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INTELLECTUAL PROPERTY AND BEYOND

ORGANIC AGRICULTURE
WHAT YOU NEED TO KNOW

NO LUCK NEEDED
CLOSER LOOK AT CLOVER BREEDING

MOVERS AND SHAKERS
WHO WERE MOST INFLUENTIAL IN 2017
We share Johan’s ambition
to surprise consumers
time after time

Johan Solleveld comes from a tomato-growing family and has been involved in variety development at Rijk Zwaan for over 30 years. Thanks to his extensive experience, and to the fact that he really speaks the growers’ language, he knows exactly what to look out for when selecting new tomatoes. Over the years, Johan has gained an ever-greater appreciation of the tomato’s versatility and potential. He knows that nature can sometimes have surprises in store, and how important it is to remain open to the resulting opportunities. In close collaboration both with colleagues and customers, he strives to make a valuable contribution to creating tasty new products every day.

It is Johan’s ambition to surprise consumers time after time. Rijk Zwaan - a global specialist in vegetable breeding - shares this ambition. We are working together towards a healthy future. Learn more at rijkzwaan.com
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Columbia River Seed will release an exciting new Kentucky bluegrass line following 2017 NTEP trials. Columbia River Seed has been submitting new varieties to the NTEP trials for 15 years and this year we are very excited to have 13 varieties being evaluated. Of the 13 varieties developed, two will be commercially released for the 2018 season and the rest will be available for 2019. We are confident that for turf managers who are looking for new, durable Kentucky bluegrass varieties that our new NAI-13-14 available from Landmark Turf and Native Seed and NAI-13-9 available from Jonathan Green Inc. in North America, Global Seed in China, and Columbia River Seed in Europe, will deliver. Both of these varieties have fantastic seedling vigor and superior wear tolerance. Plus they feature improved summertime performance with excellent stress recover. Contact us for more information.

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Plant breeders on average spend between 12 to 15% of their turnover back into research and development, which is considerably higher than many other industry sectors. Just to give you some figures for comparison, Bloomberg data from 2015 stated that telecom companies reinvest 1.4% of their revenue into R&D, automotive companies 4%, aerospace and defense companies also 4%, computing and electronics companies 6.9% and healthcare companies 11.1%. And just for comparison, a high-tech company such as Apple is reinvesting ‘only’ 10% in R&D and Facebook a mere 4%. So, with 15%, and in some seed companies even higher percentages, the plant breeding industry is a highly innovative sector. This very specific aspect of the seed sector should not be underestimated.

It depends a little bit on the crop the plant breeder is working on, but on average it takes between 8 and 12 years to create a new plant variety. However, and here’s the risky part of the whole process, when plant breeders embark on this long process of creating a new variety, they don’t know yet what consumers will desire in 8-12 years from now. Consumers’ wishes change frequently and it seems more frequently than in the past. Not only does the product have to taste good, look good, be reasonably priced, but it also has to be produced sustainably. This means that preferably and if at all feasible, the crop is produced with as little crop protection products as possible, while respecting the environment in terms of soil, water and biodiversity. Adding this all up tells us that a plant breeders research and their investments are considerable, upfront and also high risk.

Plant breeding is providing enormous benefits into the agricultural chain, and to society. There have been several research papers investigating specifically this aspect. For example, Lence et al in 2009 came to the conclusion that farmers get a USD $6 benefit for each USD $1 spent on private sector research. And DTZ in 2010 took it a bit broader and found out that for each $1 invested in plant breeding there is $40 in added value across the wider economy (taking into account higher yields & input savings at farm level). And a very recent study by Noleppa in 2016 showed that since 2000, for EU arable farming, genetic crop improvements generated an additional social welfare gain of 9 billion € and added over 14 billion € to the EU GDP. Plant breeding provided secure employment and an average increase of income of 7000 € which is 30% of the annual income of EU arable farmer. Oh, almost forgot, plant breeding also created an additional 70,000 jobs in the arable sector.

So, it is only fair for the plant breeding sector to ask for something in return, to keep this engine of innovation going. They would like a little return on investment, and this return on investment is often guaranteed by intellectual property rights, such as plant breeders’ rights and patents. Imagine you’re a plant breeder and you have created a beautiful new variety that would be a good fit for farmers in at least 20 or more countries in the same climate zone across the globe. Obviously, you would like to be able to file for plant breeders’ rights as quickly as possible in all those countries. Nothing is more frustrating than to see someone else run off with your precious new variety and reap the benefits of your hard work. Until now those plant breeders had to file for plant breeders’ rights in all the relevant countries, but there was one problem: the application forms in all those countries were different, to say the least. The data of one application form could not easily be used to fill the forms of another country. So, the result was that plant breeders often decided to only file for their plant breeders’ rights in one or very few countries. It was too cumbersome to go through the whole process for all the relevant countries. And this was not even counting the language barrier.

Until now that is. Over the past few years UPOV has developed a brilliant new system that allows plant breeders to file for those applications online, and easily re-use the data from a previous application for the same variety. This system has recently gone live, and several plant breeders have started using this new tool. And as cherry on the pie UPOV has introduced a translation tool that allows the plant breeder to file the application forms in a language they are not fluent in.

I predict that this will lead to more plant breeders filing more applications in other countries. And another piece of good news: for this year, PRISMA is free of charge. For 2018, the use of UPOV-PRISMA is free of charge.

“FOR 2018, THE USE OF UPOV-PRISMA IS FREE OF CHARGE.”

Marcel Bruins
editorial director, European Seed
mbbruins@issuesink.com
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Let’s say you just created a wonderful new variety after 10 years of crossing and selection, and now you want to protect the variety through plant breeders’ rights in a large number of countries. Until recently you had to search for the different PBR application forms of the various countries, arrange some sort of translation of the forms, and often hire a local agent to do the filing. Much of this cumbersome process is now history with the arrival of the UPOV PRISMA tool. European Seed talked with Ben Rivoire, Technical/Regional Officer for UPOV on the benefits of the new application tool.

EUROPEAN SEED (ES): CAN YOU EXPLAIN A BIT ABOUT THE DEVELOPMENT OF THE PLANT BREEDERS’ RIGHT APPLICATION TOOL (UPOV PRISMA) IN THE CONTEXT OF UPOV?

BEN RIVOIRE (BR): The purpose of the International Union for the Protection of New Varieties of Plants (UPOV) is to encourage the development of new varieties of plants by providing an effective system of protection. New varieties of plants have always been a key means for farmers to improve their economic situation and to deliver food security to society as a whole. Today, with the challenges of climate change, urbanization and an increasing population, there is an acute need for a flow of new varieties. However, without an effective system of plant variety protection, breeders have limited possibilities to achieve a return on their investment. The UPOV Report on the Impact of Plant Variety Protection (PVP) demonstrated that breeders are reluctant to release varieties where they do not have effective protection. By making it easier for breeders to make applications for plant breeders’ rights, farmers are going to have access to more varieties than in the past.

ES: WHY DID UPOV CONSIDER IT NECESSARY TO START THE DEVELOPMENT OF THE UPOV PRISMA?

BR: For some time, it has been known that breeders have faced practical challenges to make applications for plant breeders’ rights because the process was tedious and time-consuming. This was particularly the case for small and medium sized enterprises and for breeders in countries with less widespread languages. Furthermore, the administrative effort to make an application was the same for all countries, so for countries with smaller markets, breeders might not have been able to justify the investment in resources to seek protection. In the past, the tools to address those problems would have been too expensive and resource heavy to provide a cost-effective solution. However, recent advances in IT have created new possibilities. As UPOV started to explore such an approach, there were enthusiastic responses from a significant number of breeders and PVP offices. However, it was important from the start of the development of the tool to involve key stakeholders and users of the system on both sides (breeders and PVP offices).

ES: WAS THERE ANY BREEDERS’ INVOLVEMENT IN THE DEVELOPMENT OF UPOV PRISMA? IF YES, HOW?

BR: Breeders have been heavily involved since the very first day. The initiative was supported by breeders from the beginning and we are still receiving very strong support from all breeding companies and regional and international organizations representing breeders. Their feedback on the proposals and their intensive testing of the prototypes were essential and the project would not have succeeded without that vital contri-
Within UPOV, we created a specific working group of UPOV and WIPO experts to develop a functioning tool using an agile approach, where every step had to be tested and approved by users before moving to the next step. This is a key aspect to ensuring that the IT project would succeed and that a workable tool would be made available at the end of the journey, fulfilling deliverables and within the agreed timeframe. We were also lucky to have on board very competent, knowledgeable experts bringing their competencies and desire to deliver a usable tool quickly in a complex environment with a lot of technical aspects to be addressed with a very pragmatic approach.

We had to analyze business requirements and meet technical constraints, such as a security, data confidentiality, data structure and transfer. Some of the key elements required were to have an easy way to transfer application data, in a secure way, using an online platform with multi-lingual features.

This unique international and multi-stakeholder project team allowed, after three years of development and a series of testing campaigns in which breeders had the opportunity to provide their inputs through the entire process, to release a functioning tool at beginning of 2018, starting with a limited number of crops and countries. The first year was important to validate all the technical and procedural aspects of a fully functioning system in order to be able to move to a larger scale deployment which would be particularly relevant for breeders to use.

**ES: WHY DO YOU THINK IS IT ADVANTAGEOUS FOR A BREEDING COMPANY TO USE UPOV PRISMA?**

**BR:**
- Online application tool to submit application data to participating PVP Offices in required format
- Application forms can be displayed in a range of languages
- Easy access to PVP application forms

UPOV PRISMA allows breeders to make applications through an online tool that has multiple functionalities, such as different languages in which it is possible to navigate and edit application forms within the tool.

For countries who had not yet developed an online application platform, it was particularly relevant, and this remains a very strong incentive for countries to join in the development of a tool providing an international platform and exposure, in line with users’ expectations.

The tool is very efficient for breeders because they are able to access the latest application forms of participating UPOV members easily in UPOV PRISMA. They can access those forms from anywhere at any time, they simply need to select the crop and the country in which they want to make an application.

The tool available today allows breeders to select from a list of 22 countries and one region1 (see list below with search feature available online: www.upov.int/upovprisma) from around the world for all genera and species (when accepted by the authority). For users of the European Union system at the CPVO, it is now possible to link the two systems, meaning that the information can be transferred directly from UPOV PRISMA to the CPVO online system and vice-versa. For the European Union, we initially started with five crops (rose, soybean, potato, lettuce and apple), but there is a clear commitment to move soon to more crops in the coming version to be released in summer 2018.

The multilingual functionality is also a major breakthrough in terms of usability for breeders all over the world. The interface can be displayed in a choice of languages (French, English, Spanish, German, Chinese, Japanese). This would help, for instance, a French breeder to display the questions in French for an application for a rose variety in Colombia. The tool will then automatically translate much of the application (especially in the technical questionnaire where breeders need to complete all the information in relation to the variety itself and describe its main characteristics) into Spanish which is the language in which the application must be submitted to Colombia. Having access to drop down lists with pre-filled information extracted from the UPOV Technical Questionnaire (TQ) or National/ regional characteristics helps the breeder to select the relevant information and have it translated into the language required by the country selected which has provided national approved translations. For example most of the information in the TQ of any application in Turkey will be translated into Turkish. Breeders only need to provide the remaining free text translations; which could be a small part of the entire application form!

- Much of the data can be re-used in subsequent applications
- Breeders are able to duplicate a previous application for the same variety, or start a completely new application and submit their application online.

The reusability of data is a key aspect and benefit for breeders, as it really saves time and effort. For example, if you have submitted an application in the Netherlands for lettuce in UPOV PRISMA you can copy all the information already provided and saved in the system into a subsequent application in New Zealand, for instance, or Chile. Much of the application form...
will be completed automatically as the same data was contained in previous applications, which saves a tremendous amount of time and also ensures consistency between applications for the same variety.

- Different user roles can be specified (e.g. drafter, signature, translator, agent, procedural representative)
- Controlled access, secure and confidential
- Track your applications

The tool provides the flexibility to fit the needs of each breeder. For instance, if you need to have a large number of people from the same company accessing the system or one specific pending application, you can assign different roles in the tool according to the responsibility of each member of the team. In smaller companies you can perform, by yourself, the full process from the creation of the breeder account, to the completion of the application form (including the technical part) to application submission and make payment online via the secured interface. Last but not least, the tool allows breeders to monitor and track PBR submitted application around the world.

**ES:** WHAT ARE THE NEXT STEPS IN ITS IMPLEMENTATION?

**BR:** The UPOV PRISMA team is continuously looking for new features that will improve the quality of the tool and address users’ needs in terms of access to information or new ways of working. For instance, we are currently investigating the following:

- Novelty alerts
- Alerts on application deadlines
- Information on next steps after application data submitted
- Access to a list of local accredited agents/procedural representatives
- Information on DUS cooperation
- More participating UPOV members
- How to cover all crops/species for all participating UPOV members
- More PVP offices with machine-to-machine links to UPOV PRISMA, where relevant

**ES:** NOW THAT THE FIRST APPLICATIONS HAVE STARTED TO COME IN, WHAT WOULD YOU ADVISE TO PLANT BREEDING COMPANIES IN TERMS OF USING UPOV PRISMA?

**BR:** Go online and test the tool for yourselves, make the most of the special offer this year in which UPOV PRISMA is free of charge. It’s a unique opportunity to see how efficient and relevant UPOV PRISMA can be for you and your company. Use the system and see how it can help you save time and create new business opportunities.

Ultimately it is the seed industry as a whole that will benefit from this important new development and the farmers who get access to the newly released varieties.

Go to the UPOV PRISMA Website (www.upov.int/upovprisma) to see how to get started, and the UPOV PRISMA team remains at your disposal to guide you through the process and reply to your questions (prisma@upov.int).

1. Argentina; Australia; Bolivia (Plurinational State of); Canada; Chile; China; Colombia; European Union; France; Georgia; Kenya; Mexico; Netherlands; New Zealand; Norway; Paraguay; Republic of Moldova; Switzerland; Tunisia; Turkey; United States of America; Uruguay.
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To learn more about how seed companies are experiencing the new UPOV-PRISMA application tool, European Seed spoke with Astrid Schenkeveld, Specialist Variety Registration & Protection at Rijk Zwaan, and Jan Knol, Plant Variety Protection Officer at Nunhems, who both have been using the UPOV PRISMA tool from the beginning.

EUROPEAN SEED: WHY WAS IT NECESSARY TO START THE DEVELOPMENT OF THE UPOV PRISMA TOOL?

ASTRID SCHENKEVELD (AS): We are living in a world in which electronic exchange of documents is more rule than an exception. It improves efficiency and hopefully it will encourage standardization of the forms.

JAN KNOL (JK): I think the UPOV PRISMA tool might simplify the PVP landscape, where every authority is starting to make its own online filing tool, we would have one filing tool that is relevant for all countries.

ES: WHY IS UPOV PRISMA IMPORTANT FOR YOUR BREEDING COMPANY?

JK: For us as a company, to have one fully functional filing tool, which would be easy in use, is really an advantage.

AS: Rijk Zwaan is an international breeding company with subsidiaries in 30 countries and we have sales worldwide. Our vegetable varieties travel across the world. A tomato variety can be grown in Southern Europe, but also in South America, a cucumber or sweet pepper can be grown in Canada as well as in the Netherlands. One lettuce variety can be grown in Europe as well as in Australia, in the US or in Asia. Our head office is situated in the Netherlands, from where all PBR applications are coordinated and prepared. We need the help of our subsidiaries or agents to translate and submit the forms. It is something they have to do on the side, because their main job is to provide seeds and services to our customers. So, they are not as specialized as we are, in the ‘UPOV’ language. That is why my department needs to prepare the forms as much as we can.

The UPOV PRISMA tool is important to us because it has the potential to provide us with an efficient and reliable tool to submit our PBR applications. The efficiency depends on the reusability of the data, so the layout of the questions. When a country mostly follows the UPOV TG and uses drop down menus, then the data can be reused, and answers can be automatically translated. This saves us time and money and makes our application more reliable, because there can be no misinterpretation by the translator. However, when a country uses open text in its forms or deviates greatly from the UPOV TG, then this would make the system far less efficient. Because the system requires an extra fee, it can create an obstacle for the applicant to use the system.

Of course, there is always the advantage of having the latest version of the forms available in the system and an...
In UPOV PRISMA meetings, we realize that certain PVP authorities are starting to understand that some of the unique questions in their PVP procedure might not be necessary, as other PVP authorities also do not ask these questions. In this sense authorities learn from each other and start to become more focussed on harmonization instead of creating unique questions specifically for their country only. This hopefully leads in future to one identical questionnaire. After completing the application form, as applicant you can then tick the boxes of which countries you would like to apply in.

