[Hay Festival](https://www.hayfestival.com/p-12085-helen-browning-david-speller-and-jake-freestone-talk-to-rob-yorke.aspx) 25th May 2017

***GREEN-TECH TINTED GLASSES: HOW SMARTER AGRICULTURE CAN REDUCE FARMING’S FOOTPRINT***

**Intro**: Discussion on whether agri-tech innovation can reduce farming’s footprint on the environment.

**RY intro:** *I just want to start by asking a quick question? Who has eaten well today? Who hopes to eat well tomorrow? They say that we are only 9 meals away from panicking or, 2 hours away if you are going to see Eddie Izzard. Meanwhile, every mouthful of food we take, every lettuce leaf, every salmon fillet, every burger, has an impact on the environment.*

*The State of Nature Report last year, charts the decline in wildlife made from the first generation of farming intensive practices in the 70’s and 80’s. Instigated when the BBC launched The Archers which was basically a government information programme to encourage farmers to accrue efficiency. Of course, in the 50’s we spent a lot less of our income on food. Now it is 30% whereas it was around 11%, if you are not very well off it is around 17%. You see, agriculture is a landscape littered with wicked problems. Not evil, but difficult to resolve due to conflict of evidence. Shifting climates both literal and physical and where solutions require a great number of people to change mind-sets and behaviour. Who here, holds long-term principles on how we should farm? Who is ready to change their minds? It is very easy to declare that we should not be eating so much meat, we should moderate our consumption, and we should be wasting less food. These are all very laudable aims, but while we are waiting for these slow moving, generational changes to take place, we are still hungry. Technology is not all about software and drones it was once a flint stone scraping meat from mammoth skins, sulphur spread upon the fungus of various plants a 1000 years ago.*

*Today, as we enter a new era intensifying our knowledge on technology, satellites, bio-science, soil sciences, bio control, can all help agriculture continue to feed us while producing its side effects on the environment. As Albert Einstein said “We cannot solve the problems we have created, with the same thinking we used creating them.” So, to help us seek to resolve these wicked problems, focus our rose tinted views on farming through smarter green tinted glasses, I am delighted to welcome our very own Einstein Farming Panel who will introduce themselves in a moment and then I am going to throw in the first question. First, some ground rules: There are some roving mikes. I am going to take the questions. Please make your questions pithy, say, on topic. If someone asked the same question earlier, follow your thoughts. No mission statements, I am going to cut you off. I am a tough chair and will stand up and cut you off if you have a mission statement.*

*Now we are going to hear from the panel and I am going to hand over to David for the first intro.*

**David Speller (DS)**: I live in Derbyshire and my background is arable farming originally and very traditional agricultural route. About 14 years ago I had a mad idea to set up a poultry farm in Derbyshire. Never had a chicken shed before but I thought it was a good idea and that’s what I did. I then redeveloped it and looked to the future and wanted to get a bit more control over birds and the environment. The business has grown and we now look after 68 farms around the UK for our clients and looking after around 2 million birds every day. The business has grown so that we now use technology and data to manage farms around the world.

**Helen Browning (HB)**: I am here with 2 hats, as Chief Exec of the Soil Association and also a farmer based in Wiltshire. We run a really complex farm of about 1500 acres. We have a mix of beasts, which is what we are best known for – dairy cows, beef, sheep and crops and we are experimenting with agro forestry. So a complex farming system. We also market what we grow through our brand and in other ways and we run our village pub. So we have a really diverse organic farming business and it is mostly about this that I will be talking about today.

**Jake Freestone (JF)**: I am a farm manager at Overbury Farms I got into farming thanks to my godfather who had Jersey cows in Bedfordshire when I was about 12. I used to get sent up to him from Bristol on a coach and my mum and dad would say to the coach driver ‘Don’t let him off until he gets to Bedford’. We’d have a week in the summer and a week in the winter and that is where I got my farming bug. I did a Nuffield Scholarship in 2013 on breaking the wheat yield plateau in the UK and that has really encouraged me and given me the enthusiasm for soil and how we can grow higher yields and quality and more nutritious food to feed the population. I have been at Overbury since 2003 and have 3 girls and the eldest one is on a crash course – hopefully not literally, learning to drive next week.

