacer, we have optimal density of the silage, and we're crossing the face every day we're going to lose a further 3%. So, the minimal losses that we're going to achieve from field to feed passage are 13%. And that's with optimal management. If we lose the efficacy of management at any one of these stages, and we can increase the losses at each individual stage by a further five to 10%. The total losses can account for 30% which then needs replacing through supply of other feedstocks, which is a double cost of the farm.

**Martin Minchin**

Preparing, I guess in advance of harvest is one of the key areas that you would suggest in terms of addressing some of those losses, Gordon. I'm sitting here in the UK today it's minus three and I'm sure there's not many farmers thinking about harvesting, harvesting silage today but you advise preparing in advance. What do they need to consider if they are thinking of when April and May comes around for example, in the northern hemisphere here in particular?

**Gordon Marley**

My starting point on this is always making the farm understand that silage, whether they're a dairy farm or a beef farm, the quality of the silage, the quantity of the silage, the production of their silage defines the farm profit. These are costs that are basically set once you open the bunker. So, it's minus three in the UK today. It's not much better in Ireland. But I spend my whole year thinking about silage. And the farm needs to know how much it costs to produce its silage. And that's from everything from the fertilizer application to the use of the plastic to the use of the inoculant to the different harvesting stages. Part of this is communication. And in any business communication is absolutely critical. No more so in farming. The farmer whether he's a dairy farmer or beef farmer, he has to be a master of so many trades. If he's working with a contractor, that contractor is going to want to get from one farm to the next in the most efficient manner possible. And he's going to appreciate the farmer communicating with him at the earliest possible stage to give an indication of when he's going to be required and exactly what the expectations of the farm are. So, the farm should be considering the plastic that they're going to use. Plastic prices have had a dramatic fluctuation over the last two or three years based on the price of oil and the availability of plastic has had dramatic fluctuations. So even though we're based in the UK, we do still have a little bit of sunshine. dark colored plastic absorbs heat into the top area of the silage and then that leads to an increase in the activity of the spoilage organisms in the top area of the silage. It's much better to have lighter colored plastic on any kind of silage, whether it's bunker or bale. And ideally the farm will use oxygen barrier plastic, through oxygen barrier plastic and this needs ordering in well in advance to ensure you're going to get supply. We've already said that the farm must be communicating with the contractor. If the farm is going to be harvesting themselves, then all the equipment that they're going to use needs to be serviced and made sure that it is in good working order. Whether that's the bearings on a train wheel compactor, to replacing the knives on a forage harvester or replacing the discs on a mower. Even down to ensuring that the applicator is clean and that all of the tubing is clean. I'm sure that none of our listeners do this, but I have been on a few farms where the applicator from the end of one season is not emptied and it can smell a little bit ripe and it's not the greatest starting point for producing high quality silage. So, checking that the applicator is working. The bunkers where we're going to store the silage. Sometimes those bunkers need degree of repair, whether that's in between panels where we're repairing cracks in the wall, or whether it is simply covering over lumps of metal that are within the wall to stop any break off into the silage, repair the walls and repair the base of the floor. And if effluent tubes are in use, then they should be checked as well. Prior to harvesting, we're going to be walking the fields and we're going to have an idea of the quality of the silage that we're going to produce based on the quality of the grass that we are producing. So we can look at the local figures produced by various organizations. Or we can go and use plate metre readings of our own fields to get a good handle on the volume of grass that we're going to produce. Whilst we're walking the fields, we're going to get an idea of any potential challenges that might exist by way of mole hills and soil contamination. Obviously, we can't control the climate. But if we have mole hills present, then we know we're going to have a challenge, and if it's too late to do anything about the mole hills, then we can raise the cut height. That's going to reduce the ash content in the silage. Or if it is impossible to raise the cut out because we need the volume, we are short of silage, then we can probably target putting those fields lower down in the bunker, so it's going to be less challenged within the fermentation. The last thing that we need to do on an ongoing basis is nitrate testing. We've applied fertilizer, we've applied slurry. And not all of the nitrogen is going to be used for protein production. We need the nitrate level to be below 1000 ppm, in order to ensure a good quality fermentation. Nitrate buffers the fermentation and increases the time that it takes for the pH to fall which in turn leads to higher than necessary losses. So if we find that we're at 14,1500 parts per million, and we have the opportunity to wait an extra day, and the weather is going to allow us to wait an extra day then that is exactly what we should do.