**JK:** I would like to see more member states becoming involved and also more species being added. Now is the time to look for harmonization. The efficiency depends on the reusability of the data, so the layout of the questions. Therefore, I would like to encourage the member states to follow the UPOV TG as much as possible and use drop down menus, so the data can be reused, and answers can be automatically translated. I also would like to encourage them to closely look at the information they really need in order to accept an application. Do you really need the information on the basis of the UPOV Convention or your national legislation or is it ‘nice to have’? For instance, information about the pedigree or the breeding goals often have to be submitted in open text, so it cannot be reused or automatically translated while this information is not relevant for the purpose of granting plant breeders’ rights. It makes the system less attractive and might not give the added value to make up for the extra cost.

**AS:** It is amazing the amount of work done by the UPOV office. I think that it has become a very user-friendly system. Once you have a login, the system guides you through the process, step by step. Some questions are mandatory, and you can clearly see if you have missed one of those questions. I really like to drop down menus, and when comparing the candidate to the most similar variety, you can either choose between a drop down or a free text. That is very helpful as well.

When the forms are UPOV harmonized, it is not much more work than booking an airline ticket online. It has been a while since I had tested for the last time, so I had to look how I could copy from another application, but it worked. When I showed the system to another colleague, who is responsible for lettuce applications and had not been part of the testing team, she was surprised and enthusiastic.

“**UPOV PRISMA SHOULD ENCOURAGE PVP OFFICES TO HARMONIZE THEIR PVP APPLICATION FORM.”**

– Jan Knol

**ES:** What are the advantages of UPOV PRISMA over the current possibilities?

**AS:** The largest advantage is the transparency of the forms. You always have the latest version and the questions are translated in our case to English. You can submit the application electronically, which saves time and the application can be traced. The data is stored and can be reused in other applications. It is also possible to upload an .xml from your database in UPOV PRISMA, but we do not have experience with that yet.

**JK:** A major advantage is that you are always working with the most recent application form and in certain countries you might save on translational costs. Furthermore, when starting to apply in a new country, in the near future UPOV PRISMA might give you some suggestions about which agents you could approach.

**ES:** What would you advise other plant breeding companies in terms of using UPOV PRISMA?

**AS:** On the UPOV website, you can have a look at www.upov.int/upovprisma, where you can find a lot of information. If you have not tested the system, you can either contact UPOV to get access to the testing environment or create a WIPO login and have a look for yourself.

**JK:** Start using the UPOV PRISMA application tool to get experience and with that experience you can make a well-funded decision in how your company might benefit from the UPOV PRISMA tool.
A STRONG IP SYSTEM IS CRUCIAL FOR INNOVATION IN PLANT BREEDING

Plant breeding is a global and highly innovative activity. Companies invest heavily in the creation of new varieties; the average annual R&D investment mounts to 20-25 per cent of net sales (source: EU Commission Annual Global Survey). To ensure the return on investment and to stimulate new innovation, a strong Plant Breeders’ Right (PBR) system is needed. However, putting in place good regulations and a strong IP rights system for plants cannot rule out piracy in the world of plants. Therefore, it is crucial to have good instruments and procedures to enforce your rights.

HOW TO EFFECTIVELY ENFORCE YOUR PLANT BREEDERS’ RIGHTS?

Titleholders are responsible for the maintenance of their IP rights. Often this very specialized task of checking the market for infringing plant material is out-sourced to partners like Anti-Infringements Bureau (AIB) for vegetables, Breeders Trust for field crops or Royalty Administration International (RAI) for vegetatively propagated crops. These partners act like police (C.I.D) officers. They try to prevent and to track down piracy by inspecting growers and licensees regularly. When they detect something suspicious, they try to safeguard the potential evidence. This is a serious challenge and often requires an approval of the judge to collect the suspected plant material.

Several kinds of piracy can be distinguished as acts that violate the PBR of a protected variety: 1) illegal vegetative reproduction of grafted PBR crops. 2) reproduction of seeds of open-pollinated PBR crops; misuse of a popular variety to sell plants or seeds of inferior quality using this name (including mislabelling, fake logo’s and packages). 3) F2 production of PBR hybrids. 4) theft of parental lines and unauthorised sale of F1 hybrids. (Source: annual AIB infringement surveys 2010-17).

NAKTUINBOUW AS THE ACCREDITED, INDEPENDENT EXPERT

Naktuinbouw, as an independent autonomous public body, developed a forensic tool, called ‘Variety Tracer’ to be applied in cases of suspicion of infringement. As Naktuinbouw is the only organisation in the Netherlands appointed by the government to assess varieties of nearly all crops for distinctness, uniformity and stability (DUS) testing for registration and Plant Breeders’ Rights (via the Board for Plant Varieties), morphological knowledge on many crops and on the PBR system is assured. Since 2004, Naktuinbouw also established a laboratory facility for variety identification using genotyping technologies. It is the combination (and the synergy) of these elements (fields of expertise) that guarantees the power of Variety Tracer.

VARIETY TRACER – HOW DOES IT WORK?

In 2004, Naktuinbouw established a laboratory facility for variety identification using genotyping technologies. To investigate a potential infringement of PBR a Variety Tracer research project can be initiated. In a Variety Tracer project often, a combination of morphological side-by-side growing trials and genetic research is applied, but just a growing trial or only a genetic analysis is also possible. Since every potential infringement is unique, a custom-made research plan is needed. Together with the titleholder of the PBR, the particular infringement and special crop-specific information is discussed. For example, an outcrossing crop in which a lot of diversity is expected within
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a variety is treated differently than a vegetatively propagated crop for which all plants belonging to one variety have identical genotypes. This information will have an effect on the number of samples to be analysed. After a final research plan is completed, sampling of all plant material to be included is done. It is of crucial importance that the sampling should be independent. To function as legal proof, a bailiff might be involved to take the suspected samples at the potential infringers growing site. For the genetic analysis two main questions must be considered: 1. How many markers are needed (which DNA technology is best to use)? and, 2. Which reference framework is relevant (which control samples should be included into the test to compare with)? To answer this last question, Naktuinbouw developed some guidelines for the selection of samples in a Variety Tracer analysis. Samples should be representative for the diversity within the species (all relevant morphological characteristics should be present in unbiased way). Some closely related samples should be included. This can be parental lines with seedlings and, when present, known and accepted mutant varieties with the original variety. Choices on which technology to use highly depend on the crop involved and on what information is publically available. For many species sequence information and crop-specific SNP or SSR markers are available. When no DNA information is available a random marker technology like AFLP can be applied.

The interest in variety identity tests increases; the number of Variety Tracer projects grows every year. (85 projects in 2017). The projects vary from simple identity questions to detect mix-ups to complicated infringement cases involving many parties. In nearly all infringement cases that were subject of the specialized PBR court in The Hague, Naktuinbouw was involved as independent expert and the Variety Tracer report served as evidence.

FUTURE PERSPECTIVE – TECHNOLOGICAL DEVELOPMENTS
With the release of Next Generation Sequencing (NGS) technology (in 2005), a real sequencing revolution has taken place. NGS machines enable massive parallel sequencing, increasing sequencing data output for decreasing costs. NGS is often referred to as High Through-put Sequencing (HTS). To increase the resolution and distinguishable power of DNA markers used in Variety Tracer projects, Naktuinbouw now invests to replace the old technologies like AFLP and SSR by SNP genotyping based on High Through-put Sequencing. So, Variety Tracer 2.0 is currently developed. There are three phases in the process of developing a SNP genotyping method for a particular species: 1. the identification of SNPs and selection of a SNP panel that is representative for the genetic diversity within the species; 2. development of a (sequence based) method to determine the SNP genotype of multiple varieties in a high throughput and cost effective way; 3. storage of all SNP genotypes in databases that can be used for variety identification purposes including infringements. Using these new technologies will enable Naktuinbouw to increase the accuracy and reliability of the genetic research for a lower price. Variety Tracer 2.0 will be better and cheaper to be applied for a plant world without piracy.

Editors’ Note: Hedwich Teunissen is Molecular Biologist at Naktuinbouw.

“PUTTING IN PLACE GOOD REGULATIONS AND A STRONG IP RIGHTS SYSTEM FOR PLANTS CANNOT RULE OUT PIRACY IN THE WORLD OF PLANTS.”
– Hedwich Teunissen
With more than 60 years’ experience, Euralis Semences is one of the leading European companies creating corn, sunflower, sorghum, rapeseed and soybean seeds. Thanks to our original breeding strategies, each year we confirm the success by gaining more trust of farmers and reinforcing market positions in all segments.
In the first part of this three-part article, we looked at the historical and recent evolution of crop protection. In this second part, we examine the current challenges in creating crop protection products and in the final piece, we’ll present emerging trends and future outlook.

The challenges to producing crop protection products in our modern era are numerous and multifaceted. Here are the thoughts of representatives from major manufacturers on prominent challenges and how they are best met.

WHAT ARE THE MOST SIGNIFICANT CURRENT CHALLENGES IN THE DEVELOPMENT AND COMMERCIALIZATION OF CROP PROTECTION PRODUCTS?

CropLife International (Spokesperson Will Surman): Developing innovative products for farmers is not cheap or easy. On average, it takes 11 years of research and development to bring a single product to market, at a cost of $286m – up 55% since 2000. In 2016, the number of new active ingredients added to the market was at its fourth lowest since 1950 – under five.

Companies also face the challenge of overcoming unpredictable regulation. For example, the EU regulatory approach is often founded on political rather than scientific considerations while the U.S. tends to have a more risk-based and science-led approach. With such regulatory uncertainty and diversity across regions, the confidence for companies to invest in new innovations can be undermined.

BASF (Alyson Emanuel, business head of the Functional Crop Care unit in BASF Crop Protection): A challenge in the development and commercialization of biological seed treatments is on-seed survival. We are working on this diligently ourselves. For example, we have achieved 225 days on-seed survival with our inoculant Nodulator Pro 225. Another challenge in the development and commercialization of biological seed treatments is compatibility with other products, to make sure biologicals are not mixed with products that might impede or eliminate their effectiveness.

Bayer (Utz Klages, head of External Communications): Especially for resistance management, it is essential that farmers have a broad variety of tools available to fight weeds, pests and
diseases. We must help them use the tools they have in sustainable manner and work on finding new modes of action.

Monsanto (Brian Carroll External Communications Manager, Europe):
One challenge is to produce multiple herbicide tolerances. Growers have expressed a preference for this.

Dow/DuPont (Media Relations Lead Dan Turner):
First and foremost, the challenge is to find novel technologies that meet the needs of growers, regulators, the food chain and ultimately the consumer. That relates to another challenge – having the proper foresight to envision and understand those future needs.

Another challenge relating to the EU specifically is the lack of predictability of the regulatory framework and the focus on hazards rather than risks. This makes it harder to make decisions very early in the product development process about which potential leads to advance first. Currently it takes around 10 years from discovery of a crop protection product to commercialization in North America, and in Europe it takes even longer.

Syngenta (Camilla Corsi, head of crop protection research):
Increasing regulatory requirements lengthen timelines and introduce uncertainty.

HOW WILL THESE CHALLENGES BE OVERCOME?

Dow/DuPont:
The lack of predictability of the regulatory framework in the EU can be solved through forming an organization that is committed to accelerate the pace of innovation to create solutions which will deliver abundant, high-quality food now and for the future. This will also require large investments from companies.

Companies need to be patient, have a collaborative spirit and have a good pragmatic process to assess future industry needs and opportunities. Similarly important is for companies to be fully aware that not all projects succeed for various regulatory reasons, so the innovation company must be able to support large financial loss if a project is cancelled mid-way through the journey.

To find novel technologies that meet the needs of the entire system requires companies to have a unique capability for introspection. Having the foresight to envision future needs is a significant challenge – and risky if that foresight is not accurate. Finding new modes of action is very challenging and requires great science and great scientists to discover those products that will provide novel efficacy while meeting evolving regulatory demands – but it remains the Holy Grail.

Bayer:
To identify a new mode of action for the control of pests and diseases, but especially to combat weed infestations, we must innovate, powered by our people and their diverse skillsets. Our employees in R&D have a very broad variety of scientific, technical and managerial backgrounds and we support them in building on their talents, but also in exchanging and acquiring new knowledge. We follow a broad variety of approaches to find molecules of a new mode of action.

We work on that ourselves and spend billions a year, but we have also set up partnerships with external parties who support us by investing own resources into our R&D activities (e.g., GRDC in weed control research, CRDF for the search for solutions against Citrus Greening).

CropLife International:
To bring more regulatory certainty we can only continue to insist that science, not politics, is driving the decision-making process. Most members of the public understand that farmers need crop protection products to prevent pests from destroying their crop. But they are suspicious of big business – a sentiment that is certainly not exclusive to the plant science industry. The answer is to be open and transparent with the public. Currently the industry ensures detailed studies and full data are submitted to regulatory bodies for all crop protection products. All toxicologically-relevant data is also available to the public. Our industry
remains fully committed to transparency and continues to look into new methods to improve access to regulatory data.

There is also a concern among society over recent mergers between companies. While CropLife International does not comment on any potential mergers and acquisitions, nor speculate on the impact of these possible changes to the marketplace, it is important to note that all large mergers and acquisitions must obtain prior approval by anti-trust authorities in major markets around the world to preserve competition and protect consumers.

It is also important that we emphasize the benefits of plant science to the public. CropLife International and its members are committed to serving the needs of farmers worldwide by developing plant science innovations that increase crop productivity, improve farmer livelihoods, and help enable food and nutrition security in a time of unprecedented population growth, increasing pest, weed and disease pressures, and expected difficult growing conditions brought on by climate change. Companies engaged in the plant sciences see farmers as not only customers, but as partners, and are committed to developing solutions that provide agronomic benefits that support their businesses.

It is important that the plant science industry be competitive and diverse as this ensures a diverse product choice for farmers. The industry is far more diverse than CropLife International’s membership — it includes countless small and medium-sized companies; public and private sector research institutions; and multi-national, regional, and local companies — as well as emerging and new companies and research institutions that enter the industry.

Syngenta:
Industry efficiency and consolidation are needed to deal with the unpredictable impacts of climate change, low global commodity prices and increasing regulatory requirements. Innovation remains the key to success as well as integrating farmers’ needs into the R&D process as early as possible.

The current environment has prompted all companies to review their strategies and approaches to ensuring efficiency and the ability to continue to invest in new technology. It is very costly to invest in the R&D required to ‘discover’ and bring new products to market, and therefore scale for innovation is extremely important, as is leveraging partnerships. At Syngenta, we have over 400 agreements with academic institutions, companies, individuals, charities and NGO’s to ensure we can find the answers to growers’ challenges.

Syngenta is now taking a holistic approach even in the very early phase of research. Around eight years ago, Syngenta started to implement a new approach in product development and it resulted in the launch of ADEPIDYN, a broad-spectrum fungicide for multiple crops in 2016. This is an unprecedented pace of R&D. Starting with that product, molecules are assessed by our scientists for their spectrum of activity and potency but also against other criteria such as chemical stability, environmental behavior, safety, production costs and likelihood of meeting regulatory requirements.

“TO BRING MORE REGULATORY CERTAINTY WE CAN ONLY CONTINUE TO INSIST THAT SCIENCE, NOT POLITICS, IS DRIVING THE DECISION-MAKING PROCESS.”

We as an industry need to work with governments and other bodies to help shape policy and ensure that regulatory requirements are science-based. Against this background, the opportunities offered by science have never been greater. The convergence of chemistry, biology and mathematics is enabling us to innovate faster, more precisely and with more predictable results. Increasingly, we can apply predictive science to innovate by design, using data-driven techniques to create better products that meet growers’ needs.

Monsanto:
To meet the challenges of market demand, seed companies will have to offer a complete systems approach – seed treatments, herbicide and insect tolerances, chemistry solutions, even data-science options and packages – to set themselves apart from competitors in the marketplace. A timely approval process can ensure that we can bring these technologies to growers more quickly, so they can realize the full benefits on the farm. Education is also vital for helping farmers use new technologies successfully.

Collaboration is another strategy for success and we expect to continue to see collaborations that make sense for growers.

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**REDUCED CHALLENGES WITH PHEROMONE PRODUCT COMMERCIALIZATION**

Pheromones are the chemicals released by organisms to communicate with others of their species, typically released into the air and used for a variety of purposes including attraction of mates. Because pheromone crop protection products have a more environmentally benign nature than some other products, the Environmental Protection Agency in the U.S. (EPA) has adjusted its review of them. In an October 2017 Agronews article called ‘Navigating hurdles to bring pheromone pesticides to market,’ Johnny Johnson and Christian Kerr note that while mating-disruption products still have to be registered under the U.S. Federal Insecticide, Fungicide and Rodenticide Act passed in 1947, the EPA has reduced and removed several requirements. However, they explain that “just because a particular pesticide is considered a biopesticide for registration purposes does not necessarily guarantee an expedited registration process.”