**RY**: *Thank you. I did mention on purpose first generation methods of farming in the 60’s and 70’s, the first attempt to do intensive farming and it obviously had quite an impact on the environment.*

*Jake, I want to start with you, this is not about pointing fingers, this is about learning what happened before. Where farmers just following orders from the government?*

**JF**: I think this is a really good question and a great place to start a debate like this. If you think back to where we were in the 70’s, 30 years after the Second World War, government policy at that time was to maximise food production, maximise efficiency and it is only recently that this has been knocked on the head. Farmers still have that image very close to their minds and we come from an era of massive food production and that was being promoted. So things like grants being available for draining wetland areas and removing hedgerows and suchlike. It was all government policy and that is how we were being encouraged to farm. Then you come into the first generation of fertilisers and chemicals and we all know that this first round of things may have not been the most efficient and environmentally sustainable, take the diesel engine for example. So, we learn as we go along and we have got to take ourselves back to where we started to work out where we are now.

**HB**: I agree with the analysis that we came from a period of shortages and we got hooked on trying to produce a lot of food. In a way, I think some of that mantra of production at all costs is coming back into the frame again just now. I keep hearing this narrative that we have got to feed the world but even today there is loads of food out there. The issues of food shortage are of poverty is not about that we are not producing enough but about who can afford to buy it. So as farmers, we are told that our job is to feed the world and that is what we should feel good about but actually there has been a big price to pay and we are not necessarily resolving the issues of hunger that we are told we are actually on the case with.

**DS**: I think we should be clear that not all parts of agriculture have had the same stimuli from the government over the years. Generally, we are just looking after the sheds that manage the birds and up until renewable energy incentives came along very recently we were led by commercial things. As a farming business, we are led by stimuli whether that is commercial or government.

**RY**: *How many farmers are here please? Good, around 20. Any of you want to ask anything? In particular those older farmers who were around producing food in the 60’s and 70’s. Does anyone want to say something at this stage? OK, so we had the first revolution between the 1930’s and 1960’s when people were saved because pesticides and fertilisers allowed more food to be produced. As Einstein said ‘we cannot throw more fertiliser to feed more people’ How far are we into the second generation of the next green revolution? Have we just started it Helen or have we some way to go?*

**HB**: I think it is a really exciting time at the moment because some of the chickens (sorry!) are coming home to roost from that first phase of overproduction and recognising that we have got some problems. Actually most farmers recognise those problems now and we are more educated than we have ever been about understanding the issues around soils, bio diversity clashes, over supply into the environment, all of those kinds of issues are at the front, under of course, the shadow of climate change. So I think there is a mood where there is real change going on and real interest and I think some of this is has ecological solutions and some of it we have been doing for a long time. Everyone is starting to think about how they can manage their soils differently, how they can manage the complexity we have in our environment and how we can get win wins out of this. So I think that this is a really interesting time and it is a green revolution which is very different to the first green revolution. The first revolution was all about how do you produce more with less, this time I think we are still thinking about how we can produce more with less but we are looking at producing more biodiversity, more soil quality and better water quality. As well as good food to feed people and that is really exciting.

**JF**: Soil is absolutely crucial to the way we are managing our food supply for future security. It is absolutely crucial as about 80% of the world’s arable areas are currently being used at the moment for food production and we do have more food to produce for more people. So we have some challenges on that and technology can help but in terms of organic matters in our soil which can hold nutrients in to allow water to percolate through, reducing flood risk, we have got some huge win wins for farming and society. We just have to learn how to manage that soil in a more productive way. If we do that, we can actually grow more nutritious food which will reduce the amount we eat so reduce the amount people will want to eat and therefore reduce the empty calorie foods. Take wheat for example, at the moment it has about 44% of the nutritional value than it did 20 years ago. So we have some real challenges and if we can grow more nutritious food we can eat less of it and that can only be a good thing going forwards.

**DS**: I think it is really important that you guys and everyone else outside this marquee is part of this revolution as well. As a businessman you are led by what you are buying. I have a lot of designers but I cannot afford to do everything I want to do unless it links to what consumers want to purchase. So we must not forget that we all pay our part as consumers.