**Martin Minchin**

Lots of really good tips there, Gordon, thank you for sharing that. You also talk a lot about fermentation within the article. And I guess how that is so crucial when it comes to producing a quality forage crop. Why is fermentation so important? And how do we ensure the process of fermentation is optimized post-harvest?

**Gordon Marley**

Well, the fermentation is a relay race between different organisms. And you have various efficiencies in these organisms, you have highly desirable bacteria, which tend to be relatively low levels and these bacteria are very, very efficient in their fermentation. You have semi desirable bacteria, which lead to dry matter losses and energy losses and these bacteria tend to be present in higher levels. And then you have undesirable bacteria, yeasts and molds and they tend to be dominant, and they're splashed up from the soil. They're from feces, and that always present and the initial stages of the fermentation is a competition between these organisms. The quicker that the desirable organisms dominate the fermentation then the quicker we inhibit the spoilage organisms from producing undesirable byproducts and the more forage we protect, the more nutrients we protect. So, there's tricks that we can do to ensure we achieve this. The first one that I'm going to refer to is the cut height. And I've already mentioned about the risk of molehills and soil contamination. When we have soil contamination you can expect to be applying an extra 1000 million bacteria, undesirable bacteria per gramme of forage. So, we want to raise the cut height above any potential soil contamination or senescent material contamination dead material from the previous year. And the cut height should be targeting at least seven or eight centimeters, and higher if there are molehills present, or if the field is undulating. Then we want to achieve the correct chop length for the dry matter. And the chop length is important because the chop length impacts first of all how well the forage is going to compact, but also the degree of effluent that's going to be produced. When you're producing lower dry matter forages below 30, 32% dry matter, then we're going to produce effluent and we want to extend the chop length to reduce the number of cut outs. When we're above 32% dry matter, then we're not going to produce effluent and we want to reduce the chop length. We want to achieve the correct compaction for the dry matter. Now there has been a movement which I'm very, very happy about: the train wheel compactors. And these are a phenomenal piece of equipment, they have enormously increased the density that can be achieved in forages. However, if we're at lower dry matters, then that increase in density is also going to lead to an increase in the effluent production. It's not a particularly nice analogy. But the way I like to explain this is that everybody has bacteria on their feet. And even if your feet don't smell too bad, I guarantee you if you put your trainers on and pour a glass of water into one of your feet, into one of your trainers, and leave it for three days then after three days, your feet are going to smell very, very different and the starting point is exactly the same and the only difference is the moisture content. So, train wheel compactors are a phenomenal piece of equipment, but please bear in mind the dry matter that you are working with. I started with saying that we have desirable or undesirable and then semi desirable bacteria. The idea is to outcompete the undesirable and the semi desirable bacteria because these guys are costing us feed value, costing us energy, costing us milk potential, and we can outcompete them by use of a high specification silage additive. The first state, first stage of any fermentation is the conversion of oxygen to carbon dioxide. If it's taking more than one day to fill the bunker, in the ideal world, we're going to cover that bunker overnight, we're just going to pull the plastic across, we're not going to cover it with tires. But that stops the interface between the air and the silage. And that fermentation as soon as the air is stopped from getting into the grass is going to start immediately. So, pulling the plastic over the forage on a nighttime is going to reduce our losses and enhance our quality. And we can easily save a full unit of digestibility by doing this. When we're applying an additive, we need to know, we need to understand how we should apply that additive. And if we're using a self-propelled forager, it's perfectly reasonable to use an ultra-low liquid application rate down to 20, 30, 40 milliliters per ton, because you have a phenomenal distribution because of the accelerator that we have within the self-propelled or the trailed forager. If we're using a forage wagon or if we're using a baler, then we don't have this accelerator, and we are reliant on the spray pattern that we achieve from the applicator to get the distribution across the forage. So, when we're using a baler or a forage wagon, then we need to use a higher liquid application rate of at least two liters per ton, and preferably towards four liters per ton. Plastics have changed enormously over the last 20 years. And we've seen the introduction of vacuum plastics, whereby a very thin layer is covered by a secondary layer. These plastics are exceedingly good and enormously reduce the level of oxygen that can enter the silage. Nothing has perfect barrier properties, but vacuum plastic is a great enhancement on old fashioned polyethylene plastic. However, there are various through oxygen barrier plastics in the market, which are even a finer definition that let in only 20 to 30 centimeter cubed of oxygen per meter square in a 24 hour period. Admittedly, these plastics are a little bit more expensive. But I encourage every farm to be using either a vacuum plastic with a protective cover over it, or ideally an oxygen barrier plastic. Much of what we do is out competing spoilage organisms so hygiene is a key point. And this is something that is difficult to control on a farm. We're coming through fields we're coming through tracks coming through the yard. But we need to keep the hygiene in the bunker area to an optimal level. So we're not moving mud, soil, spoilage organisms from the yard into the bunker. And equally we want to keep our packing tractor on the pile on the bunker for as much of the time as possible and have its wheels off the silage for as little as possible. And then finally when we seal the bunker, then we need to seal the bunker properly seal it very, very efficiently and it needs to be sealed the night that it is finished. It's no good leaving it to the next day. Because the next day you've lost five liters of milk per ton of silage and in this day and age, we just can't afford to lose that energy that digestibility that protein. So, get the bunker covered the night that you finish filling it. You don't have to get all of the tires on get the protective cover on get all of the gravel bags on but seal the edges and seal the back and the front of the pile.