Kerr and Johnson note that manufacturers of biopesticides must: list starting materials, provide steps taken to ensure integrity and limit contamination of starting materials, verify identity and purity of the seed stock and report quality control methods and the techniques used to ensure product uniformity. They believe “the ease, relatively speaking, of registration of [pheromone] products should encourage their more widespread use in the near future. Products that kill nothing and still protect vital crops could become a vital part of our agricultural economy.”
Dear readers of European Seed,

In an attempt to draw much-deserved attention to the movers and shakers in the European seed sector, we have put together a list of people who, in our view, were highly influential in 2017. You may ask what makes an individual worthy of a spot on our list of the most influential seed people? We believe each one of these incredible people have had a significant effect on the European seed sector in the past year(s).

As you will see, each of our choices is accompanied by a short piece of text, explaining what the person’s key contributions have been, and why that person should be on our list. We deliberately did not want to make space for any short or long pieces of resumes, as those are usually available in the public domain.

Of course, we struggled to decide who should be in this selection and who should not. There will always be people who you think should have been on the list, and question why others were omitted. We very much welcome and look forward to your feedback as to who you think should have been on the list, and why. As we plan on publicizing this list on a yearly basis, we can’t wait to put together next year’s list with your future nominations.

We are dedicating a significant number of pages to this as we hope that this will generate more discussion, more engagement and above all, more appreciation for the seed sector, that is so often desperately lacking.

We would like to add that although appearing on the list can be seen as an honour, European Seed makes it clear that entrants are recognized for changing the seed world, regardless of the consequences of their actions. We hope you enjoy the list and look forward to your feedback.

— Marcel Bruins
Diego Angelo, EMEA Region Head Seeds at Bayer SAS. Diego was able to grow the seed business in EMEA in a challenging context, focusing on three main crops: OSR, of which the business is growing very well in Eastern Europe compared to 2016; cotton, where the company is now a leader in Greece & Turkey; and hybrid rice for Africa. Diego is a very dedicated and focused leader and has been an example to his colleagues in efficiency and flexibility. He lives the Values of Bayer – LIFE (Leadership, Integrity, Flexibility and Efficiency). Safety in the seed business is vital, and under his guidance, the company created a new safety award across the region specially for seeds, which resulted in a certification ISO 18001 for Bayer European Oilseeds Processing Centre.

Paolo Barbieri, Managing Director DuPont Pioneer in Europe. In his role, Paolo has been working on providing European farmers with the highest value through innovative products, services and solutions, which result in increased farmer productivity and profitability. Paolo has significantly contributed to the fast market access and success of Pioneer® brand Optimum® AQUAmax® hybrids, Pioneer Protector® products and m³™ products. While always looking for opportunities to better serve customers, Paolo has advocated plant breeding innovation like gene editing, through strengthening the relationship with external stakeholders and integrating the perspective of the consumer.

Suzanne Barratt, Seeds Communication Manager, EMEA & APAC at Bayer & Chair of the ESA Working Group Communications. Effective communication is vital for any seed company and especially so for an organisation such as the ESA. Engaging and emotional communication can make all the difference to explaining policies to decision makers, creating support and improving societal acceptance of the European seed sector. Suzanne has excelled in her role as chair of the ESA WG Coms, giving a more prominent place for communications alongside public government affairs; leading to streamlining and aligning members so together everyone can contribute towards the enhancement of the image of the seed sector.

Jan-Willem Breukink, former CEO and President of Incotec Group BV. Jan-Willem is known for his enormous commitment to the seed industry. He has been at the helm of Incotec for over 25 years and in that position he was instrumental in introducing innovative products in the field of seed enhancements into the market. Under his leadership, Incotec won several innovation and business awards, including in 2009 the Erasmus Award for most innovative company in The Netherlands, and in 2014 the European Business Award. He served in several executive roles on committees within major seed organizations, such as ESA and ISF. At present he is chairman of the board of Seed Valley and continues to share his expert guidance in the boards of various other organizations.
such as Barenbrug Group BV, Floriade BV, De Groot en Slot Allium Beheer BV and GreenPort NHN.

**Martin Ekvad**, President of the Community Plant Variety Office (CPVO). Since 1995, the CPVO has managed the Community Plant Variety Rights (CPVR) system by granting intellectual property rights for protecting new varieties of plants with unitary effect throughout the territory of the EU via a single application to the CPVO. The strength of the system is evident from the continuing increase in applications and titles in force, making it the largest system of its kind globally. Under Martin’s leadership, the organization has shown continued progress in addressing upcoming technical and administrative challenges, whilst maintaining a robust and cost-effective system for CPVR. Through his engagement in UPOV activities, such as Chairing the Legal and Administrative Committee at UPOV for a period of three years, he has kept the CPVO visible also in the international arena.

**Garlich von Essen**, Secretary General of ESA European Seed Association. Garlich has been active in ESA since 2000, first as Director Public Affairs, and since 2004 as Secretary General. Integrating the informal Eastern European Seed Network in the mid-2000s, ESA today represents the entire European seed sector from Finland to Turkey and Ireland to Ukraine. Next to countless interactions with EU decision makers on key EU seed policies and regulations, under Garlich’s leadership ESA continuously extended industry-led outreach and advocacy on a wide range of issues such as IP transparency (implementation and management of the PINTO database), seed treatment quality control (the ESTA scheme), and, most recently, on breeding innovation communication with the “#EmbracingNature” campaign. He started rotating the location of the ESA Annual Meeting all over Europe, with great success and record attendances, and has successfully selected new talent for a growing ESA secretariat. Garlich also is a sought-after speaker on EU public policy and modern association management.

**Erik Fyrwald**, Chief Executive Officer at Syngenta AG. In 2017, Syngenta was acquired by ChemChina, and one of the expected impacts of the acquisition is that it will help modernise China’s farm sector. ChemChina is keen to transfer Syngenta technology to China to improve farm productivity there while also investing for the long term to help grow Syngenta’s business globally, including most recently the announced acquisition of Nidera seeds, a major player in the Latin American seeds market. With China being a major trade partner for Europe, changes at Syngenta will have lasting consequences for the European and global seed sector. The path Syngenta takes will have a major and lasting impact on the European seed sector. Erik, in his role as CEO of Syngenta, will be making decisions affecting the future of millions of farmers around the world.
Rale Gjuric, Director of the UC Davis European Plant Breeding Academy (EPBA). The number of young people studying plant breeding has been decreasing steadily over the past decades. In a time where seed companies are having more and more trouble filling their breeding vacancies, it is imperative that new initiatives stand up that fill the education gap. Rale has been instrumental in spearheading these education efforts and has trained numerous students, which subsequently became more productive plant breeders in their respective organizations. The EPBA is part of the larger UC Davis Plant Breeding Academy, which since 2006, has offered 15 classes worldwide which were attended by 281 breeders from over 60 countries, making this organization the most recognized program of its kind.

Leticia Gonçalves, President, Monsanto Europe. Under Leticia’s leadership, the company has expanded its scope in Europe from not only selling products, but moving towards an integrated-solutions approach, helping farmers better manage their decision-making and improve sustainable practices through a variety of advanced agronomics and modern technologies, such as digital farming and biological seed solutions. Furthermore, as a female leader in a male-dominated industry, Leticia brings her unique perspective and a signature management style with a focus on talent development, promoting diversity and empowering leaders. Over the past few years, Leticia has modernised the vision and operations of Monsanto across the region to build a truly pan-European business on the principle of “one vision, one culture,” leveraging regional expertise to serve as farmers’ partner of choice.

Heinz Haller, Executive Vice President of the Dow Chemical Company and President of Dow Europe, Middle East, Africa and India (EMEAI). In 2017, The Chemists’ Club awarded Heinz the Winthrop-Sears Medal for entrepreneurial achievement, acknowledging his leadership and creative strategies that have contributed immeasurably to the growth and success of Dow over the years. This medal recognizes individuals who, by their entrepreneurial action, have contributed to the vitality of the chemical industry and the betterment of mankind. The merger between Dow and Dupont-Pioneer will reshape the global and European seed sector in an unprecedented way and the decisions the European heads of the merging companies are taking will have a major and lasting impact on the European seed sector.

Phil Hogan, EU Commissioner for Agriculture and Rural Development. As Commissioner, Phil is ensuring that EU agricultural and rural development policies promote growth, investment and new jobs, while at the same time reviewing the effectiveness of EU spending on agriculture and rural development. He is currently debating the future of the Common Agricultural Policy (CAP) and earlier in 2017, he played a decisive role...
in sealing the EU trade agreement with Japan after four years of gruelling negotiations. Besides his strong dedication of European agriculture, he has been an active communicator about EU agriculture and other policies. He shares his views on Twitter with more than 850 tweets per year.

Jan Huitema, member of EU Parliament, committee: Agriculture and Rural Development. Jan was one of two initiators of a Resolution in the EU Parliament on the patenting of products – essentially biological products – as Jan believes that no one should have the right to patent natural characteristics of plants and products coming from classical breeding. And as a result, the EU Commission issued a Clarifying Notice on this topic, eventually leading to the European Patent Office changing its course. He is also the author of the recent report on enhancing innovation and economic development in future European farm management.

Niels Louwaars, Managing Director at Plantum NL, the Dutch association for the plant reproduction material sector. Plantum is one of the leading national associations with a number of staff specialised in the main policy dossiers. Niels is also chair of the ESA CRLA, co-chair of the Plant Breeding Innovation working group of ISF and has at the national level several board responsibilities in seed related institutions. Throughout his earlier career, Niels worked on improving seed systems as a key element in realising global sustainable development goals and in aligning various policy areas such as seed regulation, intellectual property and biodiversity rights. In 2017, Niels was awarded the Outstanding Alumnus Award of the Wageningen University Fund. He was praised for the way in which he has managed to connect the different stakeholders in this sector. In his current position, he is a bridge builder working for the interest of the private sector, forging partnerships between governments, businesses and educational institutions and with other stakeholders in the policy debates.

Penny Maplestone, Chief Executive of the British Society of Plant Breeders. Penny has been relentless in her efforts to promote an understanding of the science and business of plant breeding, and to encourage an enabling regulatory framework, strong IP provisions, and investment in breeding through royalties and effective public/private sector R & D partnerships. In the past few years, the BSPB has invested heavily in communication about plant breeding and its benefits, and exemplary are the series of six short videos to explain the business and science of crop improvement, to encourage the next generation of plant scientists, and to demonstrate how plant breeding contributes positively to our everyday lives.
Steffen Noleppa, Managing Director of HFFA Research GmbH. In the past year, two ground-breaking HFFA research reports dealing with the European seed sector have been published; one on the economic and environmental benefits of plant breeding in the EU, and one on the societal costs of banning neonicotinoid seed treatment in the EU. Both reports strongly underline the positions of the European seed sector. As an agricultural economist and the lead author of these reports, Steffen has provided guidance to getting robust and science-based data out there, data that should have an immediate and resounding impact on EU decision-making. In addition, Steffen has highlighted the importance of an improved access to new plant varieties in an international context, but focussing on Vietnam on a case study base in another research report.

Marian Suelmann, Company lawyer at Rijk Zwaan & Chairperson of the ESA – Committee on Intellectual Property Rights (CIPR). Since 2007, ESA has advocated the need for a clarification to re-establish the balance between two IP systems that are available for breeders to protect their inventions; plant breeders' rights on the one hand, and patents on the other. After years of discussion, the Commission issued a clarifying notice after which the EPO suspended all the proceedings related to patent applications on plants, and will now process them in the light of the new decision. This has been one of the priority issues for the ESA CIPR for the past year. Under the longstanding chairmanship of Marian, ESA was successful in conveying this ESA message to the political forefront and prevail, leading to a major policy change.

Nigel Moore, Head of Business Administration at the KWS Cereals business unit and & ESA president since Oct. 2015. The European Seed Association is the pinnacle organization representing the European seed sector and at the head of this organization is the ESA president. In this capacity, Nigel has overseen the development and implementation of a new strategy for ESA with the vision of outreach and communication of the societal benefits of innovation in plant breeding delivered through the seed sector. These messages are reaching regulators, policy makers and thought leaders throughout Europe through channels such as the HFFA research report in 2016 and the new media ‘embracing nature’ campaign launched at the annual meetings in Rome and Riga with record attendance. Under his guidance, ESA successfully contributed to a major policy development for patenting products of essentially biological processes, and a further expansion of the ESTA scheme both of which publicly exemplify the sector’s commitment to trustful best practice.
Graeme Taylor, Director of Public Affairs at the European Crop Protection Association (ECPA). Crop protection products are a vital component in the challenge to produce enough high-quality food for everyone. Bringing this message across is not an easy task, particularly in an industry that constantly finds itself under attack. Graeme has run an excellent campaign (‘With or Without’), creating more awareness about the needs and benefits of crop protection products that is designed to shift the reputation of the industry from one that is closed, to one that is listening to society and ready to engage and address concerns. On behalf of ECPA, he has continuously argued that policy should be informed by science and designed to manage risk, particularly through his active visible advocacy on the re-approval of glyphosate which set new standards for industry association advocacy and communication. He wants to see a predictable and proportionate EU regulatory environment that fosters innovation and encourages competitiveness.

Ido Verhagen, Executive Director of the Access to Seeds Index, which aims to measure and compare the efforts of the world’s leading seed companies to enhance the productivity of smallholder farmers. In 2016, the first Access to Seeds Index came out and the second Index is scheduled to come out at the end of 2018. Although there was criticism of the Index by the seed sector, both in the preparatory phase as well as after publication, the fact remains that the Index created more awareness on access to seeds in developing countries and on the role seed companies can play in improving smallholder farmer productivity. With that, Ido has influenced the EU and global seed sector in a lasting way.

David Zaruk, Professor at Université Saint-Louis Bruxelles and KUL Brussel (Odisee) & blogger ‘The Risk Monger’. As a professor, David lectures on Risk Communications, EU Lobbying, Corporate Communications and PR. As a blogger, he has tackled many controversial topics such as neonic, bee health, glyphosate, food safety, GMO’s and many more. In his blogs, David challenges simplistic solutions to hard problems on environmental-health risks in a pro-science, anti-dogma manner. He stands open to being challenged while challenging others to keep the debate on a scientific ground. In 2017 he challenged the influence of tort law firms in fabricating science (the Portier Papers), raised the need for scrutiny on NGO funding and is defending the role of evidence in the EU risk assessment process.
PESTICIDE CONCERNS

Over the last few years I’ve spoken at various agricultural conferences and have met many farmers. But I’ve never heard a comment like: “Gee, I don’t think I’m spending enough money on pesticides, I’d like to spend more.” Or, “Is there any way I can increase my exposure to pesticides?” The point of course is that pesticides are expensive and by design are toxic, facts of which farmers are acutely aware. After all, they are on the front lines, and are far more likely to be affected by pesticides than John Q. Public.

Farming is a tough life, it’s hard to make ends meet. No farmer wants to waste money on unnecessary chemicals. They use pesticides simply because they make it possible to produce the hefty amounts of food needed to feed the world. But even with the use of pesticides, and the increased yields they afford, one out of every six people in the world goes to bed hungry every night! Organic production methods have their place, but they are just too unreliable to feed the masses.

As recently as a century ago, some seventy percent of the population was involved in food production. Today, we rely on about two percent of the population to feed us. And we want them to feed us cheaply and with a wide array of choices. We also want our produce to look good and be available year-round. All that cannot be accomplished without the judicious use of agrochemicals.

Those of us who haven’t had farming experience have little idea of the variety of plant diseases that farmers have to cope with. Leaf blight, leaf scorch, leaf spot, powdery mildew, botrytis grey mould and red stele are just some of the diseases that can affect strawberry plants. Tomatoes can be affected by fungus root rot, grey leaf spot, bacterial canker and late blight. An apple grower has to cope with apple scab, black rot, blister spot, blue mould, bitter rot, bull’s eye rot, fire blight and sooty blotch. But that’s nothing compared with the 51 fungal, 37 viral and seven bacterial diseases that wheat farmers have to contend with. And then there are the insects, nematodes, rodents and assorted weeds that can devastate crops. Each of these problems can be addressed through the appropriate use of specific chemicals. Little surprise then that over 400 different pesticides are registered for use in Canada!