***RY****: David I understand that you were the first farmer to install underfloor heating for your hens and that you wield technology that would shame Mars Rover can you tell us a bit more about it?*

**DS**: Where I stand from I am not a traditional agriculturalist and I want to challenge. I want to understand what you guys feel and want to say and I want to test the boundaries. I want to know if my chickens are happy or unhappy – let’s ask the chicken, but I need technology for that. I cannot be in my sheds 24 hours a day as at some point I have got to go to bed, or I might have to go and see my partner to make sure she is still at home. So, a robot can be left in the sheds 24/7 and droning up and down up and down, but it gives me some complications.

**RY**: *Does anyone want to ask anything? A quick question, it can be about anything.*

**Audience Qu**: This is for David. You are obviously exceeding standards for what you are doing, does the market reward you for this?

**DS**: What I am trying to do in my time in the sector is open up some gates. When I first got into technology everyone shut the door and I said there is nothing to be ashamed of, come and have a look at what we are doing. We are trying to take it to another place but it is tough. What we are doing is intensive agriculture, it is controlling with minimal decimals but a happy chicken will grow better than a stressed chicken. A stressed chicken is more likely to get diseased, it is more likely to be rejected at the factory but it is a challenge when you are working on pence per bird and that is why people are awed by the numbers, it is because we are on pence per bird.

**Audience Qu**: I want to ask the panel what their view is on arable and animal land being used for energy production.

**JF**: Not keen to be quite honest as I think good land should be used for food production and there are other ways to get clean energy, by using clean waste.

**HB**: Yes, there are major problems with maize being used for energy. Soil degradation which is one of the things we have been campaigning about. There may be opportunities in some cases and I don’t think that biomass density is entirely wrong but I think you have to be very careful about the energy out and the environmental impact as well.

**DS**: If the return is there on the investment, then the reality is for me and my investors is do it. It is not about making more and more food, it is about less wastage and about how we make it. Do we need to make sure that every single label is covered if we can use that grade 1 land to produce energy for the population that’s in the field next door is that better then using grade 3 land which is a mile away and transporting it. I don’t know but we are looking at it from a commercial point of view.

**Audience Qu**: *Some of you are closer to your customer base than others. Linked to the industry the core responsibility of the CSR of your customer base, how do you think as an industry, we can extract better value?*

**DS**: It’s about whether or not they really mean it. I go to plenty of conferences and they tell me lots of lovely things and I think I am going to change my whole business model and then the price comes in from my processing plant and I look at the figures and I can’t do it. They can talk all they like but there is a big difference between what is put out there as PR and publicity and what is reality and what is on my pay cheque. I think that until we see real value in it, I can’t afford to go where I can’t afford to go.

**HB**: As somebody who has got very close to their customer base, there are a lot of people out there who really do care about how their food is produced. I think for a lot of people, when they are shopping it is not clear what they are buying. I would like to see a lot more transparency on labels, more clarity about where it has come from and the system of production. Because I don’t think we can get the consumer driving this unless they have more information and they know what they are buying. Lots of people want to buy what they feel is either safer or better to eat or kinder.

**Audience Qu**: I am really interested in what you are saying about clarity. With this chicken business. I have worked on a farm and I know very well that good stewardship and husbandry is essential to the happy life and good meat of the product. However, using robots and drones, I would like to ask where the human touch in this because animals flourish in a good relationship. Where is that in your system please?

**DS**: If you want to come in to my sheds at 2 o’clock in the morning, that is great but it is not reality. You get on a plane, the computers are doing most of the work but you still have a pilot, this is the same thing in our industry. We are using technology to support the stockmen to entice the educated and motivated people who want to be stockmen into the industry. If you are just going to come into an industry and do donkey work all day long, you soon get demotivated. Also, you have got to go home, go to bed, go on holiday so we need to mix the two but I absolutely agree with you.

**HB**: I used to think the same about robotic milking systems, that we were taking away that human contact. But I have seen some of these working on small family farms in Ireland where they milk 80 – 100 cows, it is working fantastically well for the cows and the farmer because it is cutting down on the things which can be laborious and giving them more time to look after the cows. The cows can have their own routine and know when they want to be milked. I think this can really work actually if it is done in the right way with the right human supervision.

