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Cover image
Building a better mosquito trap. Ethan Jackson, a Microsoft researcher who is leading Project Premonition research project, designed to automatically do things entomologists previously had to do manually. Photo credit Brian Smale.

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Confederation of European Pest Management Associations

Federation of Asian & Oceania Pest Managers Associations

Editorial

David Loughlin, Editor International Pest Control Magazine

Can 2016 become any more unpredictable or unsafe? It's great when an event such as Wales qualifying for the semi-finals of the Euro2016 tournament can bring a smile to some peoples' faces and less good when others manipulate situations for some cause or their own gain, contributing to suffering and loss of life. Recent events convince me that *Homo sapiens* is the biggest pest on the planet.

In Europe we were brought to an abrupt halt on 24th June when the UK announced with 4% difference in votes, that it had decided to leave the EU. We are still not sure what it means but we ask the leading pest management associations for their views.

Our special feature this month is resistance. Perhaps a phenomenon after 60 years plus of intense pesticide use, it is becoming a greater reason for products not working. Or is it an excuse to cover poor application and misunderstanding? With contributions from Clive, Graham, Clair Keene and Pelgar, we consider how resistance is having an impact on both crops and public health pests.

Glyphosate is never out of the news of late, not just in Europe but around the world. Its position as the go to broad spectrum contact herbicide of choice is under threat and a whole generation of plant breeding is perilously poised. Martin reviews how we reached this position. We also hear how one UK authority is considering a non-chemical alternative to glyphosate as part of its amenity programme.

I jogged along the beach in Rio once. Despite showering, due to the humidity, I was still dripping with sweat several hours later, so how they will manage to hold the 2016 Summer Olympics in Rio de Janeiro is beyond me. Transmittable diseases, notably ZIKA which has already caused controversial participant withdrawals in some sports, is of great concern. We look at how one company is addressing the issue of mosquito control in Brazil and how Microsoft is working to bring about a better mosquito trap.

Moving from six to four legs we consider two relatively new technologies; one traditional, the rodenticide difethialone and one an innovative rat trap concept, that claims to uniquely target rodent species using camera recognition.

Elsewhere, Partho explains the background to insect control through baiting and why this innovation helps reduce the insecticide load in urban pest control. Graham takes a look at how to measure spray droplet size in the field and with grass cutting almost a twice weekly activity in the UK this summer, Terry assesses the role of the fungal pathogen *Microdochium nivale*, considered the most widespread and damaging disease of managed turf in the cool temperate world.

David

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Technical Consultants

Clive Boase runs the Pest Management Consultancy, probably the UK's longest-running urban pest consultancy. "I continue to be amazed by the diversity of urban pest issues. We now work with a broader range of projects and clients than ever before, including pests and construction materials, poultry pest strategies, development of experimental pesticides, bed bugs and the Olympics, strategies for urban housing, invasive species risk assessments, not forgetting training and legal work. This is a very dynamic sector." **www.pest-management.com**

Rob Fryatt B.Sc. held senior positions within ICI, Zeneca and Sorex and now leads Xenex Associates who provide advice to agrochemical suppliers, pest management companies and other organisations around the globe. Rob has been a Director of the BPCA, Director General of CEPA and chairs the CEN European Committee developing a common pest management service standard. Rob is a frequent invited speaker at industry events and has written regular opinion columns for a number of international industry publications. **www.xenexassociates.com**

Dr Terry Mabbett is a pest, disease and weed control specialist with forty years of international experience covering research, consultancy and journalism in agriculture, horticulture, forestry, amenity, livestock and public health. His current areas of particular interest are the protection of tropical tree crops and exotic insect pests and plant pathogens of Britain's native, naturalised and forest plantation trees. **Drterrymabbett@btinternet.com**

Graham Matthews DSc., FSB., FRES. began his career in Africa working on cotton pest management before joining Imperial College. Research and teaching pesticide application at Imperial and overseas has been interspersed with consultancies for international organisations, such as the World Bank. Author of several books, he was formerly an editor of Crop Protection. Retired in 2001 and now Emeritus Professor of Pest Management. **www.dropdata.net**

Martin Redbond B.Sc. has spent nearly forty years working in the crop protection industry where he has held various sales, marketing, technical and regulatory management positions with multinational companies and in contract research. He is the author of a number of important crop protection reports and has been editor of Crop Protection Monthly for the past eight years. **www.crop-protection-monthly.co.uk**

USA: Rentokil acquires Residex

In early July, Rentokil Initial plc announced details of its continued expansion in North America with the acquisition of pest control and turf products distribution business Residex LLC for US$30m. Residex is the largest independent products distribution company in the US, with annualised revenues for the 12 months prior to acquisition of $113m. The acquisition increases the scale of the Company's existing pest and turf products business, which more than doubles in size. It creates the second largest business of this type in the US market, delivering national coverage and a greater density footprint. The addition of Residex means that the Rentokil business in North America is set to deliver annualised revenues of around $1 billion by the end of the year.

In the first half of 2016 the company completed a series of 20 highly-targeted city-based acquisitions, predominantly in Pest Control in North America, Asia, Pacific and Europe. Total annualised revenues in the year prior to acquisition for these businesses acquired, including Residex, were c. £100m.

■ Source: Rentokil-Initial

Israel: Exporting predatory insects and bumblebees to Russia

Following the European boycott on Russian produce as a result of the country's invasion of Crimea, Russian agriculture was abruptly cut off from its traditional supply base. Israeli companies have stepped in and have been working to construct greenhouses for Russian farmers and consult with them on using natural methods to manage pests.

BioBee Biological Systems, in northern Israel, breeds and applies beneficial insects and mites (swirskii, *Phytoseiulus persimilis*) for use in pest control in tomatoes, cucumbers and roses.

Part of the collaboration involves experiments being carried out by BioBee in using bumblebees to pollinate cherry orchards in Crimea. The company expects, that should the trials prove a success, this would open new markets for Israel in pollinating cherry trees around the world. Crop pollination by insects has been estimated at $14.6 billion to the US economy. Bee diversity has declined considerably in the US and Europe, with many species disappearing from much of their former range. The UK has lost three species of native bumblebee and six more are listed as endangered. Four bumblebee species have gone extinct from Europe and similar declines are seen in China.

The Israeli initiative offers a solution to a problem plaguing Russian and global agriculture.

■ Source http://bit.ly/29sjvNO

Global: Delivering next-generation weed control solutions

Monsanto Company and Sumitomo Chemical Company, Ltd. have announced a new global agreement that will focus on developing and delivering next-generation weed control solutions to further help growers manage tough-to-control weeds.

Monsanto's pipeline of multi-generational herbicide trait upgrades in its research and development pipeline, are designed to provide multiple and additional modes of action for weed control well into the future. This includes PPO-herbicide tolerance traits, which are in the early phases of R&D and are expected to be included in future generation multi-herbicide tolerant trait stacks. In addition to its existing portfolio, Sumitomo Chemical has been developing a new generation PPO chemistry that has shown broader spectrum control with application flexibility that has the potential to enhance current and future weed control systems.

Under the new global agreement, the companies will work to create an integrated system of germplasm, biotechnology and crop protection that will represent this new generation of weed control solutions. As part of this, they will collaborate in the development, registration and commercialization of Sumitomo Chemical's key PPO chemistries including its new generation PPO herbicide for over-the-top and conventional herbicide application use in Monsanto's future generation weed management systems, as well as conventional applications for certain other crop uses. The new generation PPO herbicide is expected to be available within brands offered by both companies. The next-generation herbicide is expected to be commercially available early in the next decade, pending regulatory approvals. Additional details of the agreement were not disclosed.

■ Source: http://bit.ly/29rQCyx

Belgium: Electronic nose detects pesticides and nerve gas

As anyone who has been breathalysed will know, alcohol is easy to detect. As drivers breathe into the device, a sensor measures the amount of alcohol in the breath and a chemical reaction is then converted into an electronic signal and digital readout. In this case the chemical reaction is specific and the concentration of the measured gas is fairly high. But many other gases are complex mixtures of molecules in very low concentrations.

Researchers from KU Leuven have now built a very sensitive electronic nose with metal-organic frameworks (MOFs). Postdoctoral researcher Ivo Stassen explained "We created a MOF that absorbs the phosphonates found in pesticides and nerve gases. This means you can use it to find traces of chemical weapons such as sarin or to identify the residue of pesticides on food. This MOF is the most sensitive gas sensor to date for these dangerous substances. Our measurements were conducted in cooperation with IMEC, the Leuven-based nanotechnology research centre. The concentrations we're dealing with are extremely low: parts per billion and parts per trillion."