Pesticides increase crop yields, about that there is no doubt. But do they also increase the risk of health problems? As far as farmers are concerned, probably. Parkinson’s disease, some lymphomas and prostate cancer have been associated with exposure to certain pesticides. There’s no iron-clad proof but given the known toxicity of pesticides and the epidemiological evidence, there’s a good chance that we are looking at a cause and effect relationship. Another concern is raised by the hormone-like properties of some pesticides, exposure to which in the womb may have long term consequences. For example, a study of 50 Mexican girls aged eight to ten revealed that girls from a farming community where pesticides were commonly used had earlier breast development and larger breasts than girls from a ranching area where pesticides were not used. All subjects came from the same Mayan population and their families were similar in diet and lifestyle.
Another intriguing study found that the highest rates of birth defects in babies born in the U.S. occur among those conceived in the months from April to July. It is also during these months that levels of pesticides as well as nitrates from fertilizer are at their highest levels in surface waters. Conceivably some of these chemicals may have an effect in utero. Of course, an association like this does not prove cause and effect; pollen in the air or even TV reruns increase during springtime and could be associated with birth defects. But admittedly the pesticide connection is scientifically more plausible.

And yet another interesting finding. Men who work in flour mills tend to father fewer sons than daughters. A study carried out in the state of Washington found 63 per cent of the children born to flour mill workers were girls while in the rest of the state, girls made up 49 per cent of new-borns. Flour mill workers are exposed to a number of pesticides that are used to keep insects and rodents out of stored grain and flour. The idea that pesticides may have an effect on reproduction is not far-fetched. Thirty years ago, dibromochloropropane, a compound widely used at the time to kill nematodes that attack the roots of fruit trees and crops, was banned because it caused sterility in male mammals including humans.

But what does all this mean though for those of us who are not farmers, don’t live in communities where pesticides are extensively used and don’t work in flour mills? We are all still exposed to pesticides through our food, water, air and even kitchen floors. All this exposure combined, though, is orders of magnitude less than that of farmers, or indeed families of farmers. The bottom line? Occupational exposure to pesticides merits continuing investigation, but I will happily keep eating my several apples a day in spite of the fact they may harbour residues of forty pesticides, with an average of four per apple. The amounts in my view are insignificant. But I will add that I have produced only daughters and granddaughters.

Joe Schwarcz PhD is Director, McGill University Office for Science and Society, Montreal, QC, Canada

“Modern day food production cannot be accomplished without the judicious use of agrochemicals.”
Organic agriculture has been regulated in the European Union (EU) since 1991 when the first provisions laying down minimum standards for the internal market were adopted. Initially, the legal framework only covered plants and plant products. However, subsequent revisions were later introduced covering animals and animal products; it has been constantly evolving ever since to include more detailed rules on issues like labelling and imports, the extension of provisions to cover wine and aquaculture as well as establishing the now widely-recognised EU organic ‘leaf’ logo for pre-packed products.

Significant growth in both production and consumer demand in recent years has seen organic farming develop from a relatively anarchic sector into a still small, but well-established and professional industry. To keep up with such developments, the Commission’s 2014 proposal for a reform had as its main aims the need to ensure a level playing field between Member States, to improve consumer confidence, and to ensure clear rules and the removal of “regulatory obstacles” to the further growth of the sector in the EU.

The proposal thus had three principal areas of focus: strengthening and harmonising production rules, improving the trade regime, and improving the control system. The ‘harmonisation’ elements of the proposal related to tackling areas of inconsistency between Member States, including mixed farms and pesticide residues. Modifications were introduced to ensure a gradual move towards a compliance-based import regime and changes to the control system foresaw bringing all organic operators within the scope of official controls on the agri-food chain.

Even though the organic agri-food chain starts with seeds, the Commission’s proposal for reform lacked a specific vision for the seed sector and/or meaningful suggestions on how to actively promote the production and use of organic seed by breeders and farmers respectively.

There is a broad understanding within the sector that the availability of organic seed differs among species and that for certain species there is still insufficient organic seed available on the market; there are also too few incentives to encourage farmers, and there is limited will to enforce the use of organic seed. However, the Commission’s preparatory documents did not acknowledge this or include any data on the supply, demand, or flow of organic seed within the EU. No novel solutions were discussed to improve the situation, not even ‘traditional’ solutions, such as proposing transitional financial support to develop the sector.
The European Seed Association (ESA) has been active in its engagement with the Commission from the moment the first consultation procedure was launched, and suggested a clear and sensible way to both collect more data on organic seed and also to start phasing out derogations. It was underpinned by an EU-wide database, and a classification system with three categories based on the availability of organic seed that would have seen derogations prohibited for some species and sub species where there is already a wide availability of seed and phasing out others more gradually where there is still limited availability.

Unfortunately, the Commission did not take on board this more targeted approach in its proposal, and cited cost as an obstacle to the development of EU-wide data collection systems. ESA adapted by seeking to bring its suggestions to the political debate via the institutions of the European Parliament and Council of the EU (representing Member States) as they began their scrutiny of the proposal.

ESA’s dealings with the European Parliament were challenging. The Parliament’s team was led by Green MEP Martin Häusling who both refused to meet with ESA and failed to invite it to participate in a “stakeholder roundtable event” he had organised with the rest of the negotiating team. Due to limited engagement from the other main political groups on those issues relevant to the seed sector, the European Parliament eventually adopted its mandate based on a text which sought to challenge the seed marketing directives and introduce provisions which would have run counter to existing rules.

ESA’s dealings with the Member States in the Council were more successful, but still challenging. Most followed a consistent – and welcome – approach whereby whatever text was included on seeds, it should be compatible with the existing seed legislation. Unfortunately, a number of countries, keen to maintain national rules and practices, were quite preoccupied by some of the Commission’s ‘harmonisation’ proposals, and thus did not view seeds as a priority. It is for this reason that issues relevant to the seed sector were not fully addressed in the negotiations until close to the end.

Negotiators from the three institutions took almost 20 months, 18 formal “trilogue” negotiations, plus numerous bilateral and staff working group meetings before a political agreement was finally reached on 28 June 2017.

In addition to reflecting some of the Commission’s objectives on official controls and a stricter approach to imports, the final agreement also includes several provisions of particular relevance and importance to the seed and plant breeding sector.

The one positive outcome of the Parliament’s approach to seeds was that it put them higher up the agenda than the Commission had perhaps initially intended. Eventually this led to a broad agreement between the three institutions: there is a need to gather data on the availability of organic seeds, and to improve the supply and use of those organic seeds. This is reflected in Article 19a of the text which states that national databases where operators can list available organic seeds and plant reproductive material will be linked up via a central EU Commission website.

This would be the first time that such information would be made available at a centralised EU-level access point and is a highly welcome achievement. The establishment of an EU-wide database will allow operators to potentially reach a wider European market than perhaps was previously possible; it will also be easier to tell from the database whether or not organic seed is actually being used by farmers.

However, the new provisions will require efforts from the seed sector and Member States to be successful. The fact that it is not mandatory to list information in the national database may lead to an inaccurate – albeit more accurate than at present – representation of the market situation. Thus, the effectiveness of the database will depend on the willingness and capacity of seed producers to provide information, and on the efforts taken by Member States to encourage and facilitate the implementation of these measures by seed producers.
This collection and publication of data is linked to the derogations from the compulsory use of organic seeds in organic production. According to Article 35 of the agreement, these derogations would be phased out after 15 years; however, this period may be extended or reduced based on a report from the Commission (seven years into the period) which would assess the availability of organic seeds according to the information provided in the databases.

Establishing a timetable for the ending of derogations is a step in the right direction - it will hopefully lead to greater investment and innovation in the production of organic seed as companies will have greater assurances that there will be a future market for such seed. At the same time, the link between the information in the database and the end date for derogations is important - it means that the end date will be introduced based on data, rather than at a point in time that is politically arbitrary. This should prevent any disruption to the market, since derogations will only end when there is proof of sufficient quantity of organic seed. Thus, again, it is important for producers to actively update databases to ensure a true reflection of the market situation.

Derogations will need to be authorised on a case-by-case basis by national competent authorities, and only where operators have consulted the database and sufficient quality and/or quality of organic seed is not available for their particular needs. Whilst ESA still would have preferred to see its own proposed classification system phasing out derogations according to species be introduced – which would have allowed for an immediate end to unnecessary derogations - however, the adopted text will at least allow for an approach based on data, and it is our hope that the appropriate implementation of case-by-case authorisation of derogations will lead to a similar outcome in practice.

The agreed text also includes some remnants of the Parliament’s proposals relevant to the seed sector – namely provisions on the use of “organic heterogeneous material”, i.e. material that does not satisfy the variety definition in terms of uniformity, and a definition of an “organic variety suitable for organic production”.

In the case of the former, this started out as an exemption for “heterogeneous material” from the requirements of the seed marketing directives, despite the fact that there is an ongoing temporary experiment to assess whether or not this should be permitted. During negotiations, as part of a political compromise, this concept was narrowed down to only apply to “organic heterogeneous material” and significant safeguards were introduced limiting the production and marketing of such material, requiring the Commission to introduce further rules and detailed technical specifications on a species-by-species basis.

In the case of the latter, the Commission agreed to publish a political declaration outlining its intention to carry out a temporary experiment with the purpose of establishing criteria for the description of the characteristics of “organic varieties suitable for organic production” and the conditions under which they may be produced. Part of the definition restricting breeding methods was also removed in line with a deletion of the definition of “organic plant breeding” which, as originally phrased, was highly discriminatory and would have excluded many current and potential future breeding methods.

**“WE DO NOT ANTICIPATE THAT THESE ADDITIONAL PROVISIONS WILL PLACE ANY IMMEDIATE ADDITIONAL OBLIGATIONS ON THE SEED SECTOR”**

We do not anticipate that these additional provisions will place any immediate additional obligations on the seed sector, but they will need to be closely followed by ESA as they evolve and are given effect through subsequent executive acts by the Commission. Thus, ESA's work will continue even after the text is finally adopted as we monitor these developments and provide input where necessary.

The final issue which was only resolved late last year concerned the text in Annex II outlining the rules for the production of plant reproductive material. The text included in the June agreement was originally unclear: it could have been interpreted as allowing for the status quo whereby organic seed is multiplied from untreated, non-organic basic seed; it could also have been interpreted as implying that organic seed can only be produced from organic basic seed.

The text’s lack of clarity could have potentially implied significant changes if it were interpreted incorrectly: if producers were required to produce certified organic seed from organic basic seed instead of untreated conventional basic seed, this would severely limit their ability to produce such seed, the resulting qualities would likely not meet the requirements of the seed marketing directives, and prices would likely rise so significantly that they would become prohibitive. However, ESA raised these concerns with the Commission, who were open to a dialogue on this issue and agreed that further clarity was required. The text was subsequently clarified to ensure that it permits a continuation of the status quo whereby organic seed is multiplied from untreated, non-organic basic seed.

Some of those involved in the negotiations hailed the agreement in June as a great success, though on paper the improvements do not necessarily justify the time and effort which went into this reform. Many of the Commission’s objectives were watered down by Member States keen to maintain the status quo and many of the technical improvements do not give MEPs in the Parliament much political capital to use at home with their farmers and consumers.

The final text was put to a vote of the Special Committee on Agriculture (SCA) on 20 November 2017, and a qualified majority of Member States voted in favour of the text. Following this positive vote, the European Parliament’s Committee on Agriculture held a vote in which a majority endorsed the text. The next step will be for final signoff by the full plenary of the European Parliament (all 751 MEPs) and by the national Agriculture Ministers at the AGRI-FISH Council meeting, both expected sometime in April 2018. Assuming these votes pass smoothly, the intention is for the new rules to apply from 1 January 2021.

For the seed sector, we will have a new regulation which does offer some improvements to the sector. ESA’s advocacy efforts and persistence paid off, as we succeeded in retaining those elements we supported, and removing most of the elements we did not! However, our work is not over: once the text is adopted, the challenge for ESA will be to closely monitor the implementation of the regulation, including important upcoming secondary acts, and to support ESA members where necessary. Hopefully, in the medium-term, when the databases have been built up, this information will serve to influence the next reform of the organic regulation, when we can perhaps finally expect some meaningful proposals for our sector. •

Editor’s Note: Kate Wilson is the Public Affairs Manager at the European Seed Association (ESA), in Brussels, Belgium.
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UNLOCKING THE KNOWLEDGE ABOUT THE POTENTIAL VALUE OF A VARIETY

BY: RUARAIKH SACKVILLE HAMILTON

WHY IT MATTERS
Knowledge about the potential value of a particular variety of one crop emanates from the studies of hundreds of farmers and consumers, using scientific or other approaches to knowledge generation. Until now, this knowledge from all the diverse sources had not been brought together. The Global Information System (GLIS) of the International Treaty on Plant Genetic Resources for Food and Agriculture seeks to bring together information on PGRFA – where and how they are maintained, what their characteristics are, and how they could be sustainably used – from a wide range of different sources.

THE GLOBAL INFORMATION SYSTEM BRINGS TOGETHER INFORMATION ON PLANT GENETIC RESOURCES

W

We repeat it so often it begins to sound almost trite: the diversity of crops is vital for our future. The human population is growing, the land available for food production is decreasing, climate change imposes greater stresses on food production, non-renewable resources are becoming scarcer, and malnutrition remains a huge problem. How do we address the massive challenge? The answer lies in plant genetic resources for food and agriculture (PGRFA) conserved in situ and ex situ, which contain the building blocks that we can use to develop crops that are more nutritious, more productive, more tolerant of biotic and abiotic stresses, and less dependent on pesticides and fertilizers.

But identifying, finding and sustainably using these building blocks is almost unbelievably complicated. Each crop species has around 30,000 genes, producing thousands of biochemical compounds. We have still only touched the surface of understanding how they interact with each other over time to control the growth of the plant, how they contribute to a healthy diet, how they determine the response of the plant to pests, diseases, weeds, plant nutrients, extremes of temperature and moisture, soil microbes, soil structure and toxic compounds in the soil. Addressing each one of these issues is itself hugely complex. The objective is not to seek a single ideal type of crop plant: variation in crops in time and space is an essential part of the sustainable solution, matching the diversity and changeability of communities and environments.

Scientists typically try to break down these big problems into smaller, scientifically tractable pieces, and may labour for decades to make progress. Knowledge about the potential value of a particular variety of one crop emanates from the studies of hundreds of farmers and consumers, using scientific or other approaches to knowledge generation. And this adds a new dimension to the grand challenge – how do we bring together all the diverse sources of knowledge about each variety?

Enter: the Global Information System (GLIS) of the International Treaty on Plant Genetic Resources for Food and Agriculture. For the first time, the GLIS seeks to bring together information on PGRFA – where and how they are maintained, what their characteristics are, and how they could be sustainably used – from a wide range of different sources.

Rather than seeking to compile all relevant information in one place, the GLIS will build on existing information systems, helping them become inter-operable and, thus, more accessible.

The big challenge of bringing together information from different sources is that the information is gathered in different ways and stored in different ways in different data management systems. Fortunately, databases can now be made to talk to each other, even if they are designed in different ways as long as they have a common “language” for communicating with each other. The GLIS will make this interoperability among databases possible by providing a common agreed syntax to transmit and receive information.

For this to work, there are some basic requirements, an underlying framework on which all other functionality depends:

- Each sample of PGRFA in the GLIS must be uniquely, globally and permanently identified, using an appropriate, agreed form of identifier;
- Users of the GLIS must be able to trace the physical material of the PGRFA from core metadata associated with its identifier;
- Users must be able to find data, information and knowledge associated with the PGRFA; and
- Users must be able to find related PGRFA material (derivatives, ancestors, siblings).

Perhaps surprisingly, until GLIS discussions started, there wasn’t even an agreed system to identify PGRFA and the relationships between PGRFA globally. This has been a major barrier to collaboration; partners in a network, working on related PGRFA must be able to unambiguously identify related samples held by other partners in the network. Given this fundamental need, GLIS has prioritised the streamlined exchange of PGRFA between partners, so that each recipient of PGRFA can easily and accurately identify, in the recipient’s own database, the precise material received from the provider.

Digital Object Identifiers (DOIs, which are Digital Identifiers of Objects, not Identifiers of Digital Objects), have now been selected as the permanent unique identifier of choice. The Secretariat of the International Treaty has set up a mechanism to allow anyone to acquire DOIs to identify the PGRFA that they manage. A small step forward, but a vital one, one that has never been undertaken before.

With this vital step, the GLIS opens up a whole new world of new opportunities to collaborate in building up knowledge of PGRFA through connecting databases developed by diverse stakeholder groups.

Dr Ruaraidh Sackville Hamilton is currently Head of Genetic Resources Center, International Rice Research Institute (IRRI), Philippines, a position he has held since 2002.
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Corteva Agriscience™ to Focus on Seed, Crop Protection Products and Integrated Solutions

Pierre Flye Sainte Marie, Leader, Europe, Middle East, Africa Region, Corteva Agriscience™, Agriculture Division of DowDuPont, talks about a unified agriculture company that helps growers produce more and better food, with fewer resources.