**RY**: *This week is Chelsea Flower Show. We all love our gardens to be neat, perfect, lawns spared of moss, irrigated when it is needed. How is farming affected by scrutiny and regulations which gardeners seem to get away with?*

**JF**: It is becoming increasingly more cumbersome in terms of record keeping paperwork. You can argue that from a traceability point of view that is a good thing when we are selling on a global scale, particularly after Brexit. So there are some challenges and it is tough out there and we are trading in a global world and we are competing with massive farms across America, with New Zealand lamb, so there are challenges for sure but there is opportunity.

**HB**: Those standards give us a great base to trade from and I think we are proud of the high standards we have. Farmers complain about the red tape, all the bureaucracy, form filling, but actually, in most sectors now you have to do the job properly in terms of record keeping and traceability. I think that farmers have to embrace that and make sure that we have got the staff and the margins to employ people to help us to do that well. Some of the new technology makes that more straightforward. We are not just sitting with clipboards all day long. We have the opportunity to pick up data in a more sophisticated way. I don’t think we should be complaining all the time about the red tape and the form filling and paperwork we have to do because that is the world we live in.

**RY**: *Let me just add to that. Do you think that farmers need to communicate a lot more about what they are doing? Farmers take pictures but perhaps they should provide more of a backdrop and put a context to things.*

**DS**: The problem is that within agriculture, we live in our own little cocoon and we might as well be speaking a Martian language half the time because we put things across to the general consumer and think ‘that’s just obvious, you must understand that surely’ but actually no. If you are living in the middle of a city you just can’t relate to what we are getting at. If you look at the readership of the ‘*Farmers Weekly’* is it really being read by people living in the middle of London? We have to find a way of breaking down that barrier and stop thinking of ourselves in our little bubble and start accepting what everyone on the outside thinks of you and their impression of you.

**Audience comment**: There are probably some people in the audience who think that birds still live in cages and as farmers we can get that over to them.

**JF**: I think that as farmers you can get that over though. Social media, Open Farm Sundays. There are some fantastic opportunities out there. Who has tweeted today on this talk? Any of you farmers? Well I have but that is because I like it and social media is good. Every day is an opportunity to sell your story to sell your environment. I put a picture up this morning of a skylark sitting on a fence next to a field of peas. So there are opportunities and we have just got to grab them.

**HB**: Everyone is so keen to know about farming, pictures about farming, farm stories, everyone is so hungry for it.

**Audience comment**: We have got to stop being so righteous about putting signs up on our fences saying ‘We are growing food to feed you’.

**DS**: But there are some people who are poverty stricken who do not want to see pictures of us ploughing a field on a nice sunny day and lambs skipping in a field and then us going on television saying ‘we are out of money, can we have some of your taxes please’. They think ‘you are living the dream in the countryside where I want to be and you are asking for taxes so that I can fund you’. We have got to get away from the traditional route of wanting more, more to please you. Hang on, it’s a business, you are there to earn money, if you really hate it, clear off because someone else wants to do it.

**Audience comment**: I understand that battery farmed eggs have a lower carbon footprint and when we think of free range chickens we think of them being in orchards when in fact they are kept in sheds. So we are confused about what is good for the environment and for food production and animal husbandry. I personally think that chickens are happier in a more structured living environment.

**RY**: *Thank you. Jake do you want to take that? No, David do you want to?*

**DS**: Do we really want to know the full details of what you are putting in your mouth? Whether it was running around clucking and doing whatever a chicken does. It is more difficult when you are in a controlled environment. When it goes wrong it is in a spectacular way rather than a small way. When you get it right it is great but when you get it wrong it is tremendous and you get good farmers and you get bad farmers, that’s the world.

**RY**: *These days it is quite confusing for farmers because at one time they are saying ‘ban the spray’ and the other hand is saying ‘reduce cultivations, reduce emissions and at the same time, don’t use pesticides’ Are skill level requirements much higher for a farmer these days?*

**JF**: They do have to be very high in terms of legislation in terms of soil health and husbandry. If you are farming a mixed farm you have to have a large breadth of knowledge and detail. You have got to be the HR Consultant, the Accountant, you have got be everything pretty much that any other business has to do and you are pretty much doing it on your own. So the skill level has got to be really high. That should give people a really good entry into agriculture, enthuse them and get them into this lifestyle because there is opportunity out there for a whole host of skills which needs biology, chemistry, a huge range of skills are needed. The skills are becoming harder and harder to find and that is something David and Helen can agree with too.