The chemical sensor can easily be integrated into existing electronic devices, Professor Rob Ameloot added. "You can apply the MOF as a thin film over the surface of, for instance, an electric circuit. Therefore, it's fairly easy to equip a smartphone with a gas sensor for pesticides and nerve gas."

■ For more information, visit Chemical Science http://rsc.li/2aJw7Pv.

Europe: Commission gives glyphosate weed killer a last-minute reprieve

To the relief of farmers, the herbicide glyphosate will remain on the market in Europe for another 18 months. The widely used weed killer faced a 30 June deadline for re-approval of its safety, without which it could not be sold, but the decision has been stuck in political gridlock. So the European Commission stepped in to extend the safety approval until December 2017. The decision was mentioned by Commissioner for Health and Food Safety Vytenis Andriukaitis during a press conference today and may be officially announced tomorrow, according to a commission source.

The safety of glyphosate has been hotly debated ever since the International Agency for Research on Cancer declared it a "probable human carcinogen" in March 2015. Regulatory agencies had previously declared glyphosate safe when properly used, and the European Food Safety Authority was on track to renew its approval. (The differing opinions caused some confusion, which is clarified here.) Opponents of the herbicide campaigned for the commission not to renew the market license. Glyphosate manufacturers and the farm lobby objected fiercely, and member states could not reach a majority decision about how to proceed.

In his comment, Andriukaitis said that the commission granted the 18-month extension in order to have the European Chemicals Agency (ECHA) complete its review of glyphosate. ECHA is responsible for classification and labelling of hazardous chemicals, and during commission deliberations in May, some member states wanted to know ECHA's opinion on the carcinogenicity of glyphosate before voting on its re-approval.

■ Read Martin's full article on the status of glyphosate on page 226.

US: Marrone Bio Innovations pays to settle litigation

Marrone Bio Innovations reached an agreement to settle the private securities class action litigation against it. The agreement is subject to review and approval by the court after notice and an opportunity to object are provided. The settlement agreement contains no admission or concession of wrongdoing or liability by the Company or any other defendant and includes a full release of claims. The civil settlement seeks to concludes Marrone Bio's outstanding issues. Having previously paid $1.75m to the US Securities and Exchange Commission, the new agreement provides for a settlement payment of $12 million for shareholders which will be paid by insurance carriers. Accordingly, the settlement of these lawsuits will have no adverse impact on the Company's financial position or operations. Furthermore, in June, Marrone Bio announced that it had obtained a waiver from lenders, terminating the requirement that the Company maintain a $15 million minimum cash balance. Marrone Bio's civil settlement with its shareholders is separate from the criminal actions facing former Chief Operating Officer, Hector Absi who is still under indictment in a criminal case as well as a separate SEC lawsuit. Both are pending in the Federal court in Sacramento.

Europe: Good news from the continent

Certis Europe celebrated its 15th anniversary in June with a gathering of all employees, shareholder representatives and guests in The Hague, Netherlands. A full company profile will be available in the September issue of International Pest Control.

US & UK: Rollins Acquires Safeguard Pest Control

On 29th June, Rollins Inc., a premier global consumer and commercial services company, announced that it has purchased the stock of Safeguard Pest Control and Environmental Services Limited, operating in greater London and Southeastern England. It is Rollins' first company-owned operation in the United Kingdom.

Established in 1991 and headquartered in Westersham Kent, United Kingdom, Safeguard is a long established pest control company in the UK, with a rich history of providing superior pest control, bird control, and specialist services to residential and commercial customers. Owners Paul Butterick and Tim Sheehan will stay on to run the company operations.

Gary W. Rollins, Vice Chairman and Chief Executive Officer of Rollins stated, "The Safeguard acquisition is an important milestone and expands our global presence. Safeguard's outstanding management team has established the company as an industry leader, and we share a culture of continuous improvement and ongoing investment in training and development. Further, we are pleased that Paul and Tim will remain in leadership roles and look forward to sharing best practices between the two organizations."

■ Rollins Inc. provides pest control services and protection against termite damage, rodents and insects to more than two million customers, from more than 700 locations. Among the various For more information visit www.safeguardpestcontrol.co.uk and www.rollins.com.

Staff of Certis Europe with shareholders and suppliers at the celebratory gala dinner for the 15th anniversary event held in The Hague.

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Poison free	✓
Fits into IPM policy	✓

Physical barrier	✓
Instantly waterproof	✓
Poison free	✓
Fits into IPM policy	✓
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UK: University of Hertfordshire reveals ground-breaking crop disease warning system

A prototype warning system that can warn of crop disease up to four weeks before symptoms are seen – earlier than any other system currently available – has been revealed by the University of Hertfordshire's MEMS Group.

This latest bio detection system, showcased at 'Cereals 2016' consists of an integrated high volume air sampler, fluidic sample processing delivery system and on-board molecular diagnostics.

Dr. Daniel McCluskey, Senior Research Fellow, Enterprise & Business Development at the University of Hertfordshire, commented: "With a seven-day autonomous pathogen detection operation, our system conducts sensitive, specific analyses and reports them via terrestrial mobile or satellite data connection. We envisage that this data will feed into the CropMonitor forecast models to identify emerging threats. This would therefore enable farmers and agronomists to make more informed, 'smart' spraying decisions that both enhance food security and reduce the use of environmental fungicide".

The University's prototype crop disease warning system has been developed over the past 18 months, as part of a three year joint BBSRC (Biotechnology and Biological Sciences Research Council) and Innovate UK funded consortium project. Working closely with its consortium partners - Optisense Ltd, FERA Science Ltd and Bayer Cropscience - the University has applied its expertise in researching advanced integrated biodefence systems to develop a viable technology platform for the food security industry.

The prototype design has undergone extensive laboratory testing and is now ready to be deployed for field trials, with FERA and Bayer overseeing the next phase of the project. The development of the commercial device will be undertaken by Optisense and is due to commence in parallel with the next stage of field trials.

The University of Hertfordshire's prototype crop disease warning system. Photo courtesy of Fera-Science Ltd.

Asia: Solving pest problems on Australia's Gold Coast

The FAOPMA Conference, hosted by AEPMA and held from 14-16 September 2016 at the Sea World Resort and Conference Centre on the Gold Coast, Australia, is set to be a highlight Pest Management event for 2016. The theme for the conference is "Solving Pest Problems", bringing pest managers, industry specialists and experts together to work towards solving real life pest problems.

Mr Paul Hanna, one of Australia's leading motivational speakers on developing potential in individuals and organisations will be presenting the Keynote presentation at the conference. Other highlights include presentations on Termites and Termite Control, with such high profile experts as Dr Charunee from Thailand, Dr Theo Evans and Dr Don Ewart. With the emerging threat of the Zika Virus – Dr Stephen Doggett will present on the latest in Mosquitoes and Mosquito-Borne Threats.

There will be some 40+ exhibitors, showing delegates the latest in products and technologies from Australia and overseas. Major sponsors include BASF, Globe, Pelgar, Ensystex, Sherwood Chemicals and Syngenta. The conference program promises to bring some exciting new experiences, such as the special presentation Working Breakfasts, the Welcome Cocktail Reception with live dolphin show and a Tropical Themed Gala Dinner at McLaren's Landing on South Stradbroke Island for the much anticipated announcement of the Australian "Pest Manager of the Year".

Sea World Resort and the Gold Coast provide the perfect backdrop to extend the event and to enjoy the Australian Gold Coast. Special accommodation rates available through the AEPMA conference website (www.aepma.com.au/conference) and can be booked directly using the special group booking code "FAOPMA2016".

And Finally…Y-Moths fly into Paris

The UEFA European (football) Championship drew to a strange end in Paris, not because Portugal beat France 1-0 after extra time, but as Cristiano Ronaldo sat in tears on the turf, injured after just 25 minutes, a moth settled on his face and formed one of the most bizarre images of the tournament. The moth was one of thousands in the Stade de France stadium that night, pictured in clouds on the pitch as the players warmed up. The spectacle appears to have been the result of a very the bright stadium lights being left on overnight on the eve of the game, coinciding with a moth migration. The moths were Autographa gamma, the Silver Y Moth, a pest of numerous crops such as vegetables, cereals and nursery stock. Silver Y Moths migrate annually from North Africa, travelling through France to breed in Britain. The adults fly in the Paris region normally in May – June with a second flight at the end of July. The Euro 2016 final appears to have interrupted this year's northward migration. The adult moths have short lives, of as little as two weeks after emergence and must complete their migration before finding a mate. The Stade, acting as a giant moth light trap, will have ended that flight for many.