**Martin Minchin**

Gordon, I know that you're a strong advocate that forage management does not simply stop when the clamp is sealed and harvest is finished. So, within that I think we may actually have you back on for a second podcast later in the year when we talk about actually what a farmer should think about during that period of storage and we may also touch on the topic of mycotoxins, which we've not had a chance to do today. Alltech recently reentered the silage arena with the launch of EGALIS, Gordon, could you please give our listeners a quick insight into the range of inoculants that are available from Alltech? And what have you focused on when they were being developed over the past few years?

**Gordon Marley**

We've been out of the silage additive market for a number of years, but this has given us as a company the opportunity to look at different strains, production methods, and I'm very, very happy to introduce three products to the audience, EGALIS ferment, which is a very high specification homofermentative silage additive that drives the fermentation, EGALIS ferment is a 1 million bacteria per gramme of forage product. So, applying 1 million bacteria to every gramme of forage that we are ensiling. It's comprised of bacteria that work at the beginning of the pH fall, and at the end of the pH fall. And these are working exceedingly efficiently. We've done multiple trials all across Europe. And we have done a concentration of trials in the UK. What we've seen consistently is an improvement in the dry matter recovery and improvement in the digestibility maintenance, the energy maintenance, the protein recovery, and a very significant shift in the fermentation profile towards a high level of lactic acid, and a lower level of acetic acid and ammonia or butyric acid. And that reduction in acetic acid has a dramatic impact on the palatability of silage. And once you get to 1.7% acetic acid you start reducing the intake. So this is one of the multiple reasons that we don't recommend the use of Petro fermentative bacteria. The second product is EGALIS Rapid, and this product is defined entirely for maize and sorghum silage. Different kinds of maize silages have different challenges; however, the goal is always to get the fermentation done as fast as humanly possible. And with the EGALIS Rapid, we've been achieving massive improvement in the dry matter recovery in the maintenance of the digestibility. But rather importantly a shift in the fermentation profile for spreight combination the 50/50 combination of L and D lactic acid to a domination of L lactic acid. And this is relevant, especially when farms might be challenged with sub-acute rumen acidosis. As these two types of lactic acid are typically producing equal volumes, both within the rumen and within the silage. But the L lactic acid is absorbed more easily by the rumen. So, if we can shift the fermentation to L lactic acid, we reduce the risk of acidosis. And this is what we're achieving with the EGALIS Rapid. And finally, the third product is a EGALIS stability. And this is a combination of biological and chemical components with a very high specification addition of potassium sorbate, which is a broad spectrum, anti-microbial. What this means is that as soon as we apply the product to the ensiled forage, that we start having a direct impact on the use of mold present within the forage. This means that we get enhanced aerobic stability and reduce losses instantaneously on application. So, if you need to open your silage after a week, or after two weeks, and you treat it with the EGALIS stability, you have improved aerobic stability. And I'm not just talking about 10,15 hours, which many of the biological solutions are talking about. I'm talking about one or two days after a week of being ensiled, and then as the storage continues, so does the aerobic stability enhance.

**Martin Minchin**

It's exciting times for you Gordon to be rolling out a new range of products such as EGALIS, so good luck with all of that over the next few months. And again, we thank you for taking the time to join us on the podcast today and we know that it's, it's a pretty busy schedule you have right now as you're preparing for forage season in Europe in particular. As I said, we will probably have you back on again in the future, we'll maybe look at the topic of storage and forage and we may also have a full season of working with EGALIS in the field. So good to hear some of your experience with that as well. To our listeners, we hope you enjoyed this episode and we'll be back next month with another feature of mycotoxin matters. Thank you.