**HB**: Yes, it is a problem attracting those great people into farming and at the moment I think they are still leaving it because it is not interesting enough or they are not given the opportunities if they do not come from farming families. A lot of the great people coming through are from farming backgrounds and really want to do it. I think there is a real challenge in kids growing up and thinking this could be a great career for me and giving them the opportunity to enter and get excited by it.

**DS:** There is more and more technology in farming. If a tractor breaks down, the first thing the repairer will do when he arrives at the farm is get his laptop out. So that level of technology and level of skill is escalating all of the time.

**RY:** *So farmers need to be wizards with laptops rather than tractor drivers then?*

**DS:** Absolutely.

**HB**: They both go together and you also need those practical skills and yes, they do need to know technology but you are also asking them to milk a cow and sort out vegetable production and you are looking for people who are so versatile and that is a real challenge.

**DS:** The problem with getting youngsters into agriculture is that they see people having days off and every weekend off and with us we cannot give those youngsters enough money.

**HB:** We run such a big enterprise with so much going on. We have a large number of staff. With 30+ working on the farm and in the village and that does create a community which is quite attractive. If you are on your own slogging away 7 days a week it is no fun at all.

**Audience comment**: I don’t think the general public realises how technical the average farmer worker is these days. Tractor drivers earn a salary of around £60K/£70K a year which sounds a lot.

**DS**: It sounds a lot to me as well.

**Audience comment:** it seems to be that this topic of the worth of agricultural workers, food, communication, everything, all hangs on whether or not we can convey to the general public how important good food is. Because until everybody upgrades the quality of food as far as their budget is concerned, we will never have enough money to pay a decent wage, to plant a new woodland or any of these things. So we really need to keep telling everyone out there that a high standard of food is essential for all of us.

**HB:** I agree with that entirely but I also feel that however much money there is in the system, farmers are not getting much share of it even with a higher premium price. That is one of the issues we need to address as a sector and we need to be taking a bigger share of the final margin and getting more involved in the processing and retail and having a share of the businesses doing that. Otherwise we are always just a raw materials supplier a commodity supplier into that chain and somehow as farmers we have got to break that.

**DS:** I heard on the radio that they did an interview in a city centre on how many people would take a tablet for lunch if it filled you up and provided all your nutritional needs. 30% of the people interviewed said they would swallow the tablet because getting lunch is a faff, going out of the office and walking to the shop, choosing what to get, walking back to the office. That was a real eye-opener when we talk about adding value to food.

**Audience comment:** I am working in France with a group of young people and something we have not talked about is farming in collectives. It is not a job but a lifestyle and is a much bigger story than just growing food.

**RY:** *How many people here are waiting to hear about the technology, bio control, sat navs? In the 1920’s bacteria based pesticides were being looked at as a way to deal with disease. Can you take what we used in the old days with the technology we have now? With examples.*

**HB:** That is the stuff which really excites me in many ways. One of the programmes we run in the Soil Association is Innovative Farmers which is helping farmers experiment using the resources they have on their own farm. Most of the time you are reinventing stuff for the modern day rather than going hi-tech and saying we have to buy this. Some of the experiments that have been done are things like compost teas, sprouting seeds for livestock where you seem to get 25% more food value from a seed by sprouting it.

**DS:** It is cutting edge but expensive.

**HB:** It is not that expensive. It is much cheaper supporting farmers to do that kind of research on their own farms than it is to get some guys in white coats in a research centre doing stuff. But you have got to support it so one of the things we think is that some of the R&D budget the public spend on farming and the environment should be spent on farmers supporting the work they are doing. Some of the best ideas actually come from farmers. We have supported 50 projects so far for between £3K and £10K and it is enough for a farmer to buy a project and see if it has some traction at all. That sort of approach is really exciting.

**JF:** I totally agree. It is exactly right in getting farmers to experiment and supporting them to do that because it doesn’t always go right. But at the end of the day we are business people and we need to be able to experiment to move our businesses forward. If you are not moving forward you are actually going backwards. As a result of my Nuffield stuff we got really into protecting crops so we got a green cover across all of the time to protect from heavy rainfall and stopping it from drying out. Actually getting tap roots to put carbon into the soil. You have got some of them growing at 12mm a day in the summer going down 80cm which is deeper than any kind of machine is going to get to remove compaction. So we are experimenting with this but it doesn’t always work but that is the learning curve and that is what excites me. What can we look at next? How can we make improvements? Save some money?