What does Brexit mean for the pest management industry?

David Loughlin*

The UK was not an original signatory to the Treaty of Rome, when in 1957, 6 European countries (Belgium, Germany, France, Italy, Luxembourg and the Netherlands) formed the European Economic Community. The UKs subsequent application to join was blocked twice by the then President of France, Charles de Gaulle but the UK finally joined in 1973. It was however only two years old when in 1975, British membership of the Common Market was put to a first public referendum and was approved by 67% of voters. After 40 years however, on 23rd June 2016, a second referendum on EU membership resulted in a 52% vote to leave.

The process for the UK's exit is uncertain under EU law, as Article 50, which governs the withdrawal, has never been used before. Unless extensions are agreed, the timing for leaving under the article is two years from when Britain gives official notice. The assumption is, that during the two-year window, new agreements will be negotiated but there is no requirement that there be new agreements.

The decision has led to a period of political instability with the UK Prime Minister, David Cameron resigning and being replaced by Theresa May; with calls for similar changes to the opposition Labour party leadership that have yet to be settled; uncertainty what will happen next regarding Scottish independence; and how Ireland will manage the only land barrier to exist between EU and UK soil.

There will be no visible change to the EU as Brexit takes effect, such as a change to the European flag, that dates back to 1955. The flag symbolises both the European Union and, more broadly, the identity and unity of Europe. It features a circle of 12 gold stars on a blue background. The number of stars has nothing to do with the number of member countries, though the circle is a symbol of unity. However, the UK's decision to leave has given rise to uncertainty over all aspects of the economy including agriculture and crop protection.

How will these changes affect our industry? We took the opportunity to poll the opinion on both sides of the English Channel.

One major area that influences the industry most, is that of regulatory controls - the various and numerous EU regulations and directives. In crop protection, there has been considerable effort to unify the approval of plant protection products under European Regulation 1107/2009 and the earlier Directives 79/117/EEC and 91/414/EEC. How are these to be applied post separation? Similarly, for non-crop applications, the EU Biocides Regulation 528/2012 (EU BPR) and the European Chemicals Agency (ECHA), that was formed to be the driving force among regulatory authorities in implementing the EU's chemicals legislation, are both the result of many years of policy making, debate and negotiation among the member states.

Commenting, Nick von Westenholz, CEO of the UK Crop Protection Association, a key voice of the UK plant science industry, said "The EU referendum has provided a welcome opportunity to scrutinise current agricultural policy, and shortcomings in the way poorly managed regulations damage the competitiveness of UK farming, has been a key concern. We now have a unique opportunity to shape the regulations governing our farming sector for the benefit of UK farming."

Continuing Nick said, "We need to better support our farmers to bring healthy, safe, reliable and affordable food to tables across the UK. To do this, we need a regulatory environment that fosters innovation and incentivises the development and adoption of new technologies in pest control and crop science. It is now time to work with the government to put in place an agricultural policy that supports UK farmers, allowing them both to compete and trade with the rest of the world.

"The UK's vote to leave the European Union (EU) cuts to the very heart of a crucial debate over support for British farming. The Crop Protection Association is calling for a new and improved system that champions a science led regulatory approach and which supports UK farmers in ensuring a healthy, safe, reliable and affordable food supply."

Similarly, Dr Colin Ruscoe, President & Executive Chairman of the British Crop Protection Council (BCPC), that promotes the use of science and technology in the understanding and application of effective, sustainable crop production, said "The UK has often been a lonely voice arguing for better science-based regulation in the EU. Brussels has often taken the politically-expedient - but innovation-stifling - route of defaulting to the 'Precautionary Principle' when difficult risk-benefit decisions are required, Approval of new agrochemicals now involves simplistic hazard-based "cut-off" limits, based e.g. on intrinsic toxicity, ignoring exposure and risk-assessment. This approach was reinforced in June this year by the EU "Commission advocating hazard- rather than risk-assessment to identify endocrine disruptors. This will result in removal of many important – and safe-in-use chemicals."

"The Leave campaign promised that by quitting the EU, we can reduce regulations, save or re-apportion current EU contributions and "take back control". These aspirations may be realised – eventually. But huge efforts are required to agree our divorce settlement and the associated mountain of legislative changes, means it will be easiest for Government Departments to copy-and-paste existing EU Regulations and Directives into UK Law and Policy."

"Brexit will provide a unique opportunity for the UK to base regulatory approaches to crop protection chemicals, on robust risk assessment, as does the US EPA and FDA. This can provide win/wins for food production, human health and the environment – and economic benefit. For example, the 1980 EU Drinking Water Directive requires a maximum individual pesticide concentration of 0.1 µg/L. This has no toxicological basis – it was simply the limit of detection back in 1980. As a result, millions of pounds are wasted each year in removing innocuous chemicals from drinking water, and the use of important agrochemicals such as metaldehyde, of negligible human or aquatic ecosystem risk, is restricted. Huge advances in toxicological assessment since 1980 make risk-assessment approaches, e.g. WHO guideline value methodology, entirely

*Editor IPC Magazine

appropriate for safeguarding drinking water."

"We must maintain the highest standards of water quality – but do this intelligently. " he added.

Concluding Colin Ruscoe says "Many involved in food production – the UK's biggest manufacturing industry – see more downsides than upsides in Brexit. Taking immediate opportunities to form new food and farming legislation and directives, based on science, not political expediency, would be a signal that the Government will deliver benefits from Brexit."

Meanwhile in Brussels, Graeme Taylor, spokesperson for ECPA, who represent the crop protection industry in Europe, said "We are hugely disappointed, but not altogether surprised, that the UK has decided to leave the EU."

"Glyphosate is an example from our sector that epitomises how dysfunctional the EU system can be. A system where a few Member States, driven by politics rather than science, are allowed to potentially prevent the authorisation of a substance that allows the production of a plentiful, safe, sustainable and affordable supply of food for the European population, while allowing farmers to stay competitive and make positive contributions to the environment such as practicing no-till;"

"The UK could be consistently relied upon to champion the causes of innovation in agriculture, a science based approach to decision making and better and smarter regulation within the EU. Their voice will be missed, but we hope future relations with the EU will ensure that this dialogue on innovation and science continues and improves."

"We hope that the institutions will take time to reflect on the reasons that one of the largest and most influential Member States would choose to leave, and how it can address some of the issues raised during the debate such as the real concern about the unnecessary red tape and burden that Brussels places on businesses."

Speaking on behalf of the rapidly growing biopesticide industry, David Cary, Executive Director of the International Biopesticide Manufacturers Association said "IBMA, as a European focussed international association of manufacturers, see it as a non-productive move, at a time when a lot of reform of regulations, influencing our industry, are needed. We have valued the UK contribution where it has been forthcoming, in various EU and International organisations. We hope this continues post Brexit and will certainly encourage this from our side. Other Member States have shown they can still contribute to various groups promoting better regulation. IBMA would be surprised if, in the major area affecting our members, EC Reg 1107/2009, if the UK were not to still adhere to most or all aspects of this legislation."

"Therefore, IBMA members are unlikely to feel an effect from regulatory change. Many IBMA members come from outside the EU 28 now. Trade occurs effectively between EU 28 countries and those outside this grouping. It is unlikely that this will change when EU membership is confined to 27 Member States. It should be seen from all sides now that the decision has been taken to reform all areas of the European model including trade and regulation if they are needed from all sides. Opportunity out of adversity may provide a chance to take a good look and rethink for improvement across the board."

Moving from crop to public health, Simon Forrester, Chief Executive for the British Pest Control Association stated "Our country is coming to terms with a referendum result which will have massive implications for UK politics and government. It is too early to predict the political landscape, and the levels of upheaval we are currently experiencing were (to put it mildly) unexpected. We live in a time where we expect immediate answers, but none are forthcoming. In the short term it is 'business as usual' and in the future BPCA will work closely with those involved in the process of change. For the professional public health pest control sector UK legislation still applies, and any European directives or laws will remain in place until we are advised otherwise. While the actual process of leaving will take some time, the impact will be felt long before then, as different aspects of our relationship with Europe are negotiated. It seems apparent that things will change, but we cannot reasonably expect any government to throw out existing legislation in the short-to-medium term without an extremely good reason. With no political will to change any public health pest control laws, it seems unlikely that this would change following the formal Article 50 notification. Indeed, it seems more likely that the limited resources of government will be tied up in negotiating a new deal with Europe, rather than focusing attention on laws affecting our sector."