Dow and DuPont have gone through a complex process of merging and forming three new entities. Can you describe a bit more about the background of the merger and the progress?

PIERRE FLYE SAINTE MARIE (PF): The Agriculture Division of DowDuPont has recently announced the name of the intended company once it is spun-off, which is expected to happen by June 1, 2019. The intended agriculture company will become Corteva Agriscience, which is derived from a combination of words meaning “heart” and “nature”. Corteva Agriscience brings together DuPont Crop Protection, DuPont Pioneer and Dow AgroSciences to create a market-shaping, standalone agriculture company with leading positions in seed technologies, crop protection and digital agriculture. This is the start of an exciting journey. With the most balanced portfolio of products in the industry, nearly a century of agronomic expertise and an unparalleled innovation engine, Corteva Agriscience will become a leading agriculture company, focused on working together with the entire food system to produce a secure supply of healthy food.

What is the status of creating the unified agriculture company in Europe, Middle East and Africa?

PF: We are progressing well according to our plan. We are already deploying the unified company in Europe, Middle East and Africa (EMEA) region. In EMEA, we have a balanced portfolio, almost 50-50 per cent between seeds and crop protection. We have a strong position in corn, wheat, canola, sunflower and specialty crops. We are covering all geographies in the region, we have a footprint in all key countries, and we have very strong
teams in crop protection and seeds expertise, and we excel in attracting external talent.

The new Corteva Agriscience company will continue as a pure-play company, focusing solely on agriculture. Can you explain how this will benefit your customers?

**PF:** We are bringing together the complementary portfolios and strengths of three separate businesses (DuPont Pioneer, DuPont Crop Protection, and Dow AgroSciences) to become one fully integrated whole – a single global leader focused solely on agriculture. To be a pure play agriculture company, we intend to bring a broader suite of products to the market, faster, so we can be even better partners to growers, meeting and exceeding their expectations for innovation and helping them to increase their productivity and profitability.

The new division will be based on three pillars, namely seed, crop protection products and integrated solutions. I believe the seed and crop protection parts are well known. Could you expand a bit on the integrated solutions?

**PF:** This is about innovation. I am talking about three pillars. The first is the combination of the crop protection portfolio (Dow AgroSciences and DuPont Crop Protection), which is broadening our offering in the market in herbicides, fungicides and insecticides and will be able to meet customer demand in more geographies and in all key crops. The second is seeds. The strength of Dow AgroSciences in traits combined with the DuPont Pioneer lead germplasm is a huge opportunity. The third pillar is our integrated crop solutions: to combine seeds, crop protection and services where and when it makes sense. Our vision is to deliver customized products and services to meet farmers’ needs for each hectare. By combining our Dow and DuPont product lines, we are able to create more comprehensive solutions to help growers meet rising demand sustainably, responsibly and safely. Let me bring here a few examples – happening now. One is sunflower. We offer customers a wide portfolio of sunflower hybrids and solutions, in all market segments, such as our high oleic hybrids that provide direct consumer and food manufacturers benefits, thanks to their healthy and high-performance oil. Corteva Agriscience is strongly committed to sunflower innovation as demonstrated by our recent investment in a cutting-edge sunflower technology center in Seville, Spain. Additionally, we have recently introduced another innovation into the corn market: our m3™ silage brand, which uniquely positions us as a competitive actor on the silage market. The m3™ corn silage hybrids deliver greater milk production efficiency through higher yield and highly digestible starch, allowing dairy farmers to increase their productivity and profitability.

What about mid-term innovations?

**PF:** Corteva Agriscience is a global leader in the field of CRISPR-Cas for the development of agricultural products in a broad range of crops. CRISPR-CAS helps our scientists to develop innovative and sustainable solutions to farmers similar to those realized through conventional plant breeding techniques, but with even greater quality and accuracy, and with more efficient development timelines. Another innovation is ProPound™, which is a new advanced rapeseed meal with a protein content comparable to soybean meal, high levels of digestible amino acids and energy, and low levels of fiber. Through rigorous nutritional testing it has been shown that this new meal can be used successfully as a substitute for soy meal in swine, cattle and poultry feed. ProPound rapeseed is a product of conventional breeding. ProPound canola is already commercial in Canada and new ProPound varieties will be launched in 2017, among others in a stack with the successful Omega-9 High Oleic oil trait to provide two benefits from the same plant. ProPound has the potential to improve the EU’s protein self-sufficiency rate and to decrease dependency on imported soy.

Pierre Flye Sainte Marie is the Corteva Agriscience, Agriculture Division of DowDuPont™, leader for Europe, Middle East, Africa (EMEA) Region. He moved into this role in September 1, 2017 and he is based in Switzerland.
Albeit not a key priority for the European Seed Association (ESA), the issue of crop protection was an important part of the discussions on the revision of the EU Regulation for Organic Production. And here much of the debate revolved around a popular misconception about what the term ‘organic’ really means. EU consumers think ‘organic’ means ‘chemical-free’ however, that is not what the organic label actually mandates in the EU. And it is specifically this misconception that is exploited by organic producers. It is a fact that many pesticides are allowed in organic production and organic products frequently contain pesticide residues.

Examples of some of the most toxic pesticides in organic production are Boron (may affect the brain, liver and heart); Acetic Acid (burns the skin and eyes, and is a risk to bees); Copper sulphate (toxic to basically everything, it bioaccumulates and persists in the environment); Pyrethrins (neurotoxic and highly toxic to bees); Hydrogen peroxide (highly toxic to bees); Rotenone (bee killer and linked to Parkinson’s disease); Azadirachtin (highly toxic to bees) and many others.

And the European Commission wanted to change that with a plan to bring the industry in line with what consumers really think organic food is — and limit pesticide residues. And here’s where they ran into trouble. They had not calculated the opposition by both the EU Parliament, as well as by the EU Member States.

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Innovations for a better world.
Who knew that the cute clover, so easily found in meadows around the world, can have up to 56 leaflets! At least, this is the current official record of highest number of clover leaflets on a stem, established in 2009. So much for four-leaved clover... Clover, in fact, is the common name for all plants of the genus Trifolium which consists of about 300 species of plants.

Several of them are extensively cultivated as fodder crops, either sown alone or in a mixture with ryegrass. The crop has for a long time formed a staple crop for silaging, because of its versatility. It grows vigorously, shooting up again after repeated mowings; it produces an abundant crop; it is palatable and nutritious for livestock; it fixes nitrogen, reducing the need for synthetic fertilizers; it grows in a great range of soils and climates; and it is appropriate for either pasturage or green composting.

Agronomically, the most important species are red clover (T. pratense), white clover (T. repens); Crimson clover (T. incarnatum); Egyptian clover (T. alexandrinum); clover hybrids and subterranean clover (T. subterraneum).

Clover can be found all over the world, with the highest diversity in the temperate Northern Hemisphere, but many species also exist in South America and Africa, including at high altitudes on mountains in the tropics. They are small annual, biennial, or short-lived perennial herbaceous plants, and can even be evergreen. All the more reason for European Seed to check with some clover breeding companies how much luck is needed to develop a new clover variety. We spoke with Dr David Lloyd, Head of Legume Breeding at IBERS (whose commercial partner is Germinal); Lily Chin, clover breeder at Barenbrug New Zealand; Niels Roulund clover breeder at DLF in Denmark; and Libor Jaluvka, clover breeder at DLF in the Czech Republic.

European Seed (ES): Which clover species is your company mostly focusing on, and for which reason?

Niels Roulund (NR): DLF Seeds is mostly focussing on breeding of white clover (T. repens) and diploid red clover (T. pratense), because these two species have the biggest market potential, fit best to mix with DLF grasses and have the best potential for seed production.

Lily Chin (LC): Clovers are important forage legumes. Grown mainly in a mixture with grass, plantain or chicory, they can contribute significantly to productive pastures, higher animal performance, nitrogen fixation, and improved soil structure. However, until recently some dairy farms do not grow enough clover because the increased use of N fertiliser over the past few decades (in the pursuit of higher milk production) has reduced its performance. With tightening of environmental regulations on N fertiliser levels used on farms, the significance of clovers in pastures has been renewed.

We mostly focus on breeding white (T. repens) and red clovers (T. pratense). White clovers can annually contribute up to 7t dry matter (DM) per hectare and red clovers up to 15 t DM/ha, particularly on farms with inputs of less than 200kg N/ha/year. Our clover breeding program is partly based in New Zealand, where there is also significant clover usage and seed production. Clover lines are sent to multiple locations in Europe for trialling to ensure the clover produced performs under the different soil, climate and farm systems (e.g. dairy farms under mainly cut and carry systems to sheep grazing in the UK). Red clovers have a greater market in Europe than in NZ, due to the
cut and carry system on dairy farms in Europa, whereas NZ is practically all grazing.

**DAVID LLOYD (DL):** Germinal and IBERs focus mainly on breeding red clover and white clover, we also have breeding programmes for hybrids between white clover and related species like Caucasian clover (T. ambiguum).

**ES: ARE THE BREEDING EFFORTS DIFFERENT FOR EACH OF THESE DIFFERENT CLOVER SPECIES?**

**LC:** The breeding efforts for white and red clover reflect the market demand.

**DL:** The bulk of our effort is directed towards our core breeding programmes of conventional red clovers and small, medium and large leafed white clover. We spend roughly equal amounts of time on each, but we have additional programmes devoted to added value traits such as abiotic stress tolerance, nutrient use efficiency and resistance to specific diseases.

**LIBOR JALUVKA (LJ):** Our plant breeding in clover is divided into two different programs. The breeding of white clover is located in Denmark and the breeding of red clover is in performed in the Czech Republic. Field plot testing of both species is typically done in Denmark, the Czech Republic, France, England and the US.

**ES: CLOVER IS ATTACKED BY SEVERAL FUNGAL DISEASES, SUCH AS FUSARIUM, SCLEROTINIA AND ANTHRACNOSE, AND MANY OTHERS. IT IS WELL-KNOWN, THAT THESE DISEASES CAUSE CLOVER TO HAVE A RELATIVELY SHORT LONGEVITY. DO YOU BREED FOR ‘PERSISTENCE’ IN YOUR NEW CLOVER VARIETIES? AND HOW DO YOU GO ABOUT IT?**

**DL:** We also breed for persistency and have made a lot of progress particularly in extending persistency in red clover. There are a number of factors that contribute to persistency such as disease resistance, winter hardness and tolerance of grazing. These all have different genetic bases and require different breeding methodologies. Mass selection is a very effective technique for ‘general persistency’.

**NR:** Yes, in white clover we are artificially inoculating trials with Sclerotinia in order to be able to remove susceptible varieties. In red clover we perform trials which are infected with Anthracnose.

**LC:** ‘Persistence’ to disease involves many factors in addition to the clovers own genetic potential to be resistant to a strain of disease. The mineral content of soils, crop rotation, and sowing method are some examples that have a bearing on plant health and therefore how well clovers are resistant to disease. Because of this and the importance of also maintaining agronomic traits (yield and flowering), one of the most direct pathways to breed for persistency is by selection of certain populations, particularly in older stands of red clover, when selection pressures are higher.

**ES: CLOVER IS OFTEN USED IN MIXTURES WITH OTHER GRASSES. HOW DO YOU MAKE SURE THAT YOUR NEW CLOVER VARIETIES CAN PERFORM WELL IN A MIXTURE WITH GRASS SPECIES?**

**LJ:** In white clover, most of our breeding trials are done in a mixture of grass and clover. That way, we can select for the white clover lines for the best match with the grass. The red clover breeding is mostly done in pure red clover trials, but the final selections of the best populations are also done in grass-clover mixtures.

**LC:** All our trials are conducted in grass backgrounds, so these are a test of how well the clover performs in a mixed sward.

**DL:** We trial all our varieties with companion grasses (typically perennial ryegrass) and monitor the performance and quality of both species over the course of three to four years. We regard the interaction of the two species to be key to the success of a clover variety. A good clover yield is desirable, but it should never be at the expense of its companion grass. Some aggressive clover varieties have the potential to become dominant over the grass, which can be to the detriment to the sward’s overall nutritional balance. We also test our varieties under the conditions for which they are intended, so in the case of white clover we put them through actual animal grazing trials to satisfy ourselves that they will perform well on farm. We believe this is a unique aspect of the Germinal/IBERS clover breeding, selection and testing system.

**ES: IN MOST CROPS, EARLINESS IS AN IMPORTANT BREEDING GOAL. HOW IS THIS IN CLOVER? DO YOU BREED FOR EARLINESS, OR RATHER THE OPPOSITE?**

**LC:** We call earliness spring yield, and yes, this is one important goal in breeding, in order to match the feed demand and feed supply. However, a line with all-round or multiple stand out seasonally can be (Anthracnose, and many other diseases). It is well-known, that these diseases cause clover to have a relatively short longevity. Do you breed for ‘persistence’ in your new clover varieties? And how do you go about it?

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ES: PROTEIN CONTENT AND DRY-MATTER YIELD ARE ALSO IMPORTANT TARGETS. HOW EASY OR DIFFICULT IS IT TO INCREASE THESE LEVELS?

DL: Like all traits, achieving success in dry-matter yield and/or protein content is a question of effort and resources. Dry-matter yield is a simple measure and is typically the most important trait by which potential varieties are assessed. Protein content is more complicated to select for but as long as you have heritable variation you can breed for increased protein content.

LJ: Protein content can be increased relatively easy, however, the primary breeding target is dry-matter yield – which is more difficult to increase.

ES: WHAT OTHER BREEDING TARGETS DO YOU SPEND YOUR RESOURCES ON FOR CLOVER IN EUROPE?

NR: The seed yield of new varieties must be sufficient to ensure, that seed production can be done in an economically sustainable way – so we invest quite a lot in seed yield trials.

LC: Yield, persistence and seed production are the core traits in the breeding program. For the red clovers, habit is also important as it is used for hay/silage and needs to grow with tall fescue or ryegrass in mixed pasture systems.

For simplicity, white clover is divided into three different types, based on leaf size (large, medium and small) to help determine which clover types or clover mixes are best suited for the farm system. For example, large and medium types are more oriented towards a cut and carry system for dairy grazing in the majority of Europe, whereas medium to small leaf types that have greater stolon growing point densities, and are more suited to sheep grazing in the UK.

DL: Aside from yield and persistency we breed for disease and pest resistance, abiotic stress tolerance and nutrient use efficiency. We have developed hybrids of white and Caucasian clover, such as the variety 'AberLasting', that have remarkable drought tolerance, cold tolerance, grazing tolerance and pest resistance. We believe this variety has the potential to make a major difference to grassland agriculture, particularly in areas where white clover struggles to persist. We are also developing grazing tolerant varieties of red clover, which is a very exciting step forward.

ES: CREATING DIVERSITY FOR YOUR GROWERS AND CUSTOMERS IS OF CRUCIAL IMPORTANCE FOR ANY BREEDER. WHERE DO YOU GO TO FIND THE NECESSARY GERMPLASM THAT WILL HELP YOU IN YOUR BREEDING WORK? WHAT ARE THE MAIN SOURCE OF YOUR DIVERSITY: MAINLY COMMERCIAL VARIETIES, OR ALSO LANDRACES AND OTHER SPECIES?

LC: Our germplasm originates from a range of sources: local and global plant collections from both temperate and continental climates, developing our own germplasm through our crossing program, elite lines and commercial lines. Much of the global plant collections are accessed from germplasm banks.

DL: We generally use population based breeding methodologies for our core breeding programmes but we also utilise commercial varieties, land races and eco types to source novel variation.

LJ: The main source for diversity in white- and red clover is commercial varieties, in-house breeding material and collected material from nature. Creating diversity for your growers and customers is of crucial importance for any breeder.

ES: DO YOU FIND THAT YOU HAVE SUFFICIENT ACCESS TO NEW GERMPLASM, OR HAS THIS BEEN MADE MORE DIFFICULT BECAUSE OF THE NEW REGULATIONS ON ACCESS AND BENEFIT SHARING?

DL: We have an extensive gene bank of tens of thousands of accessions that have been collected from around the world over the last hundred years. Breeding began at the Welsh Plant Breeding Station in Aberystwyth in 1919, we will celebrate our centenary next year. If anything, our problem is finding time to assess the material we already have!
Content Generation

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NR: As long as the present UPOV rules not are changed, we have no problems.

ES: WHICH KIND OF INVESTMENTS IN TIME & MONEY (ON AVERAGE AND ROUGH ESTIMATES) DOES IT TAKE TO DEVELOP A NEW CLOVER VARIETY?

LJ: Breeding clovers is a slow process. To create a new variety from scratch takes around 14 years, including 3-4 years of registration in official trials.

LC: Each clover line takes 11 years to develop. As the clovers we breed are bee-pollinated, spreading plants that produce hard seeds (particularly white clovers), investments in a range of pollination cages, short and long tongue bumble bees, and specialised field equipment are necessary.