**HB:** So it is not always high tech stuff is it? It is about better management of your crop, or better rotation and managing your cultivations rather than it has to be a drone or something in outer space.

**JF:** When you do that in agriculture it can take 12 months to get a result , you probably need to do that 3 times to get a result you can rely on. Whereas David with your chickens you can do it in 6 months.

**HB**: So getting farmers together in groups so they are all experimenting at the same time over a couple of seasons and getting more replications is a great way to make that progress more rapidly. You have more people doing it, checking the results and getting replication.

**JF:** It is also about communication. So we have several WhatsApp groups which is just an open forum for farmers who can say ‘try this’ or ‘ this works’, ‘I have this problem, has anyone else?’ So we are actually learning from each other and go back 10/15 years ago it would have been farmers meeting like this, taking time to drive to, carbon footprint. OK so it is good to have the social side to it but knowledge transfer is one of the great things about tech and as long as we have a good internet signal.

**Audience Qu:** You talk about being supported to innovate, why does your industry get supported by the taxpayer and my software business doesn’t?

**DS:** We were in line to be funded for a big project by the government for research to take technology to the next level and then after 8 months of meetings they pulled the plug before anything could happen. On the other side of that, we had several commercial projects running with commercial companies and we are seeing all of those through because there is commercial value in them.

**HB:** A vast amount of public money that goes into agriculture. The reason I think you can justify it is that farmers are delivering more than just the product they sell, a lot of it is about looking after the environment and a lot is about how policy makers will be able to assess which approach will get food and social benefits too. Farming isn’t quite like any other industry.

**Audience comment:** I expect coalminers said that and the steel workers.

**JF:** You would not be able to come to a part of the world in Hay on Wye and it would not look like this if farmers were not farming it and looking after it. Whether you are in the uplands or anywhere, this does not happen without farmers managing it. So there is a lot more being delivered than just food production. Food production is actually key as we are 61% efficient in home grown food here.

**Audience comment:** It’s pretty inefficient the way it is done.If someone said I will pay you £5a month to walk yourland freely then that would stimulate you to put walks on your farm and make you a lot more proactive than someone who is sitting filling in forms to get money.

**HB:** Well everything is up for grabs now and we are going to reshape our farming policies over the next few years and I think this will be part of the discussion as to where it is justified to put public money in and where it is not.

**RY:** That is the discussion we had last year about rewilding. So, less agricultural production in the less productive areas and focus on the more productive lowlands.

**Audience Qu/comment:** I am a farmer and with 15 farmers in the room and let them show their hand if they think they should be supported by subsidies because I would love to farm without any subsidies at all and farm for the market. The problem we have got in the world it is very uneven. Even in New Zealand where you have a government which is pushing it and passionate and what we want is a government like that so can I ask if the 15 farmers in this room would prefer to farm without any subsidies going forward?

**RY:** I would also like to ask the same farmers what if the market asked you to produce something which isn’t food. Would you still farm for the open market demand? If they said farm your land as a bog, we will give you the same support payment which would be the same as you had as a subsidy. How many hands now? Yes, you are still paying for it but not producing food because you are in a more marginal area. That gentlemen there said if we do that the price of food might go up substantially.

**Audience comment:** Lets involve the supermarkets in all of this because we can look at the way they pay farmers and I think before we think about changing we need to think about that.

**HB:** Who here shops in a supermarket? We are all culpable in this, we are all consumers, we all have pension funds so are driving that shareholder value which drives all the retailers to behave in a certain way so we are all part of the problem actually.

**Audience comment:** One thing you have not mentioned is the quality in what you are producing. You have an avenue to make more money. I don’t feel comfortable about the fact that you can have asparagus all the year round.

**JF:** Rob you mentioned the uplands and equally we talked about poultry production here and in this part of the world we are used to the debate of should we build more chicken houses or do we value the uplands and the beautiful countryside we live in. As a society we need to decide if we want cheap food, cheap chickens or whether we want to pay a premium to protect the beautiful parts of the world and I think that society needs to understand that if we are going to feed the world and we have to accept that what comes with that means building more chicken sheds and everything else. If we don’t want that and we just want a green and pleasant land we have to accept the costs that go with that and the food chain somehow has to support that.