The BPCA's advice to our members is to continue to work in a professional manner, and advise their clients that all existing rules still apply. The UK Rodenticide Stewardship programme, the CEPA Certified standard, the rules for use of Aluminium Phosphide, all are still valid.

Continuing Simon said, "The UK has one of the best regulatory and standards frameworks in the world and we expect the regulators to ask for our help to plot a course for the future. We will be ready for this, supported by our Members. Over the coming months we will keep them informed of any developments."

One area where the UK pest control industry has experienced rumour and scaremongering is around the CEPA Certified Scheme. Keen to squash those rumours, Simon said, "It seems those who are unwilling to support this initiative see Brexit as a nail in its coffin – far from it. At the time of writing 36 UK Companies have achieved CEPA Certified, with another 70+ companies attending our free CEPA Roadshows to find out how their business can benefit from this standard. Before we embarked on the project to have all BPCA members audited against EN16636 by Bureau Veritas, the BPCA Executive Board had already considered what a Brexit vote would mean to CEPA Certified and to the EN standard itself. CEPA Certified is based on EN16636, a European standard that is also a British Standard. The companies who already have CEPA Certified can confirm their certificate states the standard to be BS EN 16636:2015."

"UK plc makes a huge amount of money from British Standards both at home and globally, around GBP 8.2billion (figures from Centre for Economics and Business Research), and no government of any hue is going to throw that away – so British Standards are here to stay. Also, many clients with a presence in the UK and across Europe are already building CEPA Certified into their specifications, knowing that this is a unique benchmark of quality for our sector. By the time the dust settles on what Brexit actually means on a day-to-day basis for pest controllers and their clients, the CEPA Certified standard will be fully established. Whether in or out of Europe, the UK is leading the way in terms of certification to the standard, and with our Members' help we will continue to lead the league table. CEPA Certified gives BPCA an opportunity to show all of Europe and legislators in both Westminster and Brussels that UK businesses work to the highest standards."

To reinforce Simon's comments, Roland Higgins, Director General CEPA Secretariat said, "CEPA's vision is to ensure that the Pest Management industry is recognized for responsibly protecting European citizens, their homes, their food and the environment in which they live against public health risks. CEPA and its 49 members will continue to pursue that vision, hinging it on our European Standard for Pest Management Services and CEPA Certified, its accompanying certification scheme. Less than a year after its launch more than 110 Pest Management companies in 21 European countries have already been distinguished with a 3rd party audit certificate against our Standard."

"The British public's vote in favour of leaving the European Union will not affect CEPA's determination nor that of its members, including the British Pest Control Association, to maintain the present course of using the European Standard and its certification programme to communicate to stakeholders and the public that the industry works to the highest professional standards. If ever there was a time for Brits to become a member of a European Association it is without a doubt right now: access to the European Regulator without being a member of the European Union. The best of both worlds!"

There is no doubt that the outcome of the UK referendum on membership of the EU will generate significant interest across the regulatory, scientific and food production community. To address this and to offer a first insight, the theme of the October 2016, BCPC Brighton Conference will now feature how the agricultural and regulatory environment might change in the UK. This year's Congress offers a programme of presentations, Q&A sessions, panel discussions and a CRD workshop covering existing and future regulatory challenges. A revised programme will be announced which will include presentations on EU regulatory progress and challenges, voluntary initiatives and the challenges presented by changes in arable agriculture in Europe. New presentations will include opinion from across the spectrum of stakeholders such as industry and their associations, policy makers, grower representatives and regulators. Visit http://www.bcpccongress.org/ for more information.

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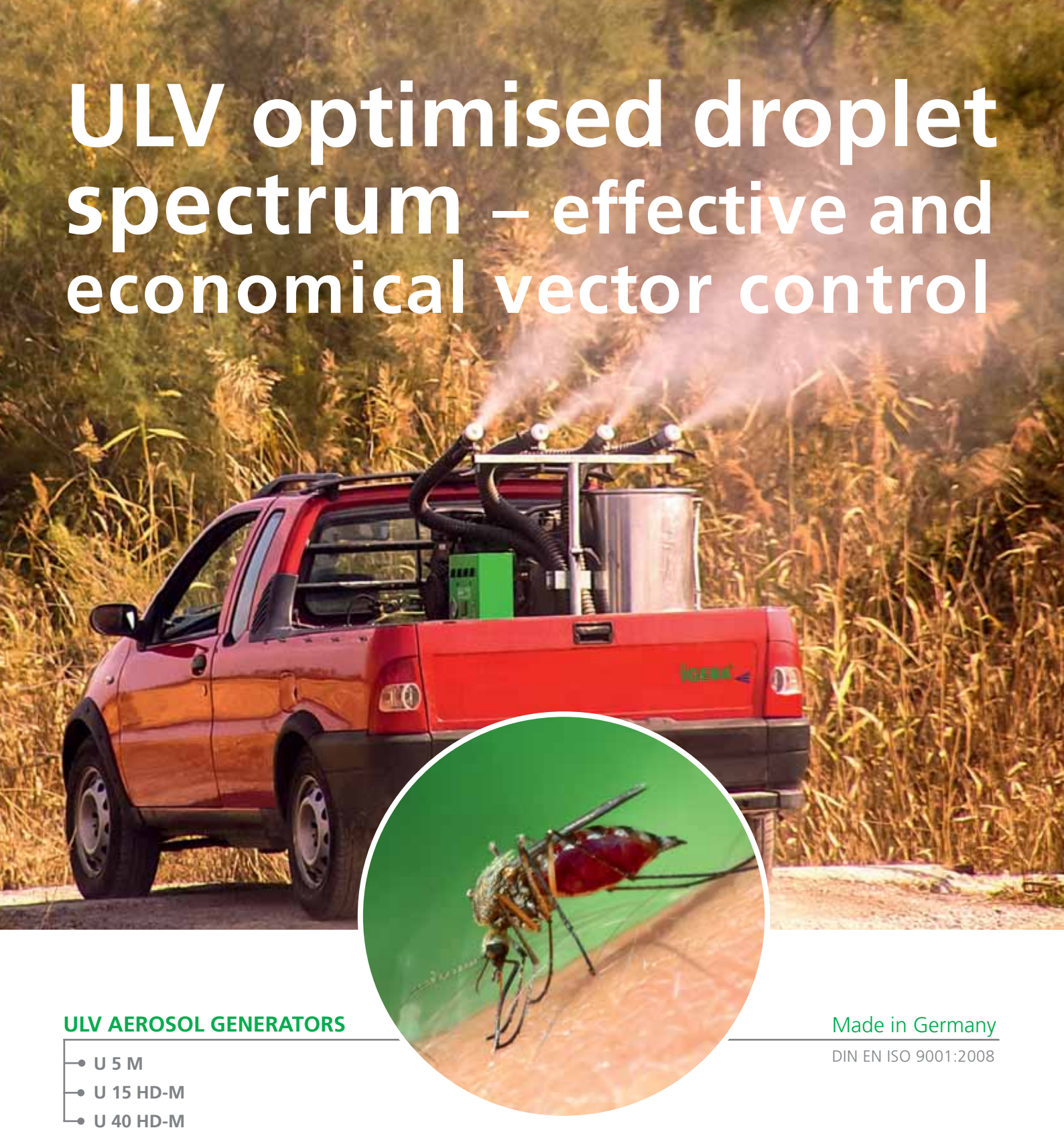