DL: It takes roughly 15 years from initial crosses to produce a new variety that can be marketed. The financial cost of this can vary but it is substantial.

ES: HOW DOES YOUR ORGANIZATION MAKE SURE THAT YOUR FUTURE PRODUCTS ARE ALIGNED WITH WHAT THE GROWERS WANT?

LC: We have field agronomists, sales, and seed production teams who interact with growers, farmers and re-sellers. They are also encouraged to visit our research station, so there is a flow of information and ideas in both directions.

DL: The Breeding Team at IBERS works closely with our commercial partner Germinal to ensure understanding of on farm requirements from the UK, Ireland, New Zealand and further afield. It is vital for the breeding programme that the varieties produced are commercially beneficial for the farmer and make a difference to financial performance of farms, whether domestically or overseas.

NR: We are having annual meetings with our product managers. The product managers are present in many countries and are working directly with farmers. They know the demand for future traits and it is valuable information for the plant breeders.

ES: WHAT IS THE BIGGEST CHALLENGE FOR A BREEDER WHEN DEVELOPING A NEW CLOVER VARIETY?

DL: Breeding is a long process. It can be difficult to judge what the market will need in 20 or 30 years that will suit the requirements of a changing market. IBERS therefore works closely with Germinal to ensure that possible future trends are identified and addressed within the breeding programme.

LJ: To combine a high dry matter yield with a high seed yield – and to foresee new demands and developments.

LC: Agronomic traits of clover and many plants are on the opposite ends of the pendulum. Flowering and persistence for example are on opposite ends to the yield trait. Whilst breeding can push these traits closer, it is a slow process as obtaining the extremes of these agronomic traits is against the natural pendulum.

ES: WHAT ARE THE INNOVATIONS (TECHNOLOGICAL, GENETIC, MOLECULAR ETC.) WHICH ARE IN THE PIPELINE IN CLOVER BREEDING?

NR: Genome Wide Selection will be the next technology added to the clover breeding.

LC: In recent years, genomic selection and hybrid breeding research have come into the clover breeding pipeline helping accelerate traditional phenotypic based clover breeding and screen the diverse genetics available in other white clover species.

DL: Plant breeding is at the beginning of a new era with the advent of genomic selection. This will give us the ability to assess the overall breeding value of individual plants on the basis of their genetic sequence without having to assess them in the field and measuring different traits over several seasons. This will allow us to look at more material, improve the efficiency of selection and speed up the overall breeding process, resulting in better varieties coming to market far more quickly than they currently do.
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CORN, SORGHUM AND OILSEEDS
EPS Driving Farmers In Their Seed Choice

CELINE CAUHAPE Corn Market Development Manager • Euralis Semences

It is our firm conviction that seed companies should not be just selling seeds and leave it at that. For us, it is a core principle that we also want to help farmers find the best variety for the intended location. And in order to do that effectively, we have developed the Euralis Profiling System (EPS). We have always been helping farmers, but this EPS really marks a turning point in our company’s support strategy for all European farmers. It offers the farmers a personalized advice, which allows them to select those hybrids that are best suited to their production objectives and pedo-climatic conditions.

More precisely, we have created five diagnostic tools, which are each responding to a specific theme: Four tools for corn, one tool for sunflower.

For corn, The Yield Profile is a tool to assess the varieties’ adaptation to the field potential, the Climate Profile for the varieties’ adaptation to the agro-climate, the Hydro profile for the varieties’ adaptation to water supply and last but not least, the Nutri Profile is for the varieties’ suitability in basic feed rations. For sunflower, the Helio Profile is for the varieties’ adaptation to the agro-climate and crop management methods.

For each of these tools, our company has defined typical situations, which are representative of the diversity of farm typologies and pedo-climatic contexts that can be found across Europe.

Thanks to the large networking of its experimental stations with its 500,000 plots spread all over Europe, our company’s teams have been able to study the behaviour of each hybrid in each typical situation. It is important to realize that the results are collected during several years. Once all the results are in, our analysts evaluate performances of each hybrid and compare those to an average yield of all equal products (competitor’s hybrids and Euralis ones), which have been tested under the same conditions. The score of the hybrid performance is then marked in a certain color to show if the product is adapted to each typical situation or not.

Using a rapid and simple diagnosis, by providing several data about the farm and crop management system, farmers get an answer with a selection of products that are meeting all their requirements and valuing at best the potential of their particular fields.

CONTENT MARKETING

Want To Connect With Growers? Grow Your A.U.D.I.E.N.C.E.

KELLY SAUNDERSON Director, Client Services • Issues Ink

At Issues Ink we talk a lot about audience, message and channel. Know who you are talking to, clearly define the message and identify the best possible path forward. Effective and engaging communication starts with taking the time to analyze the target audience.

Identifying ‘growers’ as the audience is just part of the process. Anyone and everyone in the industry will say growers are their audience. Content marketing is about engagement. To foster impactful engagement, you need a deep dive into your target audience persona so that you can assess what content will resonate with them.

Author and speaking coach Lenny Laskowsi created a terrific acronym — A.U.D.I.E.N.C.E. — that serves as a tool to help you with that deeper dive. Consider the following when developing messaging and content:

A – Analysis. Start with a general identification of who your audience is. Are you targeting another business, or creating content with growers in mind?

U – Understanding. What is their knowledge on the subject matter?

I – Interest. What is the audience interested in that you could provide? Why would they consume your content?

E – Environment. Are there external topical or environmental issues facing the audience? For example, is the audience facing drought conditions? Or, has a new competitor entered the market? How may this influence your content development?

N – Needs. What are the audience’s needs? What are the ‘pain points’ that you may be able to solve?

C – Customized. What specific needs should be addressed in the content? Keep messaging simple and focus on one need at a time.

E – Expectations. What are your audience’s expectations of you and your content? How can you meet or surpass them, thereby creating a deeper engagement?

Understanding your audience is the crucial first step in content marketing. You need an in-depth appreciation for your audience before you can tailor the message for them, and before you decide what channel is best to reach them. If you’re trying to communicate and connect with everyone, then your content is actually for nobody.
The expectations for pitch managers and chief groundsmen to create perfect pitches for the World Cup tournament are sky high. Organizers, football players and billions of football enthusiasts all over the world expect nothing less than beautiful and hard-wearing match stadiums, and groundsmen will do their utmost to make it happen.

The climatic and geographical differences are considerable from the continental climate of Ekaterinburg in the Ural region to subtropical Sochi at the Black Sea. The skill and experience of the groundsman is crucial when the strategy for the pitch management is decided. The choice of grass is one of the important strategic elements. How can the turf grass industry help in getting the job done?

**Football in its natural environment**

Football players - men and women - prefer to play on natural grass. The beautiful game unlocks its fullest potential when played in its natural environment - the natural grass pitch. Most sports venues are constructed to seat thousands of football fans, with high built-up arenas, restricting access to sunlight and fresh air – important growth elements for grasses. This creates major challenges with regard to differences in temperature and shade affecting the choice and composition of turf grass varieties and mixtures.

Thanks to rigorous and ongoing breeding, research and development programmes, together with advances in turf management techniques, today’s natural turf solutions improve year after year, providing outstanding wear- and shade-tolerance, excellent tensile strength, faster establishment and many more desirable characteristics besides.

The strong-rooting characteristics of top-quality grass varieties can be enhanced by injecting artificial fibers into the pitch base. These provide a very strong and stable surface, less prone to divots. As a result, the players will play on a natural grass surface and the pitch will be more resistant to unfavorable weather conditions. This technique is commonly used at the Russian match stadiums.

**4turf® – innovative grass for low-temperature establishment**

At all stadiums, the final appearance will be determined by the overseeding procedure. That’s what creates a high-density grass sward with erect and inviting green grass blades.

All Russian stadiums will be overseeded with perennial ryegrass. Most will choose mixtures containing traditional diploid perennials and new 4turf® varieties only available from DLF. Our enhanced product perennials germinate faster than traditional varieties and are developed especially for rapid installation and unique stress tolerance. They’re especially suitable for the Russian climate because they exhibit fast and strong establishment at soil temperatures as low as 3°C.
COPING WITH A CRISIS
AN INSIDE LOOK INTO THE GREEK SEED SECTOR. BY SEPY

WHY IT MATTERS
More than half of Greece’s arable land is used for field crops, the rest for trees, vines and vegetables. Apart from the current difficult economic situation in Greece and the reduction of funding from the banks, the seed sector companies also have to cope with recent legislative change, allowing producers to buy cheap seeds from other neighbouring EU countries where the quality of the seeds is questionable. All EU companies can operate in Greece for the distribution of planting seeds to farmers, without some obligations that the Greek companies have to follow. As a result, unfair competition is created for Greek companies which have to follow. As a result, unfair competition is created for Greek companies which are also subject to very heavy taxes.

The Greek Seed Trade Association (EEPES) has been an independent professional association that was established in 1983. The seat of EEPES has always been Athens. The association represents the interests of seed manufacturers and suppliers, and brings together leading international and Greek companies that work in the field of plant breeding, development, seed production and trade in Greece.

The activities of member companies cover very many different crops, such as cereals, cotton, corn, sunflower, oilseed rape, alfalfa, common vetch, seed potatoes, vegetables, forage peas, forage grasses, etc.

In order to broaden its field of crop representation and attract more members (such as companies active in the tree and vine sector), EEPES was renamed in 2017 into SEPY, which in Greek stands for “Greek Propagating Material Companies Association”.

ORGANIZATIONAL STRUCTURE
The association’s governing bodies are the General Assembly of the association and the Board of Directors. The General Assembly is the highest governing body of the association, and meets at least once per year.

The Board of Directors is a governing body of the association that convenes at least four times per year between General Assembly meetings. The General Assembly determines the composition of the board through an electoral procedure that takes place every three years. To date, there are seven members of the board. The president of the board organizes and guides the activities of the association. Since March 2016, Efthymios (Thymis) Efthymiadis (CEO of Bios Agrosystems S.A.) has been president of the board. The executive body of the association has the everyday executive authority, headed by the general director of the association. To date, the general director of the association is Evangelos Zangilis, an agronomist with many years of experience in planting seeds, gained both in the public sector, as well as in the private sector.

SEPY is an association with a democratic structure. Although companies with different structures and interests are members, democratic decisions are respected by all members, after suffi-
COPING CRISIS

AIMS AND TASKS
provides local employment to many hundreds of professionals.
active all over the Greek territory and their regional diversity per cent of the Greek seed market value. SEPY's members are trade in Greece. The association's members represent at least 80 companies that are active in breeding, reproduction and seed The association brings together about 40 national and foreign

NUMBER OF MEMBERS
The association brings together about 40 national and foreign companies that are active in breeding, reproduction and seed trade in Greece. The association's members represent at least 80 per cent of the Greek seed market value. SEPY's members are active all over the Greek territory and their regional diversity provides local employment to many hundreds of professionals.

The association is always open to companies that chose to act with a policy framework that enhances reliability, transparency and efficiency in the agricultural inputs market of Greece.

AIMS AND TASKS
The association's main objectives include the following:

* Active participation in the development of relevant legislation
* Ongoing cooperation with governmental authorities
* Promotion of the interests of association members by taking part in committees set up by the Greek government
* Keep members up to date as far as the National, European and World seed sector developments are concerned, providing all necessary information
* Organize and conduct seminars and workshops
* Jointly promote the common interests of the agricultural inputs sector
* Inform all stakeholders about the positive contribution of the Greek agricultural sector to overall economy and society

MAIN SUCCESSES
Following a SEPY's request, the Greek Ministry of Agriculture decided to fund a three-year program (2016-2018) for the promotion of certified seed use.

* VAT for planting seeds was reduced from 24% to 13%
* The obligation to use certified seed in order for the farmer to receive the coupled subsidy, in the cases of durum wheat and cotton.

At the international level, SEPY is currently a member of the European Seed Association (ESA) and the International Seed Federation (ISF). In addition, there are also close contacts with other national seed associations and particularly with the other associations that operate in the field of agricultural inputs, such as the Greek Crop Protection Products Association and the Greek Fertilizer Trade Association.

COMMITTEES
The technical committees have always had a key role in SEPY's organizational structure. At present, there are two such committees focused on their responsibility issues, which consist of delegated representatives of association member companies.

The activities of the Committee on Arable Crops and Seed Production and the Committee on Vegetables and Seedlings aim to:

* Discuss thoroughly all technical issues in their field with the help of experts on seed production and certification that are invited to participate when needed;
* Facilitate communication between members of the association, and discussion of the issues within the jurisdiction of the committee that arise in the professional activities of association members;
* Determine the actual questions and/or urgent problems in their field and put them under consideration to the board of directors, which then determines the position for action or response of the association for the promotion of the necessary initiatives;
* Record and evaluate the problems that arise during the implementation of legal regulation and proposing improvements, and;
* Measure the market size and other market characteristics per segment in the seed business.

KEY EVENTS
In 2013, the ISF World Seed Congress was held in Athens with more than 1,500 delegates, which was a new record for this congress. Since then, many Greek companies have shown increased interest in the global seed sector progress and have also initiated export activities of locally produced seeds.

In February 2016, in cooperation with the Greek Crop Protection Products Association during the AGROTICA 2016 exhibition, SEPY organized an event titled “The next day of agricultural sector and the role of inputs”. The event was attended by politicians, journalists, representatives of the university community and the seed sector; the event was the first initiative to address a wider audience in informing attendees about the importance of planting seeds and plant protection products.

In September 2017, in cooperation with the Greek Crop Protection Products Association and the Greek Fertilizer Trade Association, SEPY organized an Athens event titled “The contribution of inputs to the agro-food sector” with the participation of important speakers such as Garlich Von Essen (General Secretary of the European Seed Association), Georgios Rapsomanikis (Senior Economist in Food And Agriculture Organization of the United Nations) and Greek university professors with significant research experience in the field of agricultural inputs.

FUTURE PLANS

* In the CAP 2014-2020, the majority of seed production was included in the coupled EU subsidies.
* Greek companies' introduction to the ISF and ESA activities.
* Hosting and organizing of the ISF World Seed Conference in Athens, in 2019.

Elthimios N. Efthimiadis, President of SEPY

EUROPEAN-SEED.COM I EUROPEAN SEED I 47
In December 2014, nine French NGOs initiated legal proceedings against an Article of the French Environmental Code, which implements the EU GMO Directive. They argued that plant varieties in rapeseed and sunflower resulting from traditional or new forms of mutagenesis constitute ‘new hidden GMOs’ and as such need to be regulated as GMOs. The French Conseil d’Etat referred four preliminary questions to the European Court of Justice (ECJ), essentially to ascertain whether organisms resulting from traditional and new forms of mutagenesis should be subject to the GMO legislation. In October 2017, the ECJ convened in a grand chamber hearing, and on 18 January 2018, Advocate General Bobek delivered his Opinion in the case. European Seed met with Geert Glas, a lawyer from Allen & Overy, who published a legal article on the Court Case in Bioscience Law Review last year.

EUROPEAN SEED (ES): GEERT, YOU ANALYSED ALL THE LEGAL QUESTIONS AND ARGUMENTS THAT WERE BROUGHT UP IN THE CONTEXT OF THE EUROPEAN COURT OF JUSTICE CASE, AND YOU ALSO PUBLISHED YOUR VIEW ON THE LEGAL QUESTIONS LAST YEAR. DID THE LINE OF ARGUMENTATION THAT ADVOCATE GENERAL BOBEK PROVIDED IN HIS OPINION SURPRISE YOU?

GEERT GLAS (GG): It is first not surprising that the Advocate General sticks to a legal reasoning and does not discuss any more technical and scientific arguments. The reasoning consequently is set up from a legal angle and should also be seen in that light. Secondly, the legal reasoning on a lot of aspects that was followed by Advocate General Bobek in his Opinion reflects the same line of

So, what did the Advocate General Bobek say exactly?

A LEGAL ANALYSIS OF CASE NUMBER C-528/16 ON MUTAGENESIS IN PLANTS. BY MARCEL BRUINS
argumentation we followed when assessing the case for our publication in Bioscience law review last year. Like Advocate General Bobek, we also did not see the need to differentiate between “old” and “new” forms of mutagenesis techniques and also our understanding was that the GMO-definition of the directive needs to be interpreted by taking into account breeding process and the genetic makeup of the resulting plant to assess whether the GMO-definition applies.

This reasoning is also very much in line with many similar assessments, both legal and technical that have been done in the past months and years.

**ES:** THE MAIN QUESTION RAISED TO THE COURT WAS ABOUT THE SCOPE OF THE GMO DIRECTIVE AND ITS EXEMPTIONS, LIKE MUTAGENESIS. DOES THE ADVOCATE GENERAL REGARD ALL PLANTS RESULTING FROM MUTAGENESIS AS GMOS OR DOES HE TAKE A DIFFERENTIATED VIEW?