**DS:** You have got to do it for everything you eat OK. If you had lunch here did you ask them where the chicken came from where the salmon came from? We focus on what we have on the table on a Sunday or when guests come around and people roar up and down the motorway and they serve sandwiches in the garage. Where do you think that chicken comes from? It’s bought at a price, the meal deal is £3 so we move the whole purchase of your food not just think about it on a Sunday.

**HB:** One of the things which is quite interesting if you are thinking about the technology of it and the innovation which means we are straying into all sorts of territory which is fascinating. What modern foods will come through and whether that starts to take pressure off our land. So, seaweed, algae, fungi, the insects debate, there are lots of new foods, new products that we can play with that may be able to be produced without taking up that much land. This kind of pressure we are experiencing between environment and feeding the world may not be as acute because some of the innovation that is happening today. We can debate whether that is good or bad but I don’t think we are locked into that land sharing, land sparing debate that we were 5 years ago.

**DS:** The efficiency of land use will be in volume then in per square metre but it’s not what everybody wants.

**HB:** Absolutely and there may be other more acceptable approaches to producing large amounts of food on a smaller amount of land because your footprint is only small but the amount of food is large.

**Audience Qu:** You were talking about innovation I understand that gene insertion will give you 15% more production and only a 10% rise in cost. Are you going to do it and is the audience going to eat it?

**JF:** So the net gain is only 5%? I think biotech is a really interesting avenue to go down but if you are looking globally there are some massive benefits in terms of vitamin A in India, drought resistance in Zimbabwe, we have got to look across the world and not just in our very privileged position here in the UK. I would love to have a resistance to a particular insect which meant that I would not have to put insecticides onto the field. I have had to use insecticides on my linseed this year because without it the crop would have been eaten. I try not to use insecticides, I have not used any on my oil seed rape for the last 2 years for instance but the need was there and we had to do that because it is part of pest management. The biotech solution is something we need to look at as it is used around the world and it is a really interesting topic and we need to think how we can sell that to our customers because if we grow it and they won’t eat it there is no point.

**RY:** *Do we fear the bio-corporate ownership of biotech because they are the only people who can work best in that business because the government has not got funding. Do we get distracted by the ownership?*

**HB:** I think it is distracted by the motivation and all technology can be used for good or ill. As we are able to do more we need to be much more sophisticated by thinking through what we want to do and why and for what end and to give the public much more control over that. We can do almost anything. We have talked very simplicity about a few minor steps forward and we could make massive leaps forward potentially over the next decade or two. If we don’t actually start to put our values into play, what do we want to achieve how we are going to get it? These technologies are going to work for people, for the environment for the farmers rather than just allow them to run away with us.

**DS:** It is not about the gain, it’s my customer. If he says no, I don’t care if it is a 50% gain, I can’t do it because I can’t sell it so it’s pointless. I work in a borderline between commercial and agriculture and we work with investors. These people are corporate guys who put millions into what we are doing and they are looking for a return on investment. Looking after the chickens is down to me and if I said to them I will give you a ½% more they would snap my hand off.

**Audience comment:** I would like to congratulate the panel as industry leaders in their different sectors. The only way we are going to embrace technology is by attracting youth into our industry because my 11 year old knows more about technology than I do and we have got to make farming a viable career for people.

**RY:** *I have one final question. Meat from the lab grasshopper granola smartphone apps. David, Helen and Jake, in your view what’s the one big break through, the Holy Grail, the innovation and why.*

**DS:** For me it’s biometric sensors. Feedback from the individual animal about what the animal feels how the animal is because I don’t do windows because I like windows I do it because the chicken likes windows or whatever it is, will make the bird happier and improve their performance.

**HB**: If I had to choose one thing I think it is being able to understand what is going on in the soil being able to have a more vivid understanding of what we are doing and how it is affecting us, the flora, earthworms. There are others such as the robotic stuff as we have got to crack the engine problem on farms.

**JF:** Mine is the internet and computers as without either of those biometrics would not happen and soil sensoring as there would not have been any other way to get that information.

**RY:** *Thank you very much indeed*. *Biometric control, managing the soil, computer data ….all required in these finely balanced issues between maintaining yields and minimising the impact on the environment. Thank you very much David, Helen and Jake and to you, the audience, for your participation*.