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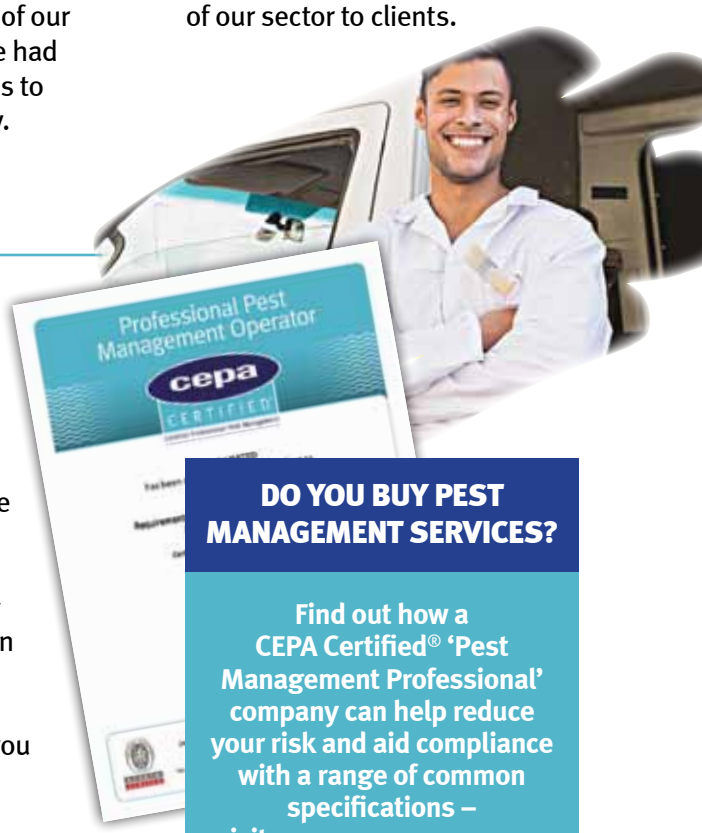

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Much ado about glyphosate

On the 28th June, just two days before the licence was due to expire, the EU Health and Food Commissioner confirmed an 18 month extension for the use of glyphosate in herbicide treatments. Meaning for the next 18 months, it is business as usual for those involved with using and selling Glyphosate. This is certainly shorter than would normally be expected but it is, as such, a re-approval and immediate legal obligations are met. There will be further detail emerging about any conditions on this extension in due course.

Throughout the protracted and, in many ways, unprecedented re-approval process for glyphosate, the Amenity Forum has been closely involved and always sought to emphasise to all concerned that any conclusions should be based upon the science and evidence. The delays in the process have had substantial impact on all aspects of our very important and essential sector and certainly made decision making very difficult.

John Moverley, Chairman of the Amenity Forum, explained, "Due to the delayed decision, one of our members has had to make preparations to cancel weed control work as they were unable to commit to being able to continue spraying. As you can imagine it's been extremely stressful for all that use Glyphosate. Further to this, other members have been affected in terms of quoting for future contracts for weed control on our public transport networks, essential for public safety. Not knowing if glyphosate might be available has created real difficulties and concerns.

Those involved in invasive weed control have wondered how they might operate and undertake this essential task. It has been made even more difficult for all involved in the sector to understand the delays, given that following the rigorous process of re-approval, the outcome was the conclusion that glyphosate was safe to use and should be re-approved. The ensuing political arguments bringing matters to a last minute decision have not been pretty and had serious consequences.

Of course the matter is not just of concern to the amenity sector but to homes and gardens and agriculture.

John continued, '' We are of course pleased that the approval has been extended and that the decision has been based, as it should be, on the science and evidence. As a Forum we promote best practice in all aspects of weed, pest and disease control. We promote an integrated approach making appropriate use of all methods for control. Glyphosate remains a key ingredient in maintaining safe and sustainable amenity areas.

We will continue to monitor matters as the voluntary initiative for the amenity sector in the UK on all aspects of weed, pest and disease control"

On October 13th, the Forum is holding a national conference where the focus will be upon the important and essential nature of the amenity sector. Further information on the programme can be found at http://www.amenityforum.co.uk/conference.html. Book your place now at conference@amentyforum.net

■ For further information, visit www.amenityforum.net.

Implementation plan on acceleration of sustainable plant protection

The IBMA (International Biocontrol Manufacturers' Association) warmly welcomed the Netherlands' initiative, to address Sustainable Plant Protection, during their recent EU Presidency. Furthermore, the IBMA welcomed that they had established a group representing 19 Member States, EFSA and EU COM and that they had prioritised two areas:

- making low-risk Plant Protection Products more available to European farmers,
- encouraging the practice of Integrated Pest Management (IPM).

The IBMA also congratulated both the Netherlands and the EU Sustainable Plant Protection Expert Group for their very effective and focused work over the last 6 months. A lot has been achieved and by engaging other Member States, a broad commitment to achieving the agreed common goals has been attained.

The Implementation Plan is broadly supportive of the IBMA's calls for both low-risk active substances within Reg. 1107/2009 and plant protection products and implementation of IPM as called for under the Sustainable Use of Pesticides Directive (SUPD). Many of the 40 recommendations call for best practice from all parties. The IBMA welcomes all EU member states implementing such measures and will certainly work with its association members to ensure well prepared dossiers are being submitted.

The IBMA particularly welcomed commitment in the areas of:

1. Interest in inferring low-risk status on existing approved active substances
2. Granting extended renewals or non-limited approvals of l-r active substances
3. Proposing fast-track procedures
4. Granting provisional approvals
5. Consideration of reduced fees for low-risk active substances and products
6. Proposing zonal or 1 zone applications with a single fee
7. Reduced efficacy requirements for low-risk PPPs using the proposed EPPO guidance
8. Exclusion of attractants and repellents including semiochemicals from regulation
9. Exclusion of substances with a physical mode of action from regulation
10. Promotion of using dedicated expertise for handling and evaluating low-risk as and PPP applications
11. Promotion of non-opening of low-risk as dossiers during authorisation of low-risk PPPs
12. Consideration of label claims for low-risk status on low-risk PPPs
13. IPM measures

However, based on the practical requirements of farmers, the IBMA do have some issues and have concerns that:

1. Provisional authorisation may be on a voluntary basis, and as experience has shown, this will not remove uncertainty and will cause issues with harmonisation particularly at zonal level
2. The proposed existing approved active substances, low-risk listing, may carry no official status, as this limits any value of such listing
3. Proposed changes are in the most part, to be enacted during a lengthy REFIT programme commencing this year but not implemented for several years, and supports these initiatives being implemented on a more timely basis
4. The IBMA further question the need and impact of a review of 396/2005 as most substances, expected to be granted low-risk status (biocontrol products in particular), will not be required to have MRLs set

In summary, The IBMA congratulate the Netherlands Presidency on their achievements with low-risk Plant Protection Products and IPM, and the unanimous endorsement of the plan by the AGRIFISH Council. The fact that the EU Sustainable Plant Protection Expert Group will be maintained during the Slovakian Presidency should facilitate this. IBMA reiterates that the legislation needs immediate repair, in order to have the required low-risk products accessing the market. No more time should be wasted: the changes foreseen by the Netherlands Presidency, the EU Sustainable Agriculture Group, the IBMA and other stakeholders should be achieved as soon as possible.

■ For more information, visit www.ibma-global.org.

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BPCA claims national award

The British Pest Control Association (BPCA) created a first for the industry when it added a new e-Learning package to its extensive timetable of professional courses. And the initiative was named winner of the New Product Development category in the MemCom Awards – a nationwide competition that rewards marketing excellence. Mandy McCarthy-Ward, training manager for the BPCA, said: "We developed the first-ever interactive e-Learning course for the pest control sector and have seen some fantastic results. "Pass rates have improved by more than 10 per cent already and the number of people taking the programme has risen sharply. "The initiative has obviously had a significant impact, but it's great to receive independent recognition and winning a prestigious award is fantastic." More than 200 delegates from professional bodies, sport organisations, charities and others saw the winners announced at the MemCom Awards ceremony in London.

The BPCA's new eLearning portal, together with its first interactive online course 'Introduction to Pest Management', first went live in July, 2015. Between July and December 2015, a total of 86 paying students went through the course – a 20% increase on the number for 2014 in its entirety. Some 120 of those who took the BPCA's 'General Pest Control' course studied the online version in preparation for classroom-based learning. The pass rate for the classroom course has improved by 10% since the introduction of the online element. The online 'Safe Use of Rodenticides' course, launched in November 2015, has a 95 per cent pass rate. The online portal also provides an opportunity for pest technicians to accrue Continuing Professional Development (CPD) points. It contains 25 CPD quizzes which have been accessed by more than 3,000 people since its launch.

New leader plans to deliver bright future for professional register

The professional register, BASIS PROMPT, is out to expand its role and increase its influence within the pest control sector, in a move to deliver maximum value to members. That is the message from Stephen Jacob in his new role as Chief Executive of BASIS Registration, the independent standards setting and auditing organisation for the UK agricultural industry and allied sectors. PROMPT acts as a vehicle for Continuing Professional Development (CPD) and provides a range of accredited qualifications. By focusing on the value of membership, Stephen hopes to continue the impressive progress of a scheme which has recorded unprecedented growth in recent years.