**GG:** If you study the Opinion of the Advocate General in more detail, you actually see that the Advocate General makes a distinction between three different categories of products resulting from mutagenesis, with each having different consequences in terms of whether they constitute GMOS or not:

- Organisms resulting from mutagenesis techniques which don't constitute GMOs according to the definition put forward in the GMO Directive (we call this in our paper ‘Category One Organisms’). Thus, only to the extent that organisms have been obtained through a technique of genetic modification and their final product contains a genetic modification which could not have occurred naturally, such organisms should be considered to constitute GMOS.
- Organisms resulting from mutagenesis techniques which constitute GMOS, but which are exempted from the obligations of the GMO Directive (we call this in our paper ‘Category Two Organisms’). In particular, Advocate General Bobek argues that both ‘new’ as well as ‘old’ mutagenesis techniques can be exempted from the obligations of the GMO Directive, depending on whether they fulfill the requirements as mentioned in the GMO Directive.
- Organisms resulting from mutagenesis techniques which constitute GMOS, but which are not exempted from the obligations of the GMO Directive (we call this in our paper ‘Category Three Organisms’).

In conclusion, it follows from this distinction that the Advocate General considers that first it needs to be assessed whether a certain organism resulting from any kind of mutagenesis technique constitutes a GMO, after which it needs to be reviewed whether such GMO could be exempted from the obligations under the GMO Directive.

**ES:** SO, THE ADVOCATE GENERAL DOES DIFFERENTIATE BETWEEN THREE CATEGORIES OF PRODUCTS AND CONSIDERS TWO OF THEM NOT TO BE COVERED BY THE OBLIGATIONS OF THE GMO DIRECTIVE. THAT BRINGS US TO THE QUESTION THAT WAS ALSO PUT FORWARD BY THE NGOS, WHETHER MEMBER STATES STILL HAVE ROOM TO SET UP ADDITIONAL REGULATION FOR THESE PLANTS? AND WILL WE THEN NOT FACE A LEGAL PATCHWORK IN THE FUTURE THAT WOULD DISRUPT THE EU INTERNAL MARKET?

**GG:** This question boils down to the issue of what we call in legal terms minimum or maximum harmonization, which boils down to the question whether or not member states have a so-called margin of discretion to impose national measures beyond what is left to them by the harmonising (European) measures.

The Advocate General has indicated that for Category One and Category Two organisms, he considers that member states still have some leeway to adopt certain national measures.

You are correct in assuming that this in practice could lead to different legislations which would disrupt the functioning of the European internal market. That's why we think that any measures imposed by member states with respect to such organisms should be in compliance with EU law. Thus, any such measures should be rather limited in scope and consequently must comply with the legislative choice of the European legislator, meaning that such measures can't be more far-reaching (for example in terms of notification duties) than the obligations imposed in the GMO Directive on the specific category of organisms resulting from mutagenesis techniques which are subject to such obligations.

This means that there is a different sort of leeway with respect to the different categories of mutagenesis organisms. For example, with respect to Category One Organisms, member states could enact certain national measures, which can't however be more restrictive than the obligations included in the Seed Directives (as such Category One Organisms are already subject to the European seed legislation).

**ES:** LIKE SO OFTEN, THE NGOS INVOLVED IN THIS COURT CASE ALWAYS STRONGLY ARGUE THAT THE PRECAUTIONARY PRINCIPLE IS DISREGARDED IN THE GMO DIRECTIVE AND THAT SOME ARTICLES OF THE DIRECTIVE ARE THEREFORE INVALID. DID THE ADVOCATE GENERAL FOLLOW THIS LINE OF ARGUMENTATION?

**GG:** The Advocate General clearly rejects the alleged invalidity of certain articles of the Directive and indicates that there is no factor of any kind which indicates that the validity of Articles 2 and 3 of the Directive (which define the scope of the GMO Directive) is affected.

The Advocate General however does stress the importance of a review (and update) of legislation even after it is adopted and stresses the importance of the obligation of the European legislator to keep its legislation reasonably up to date. Given that the European legislator has in fact updated its GMO legislation several times over the past 15 years, the Advocate General clearly states that the duty to update legislation was taken by the EU legislator with respect to the GMO Directive.

*Editor’s Note: Geert Glas was asked by the European Seed Sector to provide a legal view on the opinion of the Advocate General.*
One of the biggest challenges for any risk communications professional today is to deliver positive messages on pesticides. Like any communications process, trust is essential, but in a chemophobic world, trust in chemicals is a rare commodity. Pesticides found on the food the public consumes creates a vulnerability (fear) that cannot easily be overcome. People have to be convinced that their food is safe, any pesticide residues are of no risk and are there for a reason. In this case, we are asking a mother feeding her child to trust the chemical industry… a challenge indeed.

It wouldn’t be half as hard were it not for the opportunists seeking to take advantage of a vulnerable population worried about their health and the environment. With social media networks making it feel like cancer is found in every spoonful, frightened consumers reach for their wallets and the dream of a chemical-free world. The narrative driven by the chemophobic activist community is that pesticides are dangerous to consumers, unnecessary and destroying the environment. They have left most of us thinking there must be some evil industry conspiracy wanting to pollute the countryside, poison children and profit from some intentional cancer plague.

Anti-GM campaigners have recently shifted their strategy to focus on how seeds are bred to resist certain pesticides. The activist attacks on glyphosate were part of an anti-GM campaign. Their logic is clear: attacking golden rice or GM brinjal was not going to increase membership or donations, but pesticides attract public fear with minimal effort. So for those taking up the challenge of getting the public to warm to pesticides (or pesticide-resistant seeds), allow me to catalogue what I feel are 10 best practices. There have been mistakes in the past as there will likely be in future, but perhaps an open discussion is the best place to start.

**TEN RULES FOR COMMUNICATING ON PESTICIDES**

1. **DON’T DIMINISH HOW PEOPLE FEEL FRIGHTENED OR DISMISS THEIR CONCERNS**
   Scientifically literate individuals understand the insignificant levels of pesticide residues found on most foods, the comparatively high levels of hazardous natural chemicals and the decades of research that have gone into registration and compliance of all pesticides. But the public does not and they have been made to believe, most recently with the Monsanto Papers, that nobody knows with any certainty if any pesticides are safe at all. A scientist who dismisses their concerns, regardless how ridiculous they sound, is quickly dismissed.

   When people feel vulnerable, they seek out someone they can trust and who understands them. Don’t answer their questions with data, alienating chemical names or titles of important scientists or institutions. Try to put your answer into a personal story, compare the risk to an everyday exposure (like a cup of coffee) and try to demonstrate why farmers use these products. Anti-chemical gurus became popular because they understood and shared the vulnerabilities the public felt.

2. **CELEBRATE ACHIEVEMENTS: HIGHER YIELDS, SECURE HARVESTS, LESS LABOUR**
   Malthus thought the world could not feed one billion people. Agri-technology has allowed man to feed an ever-growing population with higher yields and less input and this should be celebrated. Man is a story-telling animal and the development of each pesticide is a story of how scientists were able to find a means to solve a problem and allow farmers to successfully bring a crop to harvest. Children in most countries no longer need to spend their summers pulling weeds. The best story to tell is one of food security: We no longer live in fear of major global crop failures – the technology is proven and trusted.

3. **MAKE IT CLEAR THAT THE NATURAL VS SYNTHETIC SOURCE IS NOT AN ISSUE**
   A dominant cultural narrative today is that natural is trusted. Organic food lobbyists like to claim their pesticides are safer because they come from a natural source. But the public needs to understand that all pesticides contain toxins that are used to solve specific problems (if they weren’t effective, they would not be used). Consumers must be reassured that all toxins used in crop protection, whether natural or synthetic in origin, have been well tested and are safe. The organic industry needs to behave in a more ethical manner here.

4. **USE PRECISE TERMS WHEN POSSIBLE: INSECTICIDE, HERBICIDE, FUNGICIDE**
   The word “pesticide” obviously has a bad connotation. More importantly, it does not say what the substance does. An insecticide kills insects – insects eat crops. If the public has a better idea what a substance does, they can better accept its necessity. While we don’t want pesticides, we also don’t want insects in our food, weeds in our garden or moulds or blight on our plants. A precise vocabulary is essential in risk communications.

5. **SHOW WHY FARMERS USE PESTICIDES (BENEFITS) AND ONLY WHEN NECESSARY**
   Farmers and farming are seen differently. Farming is seen as a rather simple process: you plant a seed and in a couple months you take a harvest to market (… and I grew beans in my garden once!). Conventional farmers, on the other hand, seem to work for some industrial complex, poison the land and don’t care about public health. The organic food lobby bias that conventional farmers spray (douse, drench…) indiscriminately is inexcus-
The public needs to understand that farmers use pesticides only when there is a reason, at the lowest levels possible (it costs money) and with prevention in mind. There are clear benefits in using them. If a farmer could successfully grow crops without pesticides, surely he or she would.

6. PRESENT PESTICIDES AS PART OF A FARMER’S TOOLKIT USED IN DIFFICULT TASKS

Integrated Pest Management (IPM) is a good example of how a farmer has many tools to deliver a crop to market, including pesticides. But these tools need to be of the best quality (farmers generally use the best crop protection tools available). Each time a pesticide is removed from the market (and this is happening in Brussels at an alarming rate), farmers have to look for alternative tools (often older pesticides with less sustainable profiles). The public, especially the media and policy-makers, have to understand that banning important farming tools is not necessarily a step in the right direction.

7. HIGHLIGHT THE 50-YEAR TREND OF LOWERING DOSE LEVELS, BETTER TECHNOLOGIES

The first pesticides on the market in the 1960s were admittedly rather harsh (like any emerging technology). But over the last 50 years, scientists have worked to continuously improve agri-technologies (product stewardship), lowering dosages, reducing environmental and health impacts and providing better crop performance. Activists like to portray the industry with old images of crop dusters and military grade chemicals - they know the public might be attracted to advanced technologies. Precision agriculture is one such example of an attractive technology that could capture the public imagination if the story is told well.

8. DEMONSTRATE VISUALLY THE VOLUME OF COMPLIANCE RESEARCH STUDIES

The pesticide risk assessment process is not widely understood and trust in regulators is declining. Activists have made the process seem sinister: that a company puts a poison on the market with no data, and when cancers start to increase, the company then lobbies regulators to allow them to continue to make profits. If people understood the amount of testing and compliance measures required before a product goes on the market, and the levels of research required to keep it on the market, their trust in the process may improve. I often hear the terms “10 years and 10,000 pages” to describe how the risk assessment process works. That image needs to be visualised in a way to show the volume of work and research required to comply.

9. PUT TOXICITY INTO A BANALISING CONTEXT

Most people are numerically illiterate (they buy lottery tickets to pay off their credit card debt). Expressing toxicity in terms of LD50s to a person who equates “chemical” with “cancer” is a waste of time. You need to put the toxicity into a context people understand. For example, if you get people to remember there are more carcinogens in a cup of coffee than in the pesticide residues of a year’s consumption of fruit and vegetables (Bruce Ames), they may begin to understand the risk a bit better (or stop drinking coffee). To say glyphosate has a very low toxicity is meaningless, but if you show how it is less toxic than ingredients found in chocolate or biscuits, maybe they will get it. I call this the banalisation of risk.

10. HELP PEOPLE FIND OUT MORE INFORMATION FOR THEMSELVES

An essential element of trust is agency. I fear flying more than driving my car to the airport because I know I am in control of the vehicle. If I can find correct information on pesticides myself I will gain my own understanding. Any communication effort should leave the audience with a means to find out more information by themselves. When I tell people there are more carcinogens in a cup of coffee, I ask them to Google “Bruce Ames + coffee + pesticides”. There is a lot of information out there, but people need to be sent in a good direction. A passive receiver hears information, an active one learns it.

These 10 rules make communicating on pesticides seem easy. Of course anyone who has tried this challenging task will attest it is not. There are many clever and manipulative activists who are always one step ahead of you, using fear tools like children, bees and fear of cancer to undermine public trust. NGOs or social media gurus have no ethical codes of conduct restricting their behaviour (so their lies and fear-mongering can be justified in a sort of Machiavellian zealot ethics). Neither industry nor regulators can play by the same rules.

An important element of trust is the messenger. An industry spokesperson is probably the least credible voice to deliver a positive story on pesticides. Farmers and scientists need to step up and be the story-tellers. They too will suffer from the continued aggressive assault on agri-technology.

I am sure there must be ten more rules to add to this conversation and each pesticide or class of substances are different. Cultures have different perspectives (many languages consider pesticides as medicines for plants) and there are different levels of scientific literacy. One point is certain: we have a general idea today what doesn’t work when communicating on pesticides. Things can only improve… right?

David Zaruk is a professor based in Brussels writing on environmental-health risk policy within the EU Bubble. He writes a blog under the name: The Risk-Monger. The comments in the Risk Corner are his own and does not necessarily represent the views of European Seed.
Growers and advisers have access to a new tool that can help them assess the long-term profitability of methods to control brome grass – one of Australia’s most costly cropping weeds.

The Brome RIM tool is hands-on, user-friendly decision-support software that has been adapted from the well-known RIM (Ryegrass Integrated Management) model for annual ryegrass. The original RIM model, that was developed by the Australian Herbicide Resistance Initiative (AHRI), was modified by CSIRO - with Grains Research and Development Corporation (GRDC) investment as part of the GRDC Stubble Initiative - to include brome grass.

The University of Adelaide and Mallee Sustainable Farming also helped in the development and testing of the new tool. CSIRO farming systems scientist Rick Llewellyn, who led the development of Brome RIM with colleague Marta Monjardino, said brome grass – comprising two main problem species Bromus dianthrus and B. rigidus - was an annual grass weed that was widely distributed across cropping areas of southern Australia.

“It is very competitive against crops and is the major grass weed in many districts, with a lack of herbicide options making it difficult to control in cereals,” he said. “Changes in brome grass populations mean its germination is now often more staggered and occurs later in the season, allowing it to evade early season control.”

Llewellyn said brome grass was becoming an increasing problem in some cropping areas due to a higher intensity of cropping in rotations, reduced tillage and limited effective herbicides for its control in cereals.

Llewellyn said the nature of brome grass meant the use of an integrated weed management (IWM) strategy, combining several tactics to drive down the weed seed bank over several years, was particularly important as there were few individual practices that offered consistent high efficacy. Weeds compete with crops for light, water, and nutrients. Common ragweed, which is taller than soy, has historically been overlooked as a threat. And little is known about its impact on soy in the Midwest.

So, the scientists struck out to a soybean field near Mead, Nebraska. In 2015 and 2016, they planted soybean and ragweed in late spring. Within the experimental plots, ragweed density ranged from no plants (a weed-free control) to 12 plants per meter (about 39 inches) of the row.

The researchers had two goals: see if ragweed posed a serious threat to soybean, and see if there’s a way to estimate the yield loss early in the growing season.

Barnes was surprised by how much the ragweed stifled the soybean in both years. The soybean crops did worse than in previous studies. One ragweed plant every 1.6 feet of soybean row decreased soybean yield by 76% in 2015, and by 40% in 2016. And soybean yield was reduced by 95% in 2015 and 80% in 2016 when common ragweed plants were grown only three inches apart in the soybean row.

During the experiment, there was plenty of water to go around for both plants. So, the scientists think ragweed mostly hurt soybean by starving it of sunlight.

What’s more, it was very hard to predict early in the year how the soybean would fare. Barnes found that not until early August could he plug ragweed numbers into an equation and accurately predict what the soybean loss would be. Now, Barnes and his team are sharing this information with growers in the area.

By knowing how much damage the weeds might do, farmers can weigh that loss against the cost of killing the weeds. More studies will be needed to hone in on the dynamics of ragweed—and other weed—growth. An end goal, he says, is to predict early in the season how weeds will impede crop yields, so farmers can make better decisions on how to manage them. Such estimates could help farmers know if, when, and how much pesticide to apply.

High-yielding hybrid rice is going to cross 50% of the total area planted with paddy in the next three years from the current range of 25% to 30%, which will increase the output by two million tons, said Guard Rice Research and Services CEO Shahzad Ali Malik.

Plantation of hybrid rice seeds in Pakistan is being spearheaded by national seed companies, mainly in collaboration with Chinese firm Guard Agri.

Malik, who was founding president of the Seed Association of Pakistan and ex-president of the Rice Exporters Association of Pakistan, said with efforts of local scientists, the role of private sector in seed research and development was growing day by day.

“With the doubling of hybrid rice seed coverage from the present 25-30% to over 50% in the next three years, national rice production is expected to increase by two million tons,” he emphasised, adding that overall production would go up from the current 6.9 million tons to nine million tons.