PROMPT has grown by more than 14% since 2014. Stephen now wants to see the majority of qualified pest controllers in the UK signed up to the register within five years. PROMPT already delivers significant benefits to its members, but several developments are in the pipeline. Stephen is keen to see the future of the register led by members themselves and says a membership survey, to be launched later in the year, will be key.

The progress of PROMPT has been mirrored by that of the wider BASIS Registration, which has developed in recent years into an organisation serving a range of sectors including crop protection, amenity, public health and plant nutrition. Established by the pesticide industry at the request of the government in 1978, it is also a vehicle for initiatives to protect public health and the environment from risks associated from the use of pesticides. It promotes a holistic approach to crop protection and provides a forum for industry, regulatory authorities and government to discuss the maintenance and promotion of professional standards.

The BASIS Amenity Training Register is an important vehicle for amenity contractors offering professional pesticide services, while Amenity Assured provides annual assessment for such contractors along with advice to local authorities as well as industrial, utility and environmental sectors. The BASIS store inspection scheme uses independent training assessors to ensure registered stores in the UK are taking the proper precautions. Wildlife Aware is a training course designed for professional pest controllers, local authorities and game-rearing enterprises. Run in collaboration with CRRU, it helps demonstrate expertise in modern techniques to balance rodenticide use with environmental concerns. BASIS also runs FACTS - the body responsible for setting standards, training and accrediting CPD for those providing plant nutrient management advice.

More than 5,000 qualified advisors help to maintain standards of excellence in farm management throughout the UK. The BASIS Approved Trainer Scheme (BATS) is designed for individuals and organisations wishing to provide training for BASIS courses, while the aim of RAMPS UK is to ensure the sustainable use of metallic phosphide products in all market sectors through the training and registration of stockists and end-users.

■ For more information visit www.basis-reg.co.uk.

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Using the 'R' word

Clive Boase*

Access to a range of effective pesticides is a crucial prerequisite of most pest management programmes. Public health and food production rely heavily on it. Although at one time it may have been assumed that there would always be a range of products available in each sector, that is certainly not the situation now. There are number of reasons why the choice is narrowing, but one important issue, that increasingly limits choice at the end user level, is the 'R' word - pesticide resistance.

Pesticide resistance is not a new issue and has been studied by the scientific community for decades. Scientists have a grudging admiration for strains of pests that, despite the best efforts of molecular modellers and synthetic chemists, yet again confirm that Darwinian selection and evolution is alive and well. On a more practical level, there is some kudos to be gained by being the first to report resistance to a new class of pesticides, or that a particular pest has unexpectedly become resistant. Such findings can send ripples through the pest control community. Nonetheless Mark Twain's famous line '…the report of my death was an exaggeration' can apply equally well to pesticides. Despite early reports of resistance, some pesticides may remain in regular use for decades, albeit with modified use patterns, or with a restricted spectrum of target pests. Anti-coagulants for rodent control and pyrethroids for fly control, would be examples of particularly tenacious pesticides.

Table 1 below shows the numbers of papers published on insecticide resistance for particular insect pest groups. This brief survey also shows the proportion of papers that mention resistance management, with this topic being more likely to be raised in relation to bed bugs, than to other pests.

It is clear that among scientists at least, the R word is used often and openly. Its existence is well understood and accepted, and its potential impact is recognised to the extent that management strategies are explored, developed and tested. However it is interesting to look at the extent to which this weighty body of scientific information has been transferred, adapted and used by pest control practitioners.

There are several areas where scientific research work on resistance has had a very direct and positive influence in practice. In vector control for example, there has been a close and dynamic cooperation between basic research on insecticide resistance, and vector control in practice. Field staff conduct surveys on the extent and type of resistance, manufacturers actively seek out compounds with alternative modes of action, and various resistance management schemes are modelled and tested on an operational scale. Similarly, in rodent control, there has been extensive research on resistance, coupled with the development of advice and guidance on preventing and combatting resistance.

However, knowledge of resistance and its management have not trickled down equally into all areas of pest management. It is probably true to say, for example, that the general pest control community whether it be in Europe or the USA, does not have the same dynamic relationship with the science of insecticide resistance as the vector control community does. Despite the efforts of organisations such as the Insecticide Resistance Action Committee, awareness of pesticide resistance, how it arises, and how to detect, prevent or avoid it, are all relatively low.

When pest control technicians are asked about the extent to which they have ever encountered pesticide resistance, the usual feedback is that resistance is a rare problem. 'Poor treatment' would probably be the most commonly voiced explanation for the cause of any resistance found. Some technicians may admit to occasional call-backs for some pest types, but these are usually attributed to poor cooperation from the customer. For example, problems in controlling bed bug control are more likely to be explained by the customer's failure to carry out laundry recommendations, or by guests bringing in more bugs, than in terms of insecticide resistance.

To be fair, there are limited opportunities for pest control technicians to share views and experiences with those involved in fundamental research on resistance management. Instead they tend to rely on information from their manufacturers and distributors. By their nature, these organisations have a strong incentive to maximise sales of new insecticides. There is market share to be won from the competition, development costs to be recouped, and profit to be made before the compound starts to lose patent protection. The last thing a manufacturer wants or needs is widespread dissemination of news that the target pests are already starting to develop resistance. This understandable reticence to share information on resistance is not confined to manufacturers and distributors. Those responsible for supervising pest control technicians, regularly voice concerns, that if resistance is discussed too widely, then some technicians may use it as a smoke screen to conceal poor pest control practice.

Looking to the future, the pest management industry as a whole and their end customers, would benefit from a more open conversation about the 'R' word. By accepting and addressing the reality of resistance, then the industry can start to assemble measures to manage the onset and development of resistance. As explained above, it is to the long-term

*The Pest Management Consultancy, www.pest-management.com

Table 1: Published studies on insecticide resistance, since 1970.

Target pest genus	Number of papers mentioning "Insecticide resistance"	Proportion of which mention "Insecticide resistance management"
Anopheles	1824	30%
Musca	1084	30%
Blattella	455	22%
Cimex	128	45%
Ctenocephalides	55	14%

benefit of the pest control industry to have as broad a range of products available as possible. This is not simply for the sake of choice, but because by having access to a range there is the opportunity to adopt resistance management strategies that will hopefully keep all the products in that range on the market. By using the 'R' word more regularly, it will gradually lose its negative connotations, and become just another technical issue that the industry can address successfully if it works together. Handled positively all the players; manufacturers, practitioners, and the end customers, will benefit. Win-win-win.

Six of one, half dozen of the other: the future of weed management?

Clair Keene*

You cannot avoid the topic of herbicide resistant weed management these days. Whether you grow cotton in the Delta of Mississippi, soybean in Indiana, or corn in Pennsylvania, chances are good that there are herbicide resistant weeds near or on your farm. While weed species of concern may differ from region to region, resistance problems do not. In this article, I would like to share with you a little perspective on the current situation and a few things to keep in mind as you consider weed control options in the future.

Herbicide resistance is not a new problem. For example, atrazine was first registered for use in the U.S. in 1958 and the first incidence of an atrazine-resistant weed, Common Groundsel (*Senecio vulgaris*), was reported in 1968. For as long as we have been using herbicides, there have been weeds capable of evolving resistance. But in previous decades, there were other factors that helped buffer against the problem that herbicide resistant weeds posed. Tillage was used more often and controlled weeds by burying them and their seeds or uprooting seedlings. Farms were smaller and typically allowed a farmer to spend more time per acre on weed control. In the realm of herbicides, more companies were competing against each other to develop new modes of action and bring products to market. Duke (2012) estimates that before 1990, a new herbicide mode of action was commercialized about every three years. Since 1990, there have been no new modes of action introduced.

The other major game changer was the introduction of Roundup Ready crops. Roundup Ready soybeans were first sold in 1996 and provided a simple, effective option for controlling both broadleaf and grass weeds with little risk of crop injury. This was a major advantage over older chemistries and growers responded by adopting the technology at an unprecedented pace. In 1997, Roundup Ready canola and cotton were introduced and corn followed in 1998. Even in a corn-soybean rotation, the same herbicide could now be used every year. Growing Roundup Ready corn and soybean and relying heavily, or in some cases exclusively, on Roundup homogenized weed control across crops. This in turn reduced the benefits of crop rotation on weed management. The Roundup Ready system was simple, convenient, and facilitated the adoption of reduced-tillage practices. The labour-savings resulting from reduced tillage, complemented larger trends of increasing farm size and fewer farmers. But the great success and wide adoption of Roundup-based weed management was its own Achilles' heel.

Frequent use and a lack of diversity in control tactics, even across crop rotations, selected for weeds that were glyphosate resistant. Glyphosate resistant weed species are now common in many states and some examples include waterhemp (fam *Amaranth*), kochia (*Bassia scoparia*), Palmer amaranth (*Amaranthus palmeri*), common ragweed (*Ambrosia artemisiifolia*), and horseweed (*Conyza canadensis*), also known as marestail. Some of these species have developed multiple herbicide resistance and options for chemical control are running out. There are populations of waterhemp in Illinois and Missouri that have been identified as being resistant to three classes of herbicides: triazine (Group 5), ALS (Group 2), and PPO (Group 14); or glyphosate (Group 9), ALS (Group 2), and PPO (Group 14).

So where do we go from here? We are being presented the option of growing crops with multiple herbicide resistance traits such as Dow's Enlist™ which combines glyphosate and 2,4-D resistance or Monsanto's Roundup Ready 2 Xtend™ which combines glyphosate and dicamba. These options will likely be available in multiple crops which means in-season herbicide applications could again be the same, even in different crops. While these options may help control some glyphosate resistant weeds in the short-term, the evidence is not strong for continued control into the future. Even within the constraints of corn-soybean rotations, we have the opportunity to be more creative in how we manage our weeds. Cultural practices such as narrow row spacing in soybean, selecting corn hybrids with fast emergence, planting cover crops, aligning fertilizer application with crop uptake, and selecting a diverse herbicide program across crops are all practices that contribute to more robust weed management programs. As new crop-herbicide combinations become available, a longer-term perspective on weed management is still important. Consider not only what you do within a year, but also what you do across years. Selecting different tactics across time will be key to preserving the value of the technologies you use.

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Reference

Duke, S.O. 2012. Why have no new herbicide modes of action appeared in recent years? *Pest Management Science* 68:505-512.

Pragmatic decisions regarding insecticide resistance

Graham Matthews*

There are many publications recording the selection of insect populations resistant to insecticides, due to their continuous use, that enables rare individuals that are naturally resistant to survive and reproduce more successfully, than the susceptible insects. Examples include the abandoning of the successful indoor residual spraying programme organised by WHO, in which the very persistent insecticide DDT was used to control *Anopheles* mosquitoes, as soon as tests indicated that the mosquitoes had become resistant to DDT. In agriculture, the frequent application of insecticides on cabbages in Malaysia, led to resistance to a range of insecticides with different modes of action. In contrast few publications report successful implementation of programmes to overcome or delay the selection of resistance.

In Zimbabwe, when cotton spraying was recommended in the 1960s the timing of sprays was based on crop scouting to determine when either carbaryl (Sevin) or DDT should be applied against bollworms, while dimethoate was sprayed against aphids and red spider mites. Quite soon there were reports of inadequate control of the red spider mite on certain farms, despite sprays being applied correctly. Subsequently, it was discovered that, instead of a few sprays applied to cotton, dimethoate was used throughout the year on irrigated vegetables. In 1973, Duncombe published 'The acaricide spray rotation for cotton', which involved dividing the country into three zones (Fig. 1), in which acaricides with a certain mode of action, could be used for two years before being moved to the next zone for the subsequent two years, thus completing the cycle after 6 years and then repeated. Originally an organophosphate was used in one zone, rotated with the organochlorines dicofol and tetradifon. After a relatively short period, it was noted that mites were no longer resistant to dimethoate as the selection pressure had been removed, indicating that in this case, resistance stability was low.

The programme continued successfully at least until 2000, but Tibugari et al., (2012) pointed out that while older farmers were aware of the rotation scheme, there were many new farmers under the land reform programme who were not aware of it. This was no doubt due to a breakdown in the extension services, plus the non-availability of the recommended acaricides. Further training of farmers was needed.

In Australia, aerial sprays of DDT, were replaced by pyrethroid sprays against bollworms, but *Helicoverpa armigera* was soon reported to be resistant to pyrethroids. The immediate reaction was to limit pyrethroid sprays to a short period each year for all crops. This policy was successful, but introduction of genetically modified cotton, utilising the *Bacillus thuringiensis* toxin genes, has changed the spray programme. Care is needed in choosing traits to maintain activity against the bollworms to avoid selecting resistance to the Bacillus toxins.

In controlling mosquitoes, the IRS programme has been replaced to a large extent by extensive use of bed nets impregnated with a pyrethroid insecticide, with over 200 million nets in use. Inevitably resistance to pyrethroid insecticides is now widespread in Africa, indicated by extensive surveillance of mosquito populations in Africa (Ranson et al. 2011), with the situation getting worse over the last few years (Ranson and Lissende, 2016). Two global databases have been established (IR Mapper and VectorBase) and a third by WHO is planned.

While it has been suggested that resistance is due to widespread use of insecticides in agriculture, several companies have developed long-lasting insecticide-treated nets (LLINs) (Fig.2) that maintain effective levels of insecticide for at least 3 years, even after repeated washing. Analyses of permethrin content of 198 sub-sampled nets, of different ages (Fig.3), show the mean permethrin content was 16.5 g/kg (95 % CI 16.2–16.9 g/kg). Nets older than 4 years had a permethrin content below the WHO recommended concentration for brand-new nets. Thus mosquitoes that enter houses, are being continuously exposed to pyrethroids on the surface of nets throughout the year. A short-term reaction, in relation to bed nets, has been to introduce a combination net with the synergist piperonyl butoxide added to pyrethroid treated nets to counteract the resistance.

The Innovative Vector Control Consortium (IVCC) at Liverpool highlighted the threat to controlling malaria due to resistance and was able to get funding to help manufacturers to seek new insecticides suitable for vector control. Some new insecticides may be available, but commercial approval

Fig. 1 Division of Zimbabwe into 3 zones for Acaricide rotation scheme.

*Emeritus Professor, IPARC, Imperial College, London

Fig. 2 A long lasting Insecticide treated bed net.

takes time. What happens when a new molecule enters the market? The experience in the past has been to recommend its use for all kinds of insect pests, but widespread use of one mode of action inevitably recycles the resistance problem. Ideally, a resistance management policy is needed and in the vector control situation, there is a need to develop, in each country or region, a system similar to the acaricide rotation scheme. This will need to take account of the rainfall patterns and altitude that affect the distribution of *Anopheles* spp. within the country. In areas with a single rainfall season, the rotation of insecticides for indoor residual spraying may be an annual or biennial event for the whole country, although with a division between the north and south of a country such as Malawi, insecticides with two modes of action might be rotated within a country.

In countries nearer the equator, where rainfall can occur during most months during the year and where malaria is a more constant problem, an annual rotation approach may be more appropriate. The important factor is to avoid applying one insecticide continuously, until resistance is detected. Reliance on one control tactic should also be avoided, by adopting an integrated vector management programme in which non-chemical methods, such as drainage and improved housing with screens on doors and windows, should be actively recommended.

Controlling *Anopheles* larvae has not been widely adopted due to the diversity of places where different species can breed. Nevertheless, treatment of areas of permanent water, such as ponds and irrigated land, is possible with a greater range of insecticides, including *Bacillus thuringiensis isrealensis* (Bti). Further consideration should be given to sequential space sprays in urban areas, especially where poor quality housing limits the effectiveness of IRS. Area-wide space treatments using a cold fog, apply low doses which are not persistent, and so exert less pressure on selection for resistance. In the USA, aerial application of adulticides, utilising small droplets as in cold fogs, allows for rapid treatment of large areas and with sequential treatments, can decrease a mosquito population at the start of the wet season.

As an alternative to rotation of insecticide, some have advocated using a mixture of two insecticides with different modes of action. However with this approach, it is likely that some selection for resistance is operating and resistance to both components of the mixture could occur.