In hybrid rice, around 90% of the area planted with the long-grain seed lies in Sindh while the remaining 10% is cultivated in south Punjab.

Scientists have found that ragweed can drastically reduce soybean yield.

“It wasn’t really a weed we were worried about too much,” says Ethann Barnes, a graduate research assistant in agronomy and horticulture at the University of Nebraska-Lincoln. “We didn’t expect it to be this competitive.”

More studies will be needed to hone in on the dynamics of ragweed—and other weed—growth. An end goal, he says, is to predict early in the season how weeds will impede crop yields, so farmers can make better decisions on how to manage them. Such estimates could help farmers know if, when, and how much pesticide to apply.
The European Commission has approved under the EU Merger Regulation the acquisition of Monsanto by Bayer. The merger is conditional on the divestiture of an extensive remedy package, which addresses the parties’ overlaps in seeds, pesticides and digital agriculture.

“We have approved Bayer’s plans to take over Monsanto because the parties’ remedies, worth well over €6 billion, meet our competition concerns in full,” says Commissioner Margrethe Vestager, in charge of competition policy. “Our decision ensures that there will be effective competition and innovation in seeds, pesticides and digital agriculture markets also after this merger.

“In particular, we have made sure that the number of global players actively competing in these markets stays the same. That is important because we need competition to ensure farmers have a choice of different seed varieties and pesticides at affordable prices. And we need competition to push companies to innovate in digital agriculture and to continue to develop new products that meet the high regulatory standards in Europe, to the benefit of all Europeans and the environment.”

The 21 March decision follows an in-depth review of Bayer’s proposed acquisition of Monsanto. Monsanto is the world’s largest supplier of seeds, which generates most of its sales in the US and Latin America. Monsanto also sells glyphosate, which is the most used pesticide worldwide to control weeds. Bayer is the second largest supplier of pesticides worldwide, with a stronger focus in Europe. The transaction creates the largest global integrated seed and pesticide player.

EU brings the consumer information on GMOS in your language

Factual information about GMOs in Europe can be hard to find, especially in languages other than English. Instead there are a lot of misperceptions about a fascinating technology that has truly revolutionised food and farming in much of the developed and developing world.

This is why EuropaBio, together with partners in 11 countries, is launching the GMOinfo.eu website, which includes important information about GMOs in 10 different languages.

GM crops are already benefiting millions of small farmers and their families in 19 developing countries. The European Academies of Science confirm that “There is compelling evidence that GM crops can contribute to sustainable development goals with benefits to farmers, consumers, the environment and the economy.”

International

Pakistan ‘close to’ opening up - officially - to GM seed

Pakistan may be on the verge of - officially - opening up to genetically modified seed, although the switch may come too late to boost yields this year in cotton, which farmers are planting with outdated technology.

Progress on several fronts on reform of seed approval and intellectual property regulations may “be operational in 2018, opening Pakistan to the official introduction of modern biotechnology … for the first time in its history”, the US Department of Agriculture bureau in Islamabad said.

The move would not mean Pakistan farmers growing biotech crops for the first time.

The country’s farmers have grown genetically modified cotton for some 15 years on what the bureau termed an “informal” basis, with GM seed now accounting for some 95% of seedings.

A USDA report last year flagged that “Pakistan’s agricultural community is generally supportive of the expanded utilisation of biotechnology. Consumer acceptance is more mixed, but the production and consumption of biotech crops is generally accepted.”

U.S. SECRETARY PERDUE ISSUES USDA STATEMENT ON PLANT BREEDING INNOVATION

U.S. Secretary of Agriculture Sonny Perdue 28 March issued a statement providing clarification on the U.S. Department of Agriculture’s (USDA) oversight of plants produced through innovative new breeding techniques which include techniques called genome editing.

Under its biotechnology regulations, USDA does not regulate or have any plans to regulate plants that could otherwise have been developed through traditional breeding techniques as long as they are not plant pests or developed using plant pests. This includes a set of new techniques that are increasingly being used by plant breeders to produce new plant varieties that are indistinguishable from those developed through traditional breeding methods. The newest of these methods, such as genome editing, expand traditional plant breeding tools because they can introduce new plant traits more quickly and precisely, potentially saving years or even decades in bringing needed new varieties to farmers.

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INDUSTRY NEWS

A joint study by Exeter University, Rothamsted Research and Bayer has discovered enzymes in honey bees and bumble bees that determine how sensitive they are to different neonicotinoid insecticides. As in other organisms, toxins in bees can be broken down by enzymes called cytochrome P450s. The researchers carried out the most comprehensive analysis of bee P450 detoxification enzymes ever conducted. The study identified one subfamily of these enzymes in bees – CYP9Q – and found it was responsible for the rapid breakdown of certain neonicotinoids, such as thiialcloprid, making them virtually non-toxic to bees. Bayer is confident that this knowledge will enable the company to design further bee-friendly insecticides in an even more targeted way, using relatively simple methods (in vitro) at an early stage of a product’s development.

Scientists at the University of Missouri map additional soybean genomes, which could help breeders fight diseases and other challenges in the crop. Approximately 340 million metric tons of soybeans are produced globally each year, with the market for soybeans worth $40 billion in the U.S. alone. Having a map of soybean genes is key for breeders, who work to develop varieties that farmers can use to help battle diseases and other environmental factors. For nearly a decade, only one soybean cultivar – “Williams 82” – had been sequenced, but MU scientists led by Henry Nguyen now have succeeded in mapping two more, giving breeders access to a broader array of soybean genes. The purpose of this sequencing project, “Better Soybean, Better Life,” is to assist molecular breeding and genome editing in order to enhance the productivity, biotic and abiotic stress tolerance, and nutritional quality of soybeans around the world. Having several reference genomes will allow breeders to develop and deliver new varieties more quickly and efficiently.

PEOPLE NEWS

Professor Melanie Welham has been selected to be the Executive Chair of the Biotechnology and Biological Sciences Research Council (BBSRC) when UK Research and Innovation (UKRI) comes into being in April 2018. Professor Melanie Welham is currently interim Chief Executive of BBSRC having previously served as Executive Director, Science for BBSRC. Prior to this, Professor Welham worked at the University of Bath as Professor of Molecular Signalling and was the first woman to be appointed a professor in her department. Melanie is a leading researcher in molecular signalling and stem cell science.

Phytelligence, an agricultural biotechnology company, adds Peter Viss to its team as vice president of global sales for nuts, hops and new crops. In this role, Viss will lead the company’s efforts to provide new and existing growers with premium planting stock in these segments. Viss will work with Phytelligence’s customer service, accounting and marketing teams to ensure growers have access to the highest quality nut trees, hop plants and new product lines.

After 44 years in the grass seed industry, Steve Tubbs (66) of Turf Merchants Inc. (TMI) is retiring as president. Based in Tangent, Oregon, TMI is a developer, producer and marketer of turf grass seed for the United States, North America and more than 20 other countries.

BUSINESS NEWS

CIS Semillas and Gro Alliance enter a joint venture to offer seed nursery services in Chile. CIS Alliance combines the expertise of CIS Semillas and Gro Alliance to create a leader in contract nursery solutions for row crops, cereals, oilseeds and vegetables. CIS Alliance’s mission is to help enable the creation of the next generation of hybrids and varieties that produce more output using fewer resources on less land. Its team of experienced breeders and technicians provide unique solutions and industry-leading communication to support some of the world’s most advanced breeding programs.

Monsanto Company and Pairwise Plants, an agricultural startup, have announced a collaboration to advance agriculture research and development by leveraging gene-editing technology. Under the agreement, Pairwise will work in corn, soybeans, wheat, cotton and canola crops exclusively with Monsanto. The companies bring unparalleled expertise and complementary intellectual property (IP) to a strategic alliance expected to drive new and needed solutions to help farmers produce better harvests, protect crops from evolving threats, and conserve resources in the face of mounting environmental challenges. Under the companies’ collaboration and licensing agreement, Monsanto would contribute $100 million to access and develop Pairwise IP in row crop applications, including an option to commercialize products resulting from the research collaboration.
BEE SURVIVAL COMPUTER MODEL ADOPTED BY INDUSTRY

A computer model, called BEEHAVE, developed to help gain a better understanding of the causes of bee declines, is now being recommended to industry users to assess threats to bees. The model has been developed by Professor Juliet Osborne and colleagues at the University of Exeter. Agriculture companies, Syngenta and Bayer are both using BEEHAVE to assess how their pesticides affect bee colonies and are promoting it to the worldwide agrochemical industry. Understanding pollinator declines is extremely important but carrying out experiments on pollinators, including bees, is very difficult, as so many factors affect them. Laboratory-based experiments cannot accurately replicate the situation in the real world, while experiments in the field are influenced by many factors that make it hard to interpret the results. BEEHAVE and BumbleBEEHAVE allow scientists to study threats to bees in a virtual world based on everything that is currently known about bee biology, and to hone their experiments on real bees. Researchers enter into the model information about available sources of pollen, presence of pesticides, and any diseases affecting a bee colony, and BEEHAVE predicts the eventual colony size, whether it will survive the winter, and the amount of honey it will produce. BumbleBEEHAVE produces similar results regarding the fate of multiple colonies of different species of bumblebee.

THE ABSENCE OF ANTS – ENTOMOLOGIST CONFIRMS FIRST SAHARAN FARMING 10,000 YEARS AGO

By analysing a prehistoric site in the Libyan desert, a team of researchers from the universities of Huddersfield, Rome and Modena & Reggio Emilia has been able to establish that people in Saharan Africa were cultivating and storing wild cereals 10,000 years ago. In addition to revelations about early agricultural practices, there could be a lesson for the future, if global warming leads to a necessity for alternative crops. The importance of finding came together through a well-established official collaboration between the University of Huddersfield and the University of Modena & Reggio Emilia. The team has been investigating findings from an ancient rock shelter at a site named Takarkori in south-western Libya. It is desert now, but in the Holocene age, some 10,000 years ago, it was part of the “green Sahara” and wild cereals grew there. More than 200,000 seeds – in small circular concentrations – were discovered at Takarkori, which showed that hunter-gatherers developed an early form of agriculture by harvesting and storing crops. But an alternative possibility was that ants, which are capable of moving seeds, had been responsible for the concentrations. Dr Stefano Vanin, the University of Huddersfield’s Reader in Forensic Biology and a leading entomologist in the forensic and archaeological fields, analysed a large number of samples, now stored at the University of Modena & Reggio Emilia. His observations enabled him to demonstrate that insects were not responsible, and this supports the hypothesis of human activity in collection and storage of the seeds. The investigation at Takarkori provided the first-known evidence of storage and cultivation of cereal seeds in Africa. The site has yielded other key discoveries, including the vestiges of a basket, woven from roots, that could have been used to gather the seeds. Also, chemical analysis of pottery from the site demonstrates that cereal soup and cheese were being produced.

PENN STATE-DEVELOPED PLANT-DISEASE APP RECOGNIZED BY GOOGLE

A mobile app designed by Penn State researchers to help farmers and others diagnose crop diseases has earned recognition from one of the world’s tech giants.

PlantVillage, developed by a team led by David Hughes, associate professor of entomology and biology, was the subject of a keynote video presented at Google’s TensorFlow Developer Summit 2018, held March 30 in Mountain View, California. The event brought together a diverse mix of machine learning users from around the world for a full day of technical talks, demonstrations and conversation with the TensorFlow team and community.

PlantVillage and its mobile app — called “Nuru,” which is Swahili for “light” — uses artificial intelligence and machine learning to train computers to recognize disease symptoms. When deployed on a smartphone, the app couples with the device’s camera to capture images of diseased plants and provides the user with a preliminary diagnosis with a high degree of accuracy. The user also can get disease-management information and advice.

The program incorporates TensorFlow, open source software for numerical computation using data flow graphs. Originally developed by Google’s Machine Intelligence research organization for the purpose of conducting machine learning and deep neural networks research, TensorFlow is general enough to be applicable in a wide variety of other domains as well, according to the TensorFlow website.

The Google video featuring PlantVillage focuses on the research group’s work in Tanzania, demonstrating how local farmers are using the app to diagnose disease in cassava, an important crop that helps to feed 500 million Africans every day, Hughes noted.

TOMATOES MOST POPULAR VEGETABLE – BANANAS MOST-LOVED FRUIT

Dutch IT company, Roamler, has conducted a survey regarding fruit and vegetable trends in 2018. The results: consumers seem to have resolved to eat more fruit and vegetables in the Spring, rather than at New Year. Forty percent of the respondents buy their fruit and vegetables every other day; 47% do so once a week.

The preference for buying fruit and vegetables at the supermarket is highest in the United Kingdom (88%), the Netherlands (84%), and Belgium (82%). In Italy and Spain, the preference for local markets is stronger. Discounters are in the last place, except in Germany, where 26% of people prefer buying from these kinds of retailers.

Promotions influence the choices of 70% of consumers. About 87% of the respondents use vegetables for dinner, 69% for lunch, and just 5% for breakfast.

The most popular vegetables are tomatoes, potatoes, carrots, mushrooms, and sweet peppers. In Europe, tomatoes are at the top of this list.

For 67% of Europeans, a nice piece of fruit is the ideal snack. Most Italians add some fruit to their lunch and dinner meals (56% and 40% respectively). About 2 out of 10 Europeans do the same when it comes to their evening meals.

Bananas are the most popular fruit (50%) throughout Europe. They are followed by apples (38%), soft fruit (37%), melons (25%), and grapes (24%).
As agriculture is going to face during the 21st century a series of unprecedented challenges to provide high quality and diverse food in sufficient quantities to the growing world population, while simultaneously combatting the negative effects of global warming and the emergence of new diseases and pests and needing to reduce its environmental footprint and water dependency, the success of plant breeding innovations is more critical than it has ever been. Investment in plant breeding will greatly depend on the incentives provided by society to invest in research and development to create new and better varieties.

Intellectual property rights are the most effective catalyst to generate innovation in all fields of technology. Hence it is critical to ensure that the current UPOV system evolves and is commensurate to stimulate the necessary investments in plant breeding that will allow agriculture to cope with the huge challenges ahead of us for the 21st century.

At the end of the 50s breeders requested the creation of a sui generis system of protection for their new varieties after they realized that neither the plant breeders right granted by the OECD member States and the debate about the UPOV system was mainly focused on the question of the distinction criteria. What is the minimum distance required to declare that a candidate variety is distinct from an existing one?

This question remains an open one.

At the end of the 80s, transgenesis appeared and breeders were concerned that because of the breeder’s exemption and due to the lack of clarity regarding the minimum distances under UPOV 1961, those having access to this new technology could freely and easily take full advantage of decades of incremental variety improvement by inserting one or more transgenes into PVP protected elite varieties and thereby claim sole ownership of the resulting varieties together with freedom to operate.

This was the main reason why UPOV was revised in 1991 and the concept of essentially derived variety (EDV) introduced thereby establishing the principle that the commercial exploitation of an EDV depends on the authorization of the breeder of the protected initial variety from which it essentially derives.

While the EDV concept seemed to be well adapted to the new situation, its effectiveness has shown its limits when it comes to enforcing the PVP rights against an alleged EDV.

The difficulty of meeting the burden of proof regarding an act of essential derivation, which lies with the PVP owner, has already been rendered more difficult in the last decade with the progress of marker assisted selection and will be gaining even greater significance going forward with the development of new plant breeding innovations. The main issue presently fueling debates at UPOV and within the seed industry is the lack of clarity about the key definition for what constitutes the essential characteristics resulting from the genotype that an EDV must retain after the act of derivation.

Meanwhile other international conventions have been introduced which aim at regulating access to in situ and ex situ plant genetic resources. The Convention on Biological Diversity and the FAO International Treaty on Plant Genetic Resources for Food and Agriculture have drastically changed the freedom that breeders had to access and use such plant genetic resources. Those resources are no longer accessible and usable freely but require the prior informed consent from Member States which have sovereignty over them and the perpetual sharing of the benefits resulting from any use.

Last but not least, over the last 20 years, the commercial life cycle of varieties for many crops has been drastically reduced allowing less time for breeders to recoup their investments. With the plant breeding innovation technologies that have surfaced during the last 5 years, such as gene editing, the breeding cycles will accelerate even further together with the obsolescence of new varieties and it is possible that, despite the EDV concept, a situation similar to the one that led to the revision of 1991 will occur.

It seems that, in light of these new technical and legal developments, the UPOV system deserves an in-depth review, including its conditions of grant, scope, exemptions, duration and enforcement mechanisms, to ensure that it will fully play its intended role for most part of the 21st century.

Jean Donnenwirth is the Global PVP & EMEA Germplasm Security Lead for DowDuPont
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