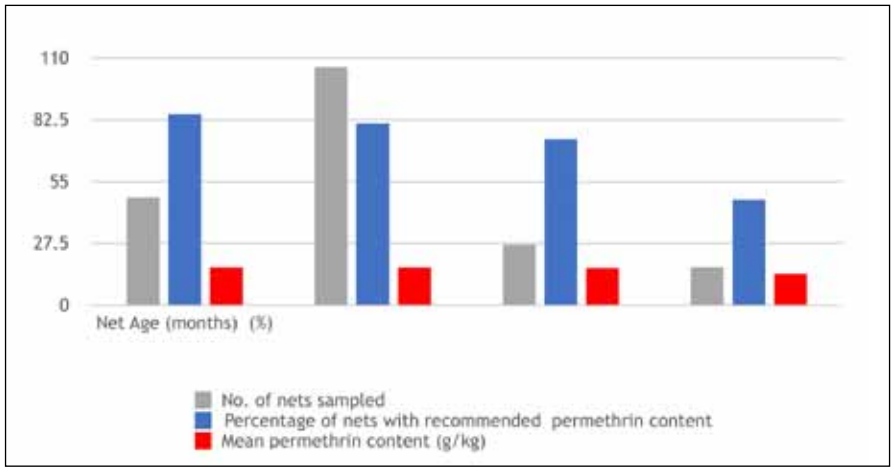

Fig.3 Assessment of pyrethroid (permethrin) content on LLITNs. (from Massue et al., 2016)

References

Duncombe, W.C. (1973) The acaricide spray rotation for cotton. *Rhod. Agric. J.* 70, 115-18.

Massue, D.J., Moore, S.J. Magen, Z.D. Moore, J.D. et al. (2016) Durability of Olyset campaign nets distributed between 2009 and 2011 in eight districts of Tanzania. *Malaria J.* 15:176

Ranson, H., N'Guessan, R., Lines, J., Moiroux, N., Zinga Nkuni, Z. and Corbel, V. (2011) Pyrethroid resistance in African anopheline mosquitoes: what are the implications for malaria control? *Trends in Parasitology*, 27, 91–98.

Ranson, H. and Lissende, N. (2016) Insecticide Resistance in African Anopheles Mosquitoes: A Worsening Situation that Needs Urgent Action to Maintain Malaria Control. *Trends in Parasitology*, 32, 187-196.

Tibugari, H., Mandumbu, R., Jowah, P. and Karavina, C. (2012) Farmer knowledge, attitude and practice on cotton (Gossypium hirsutum L.) pest resistance management strategies in Zimbabwe. *Archives of Phytopathology and Plant Protection* 45:20 2395-2405

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What is resistance (and why does it matter?)

Nic Blaszkowicz*

Alex Wade, Technical Manager at PelGar International in the rodent pens at Church Farm where PelGar undertakes formulation development work and behavioural study.

In the 1920's, cattle farmers in Alberta, Wisconsin started to lose cattle to minor routine procedures like castrations and dehorning. These normally simple procedures were frequently ending in the death of the animal through major haemorrhaging. It turned out that the sweet-clover feed, that the animals had been eating, had been naturally producing a chemical called dicoumarol, as it began to rot. It wasn't until a decade later however, that anyone attributed the animal feed to the unexplained deaths in the animals and it was not until 1939 when it was fully understood which molecule was responsible for the reduction in clotting factors. By the 1940's, dicoumarol had been fully isolated and synthesised and the more potent synthetic version had been named warfarin (after the institute which undertook the work, the Wisconsin Alumni Research Foundation).

By the late 1940's, warfarin was being widely used as an oral rat poison. It was used to great success for a decade, until the first reported instances of resistances in brown rats in 1958 (Boyle, 1960) and then subsequently in mice (Dodsworth, 1961). With the onset of resistance to warfarin growing rapidly (Müller, C.R. & Rost, S., 2011), a flurry of research was undertaken to find a replacement. Initially research was led by screening a catalogue of chemicals which had been rejected by the pharmaceutical industry for their toxic properties. This process proved to be costly and overly time-consuming, with only a few active compounds making it to field trials – notably norbormide and parachlorphenyl silatrane. Neither of these proved to be promising replacements.

Instead, a revision of the original, anticoagulant compounds was undertaken by Hadler and Shadbolt. They looked at the resistance mechanisms and what was understood about the coagulation theory at the time and set about to create a molecule specific to the task. What they succeeded in creating was the hydroxycoumarin-based anticoagulants, the first of which was called difenacoum. As with the first generation anticoagulants, widespread use lead to history repeating itself with resistance loci starting to appear in populations of brown rats.

What is resistance?

Resistance as we know it, is a largely misunderstood concept. So often it is used interchangeably in conversation with words such as tolerance and immunity. In reality all three words mean very specific and very different things. Resistance, as far as we are concerned, was best defined by Greaves who said;

> "*Anticoagulant resistance is a major loss of efficacy in practical conditions where the anticoagulant has been applied correctly, the loss in efficacy being due to the presence of a strain of rodent with a heritable and commensurately reduced sensitivity to the anticoagulant.*" (Greaves 1994)

Resistance therefore is the measure of difficulty that a chemical or strategy has at controlling a specific pest population, with the key term, in Greave's definition, being 'in practical conditions'. Often what is recorded in the laboratory is only an indicator of what occurs under the more dynamic conditions of fieldwork. This can be for many reasons, but primarily because resistance can come in many guises; behavioural, biochemical and genetic, all of which will confer varying degrees of protection to the target population from treatment.

Behavioural resistance is where an animal alters its behaviour, and in doing so increases the likelihood of its survival when faced with a certain treatment or situation. Aversion to bait formulations and other equipment is the most common form of behavioural resistance. A classic example of this is found in the behaviour of mice in Birmingham. Populations of mice have become averse to carbohydrate rich foods, leading to near total bait aversion of conventional formulations.

Biochemical resistance is where an animal's metabolic pathways detoxify and remove poisons at a rate fast enough, to allow them to survive what would normally be considered a lethal dose. Biochemical variations, in the presence and abundance of these detoxifying elements, are what is largely responsible for the variation in the amount of bait required to achieve a lethal response between different sexes within the same species (Sébastien Lefebvre, et al., 2016). Although the instances where this form of resistance becomes of practical impact in the anticoagulant roden-

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ticides is rare, it has been observed with other active compounds used for rodent control, both in the past and present.

Genetic resistance is by far the most prevalent of the three forms of resistance seen today. In rats, it allows for the greatest degree of protection from the bait formulations commonly used. Both first and second generation anticoagulants work by binding to and subsequently inhibiting, the function of the Vitamin K epoxide reductase enzyme (Müller, C.R. & Rost, S., 2011). This inhibition effectively breaks the Vitamin K cycle, denying the animal the ability to produce chemicals which are (amongst other processes) essential to the clotting of blood. The effectiveness of a molecule to inhibit this enzyme, is directly linked to the strength with which it binds to it. With genetic resistance, the coding responsible for the enzyme alters slightly, not so much that the change causes the enzyme to cease functioning entirely, but enough so that the binding site for the anticoagulant becomes altered or obscured. This alteration to the structure of the enzyme reduces the binding affinity of the anticoagulant to the enzyme and with this loss in sensitivity comes a loss in efficacy.

How does effecting one gene cause so much trouble?

In the simplest terms, genes code for proteins. More specifically genes code for strings of amino acids in a very specific order. Under normal circumstances a gene will provide the template for a string of amino acids which, when exposed to certain conditions, will fold itself from a string into a complex three dimensional shape, a protein. Some of these proteins are structural and many others like enzymes are functional in the biochemical processes of the cell. Sometimes the genetic code, which corresponds to a specific protein, becomes damaged, with certain amino acids missing, replaced or their order altered. Each of these changes is known as a mutation and each mutation has the capacity to drastically alter the shape of the protein it codes for. If a mutation has a severe effect on the structure of the protein it is coding for, the shape may be altered so dramatically that it may not function at all, causing the mutation to become lethal. When a mutation occurs that alters the shape of the protein enough to reduce the binding of poisons to it – but not so much that it ceases to function altogether – then resistance occurs.

So far, there have been multiple individual gene mutations which are shown to confer resistance to the second generation anticoagulants in rats, many of which are known to cause practical resistance in the field. Despite the vast geographical areas where these genes are found, it is interesting to note that the genes which confer resistance tend to move in 'pockets' which is indicative of the rodents' population dynamics. This means that resistances, although found over a wide area, might be dramatically different between neighbouring farms. With one farm showing high levels of resistance whilst a neighbouring farm shows no specific resistance at all.

Resistances usually come at a price. Deviating from a gene type which has been selected and refined over thousands of generations usually comes with a loss in efficacy. In some populations of bromadiolone resistant rats for example, there is a higher requirement for dietary Vitamin K in order to reproduce effectively (J. Jacob, et al., n.d.). Other issues, such as retardation to growth and even a reduction in survival, means that resistance to rodenticides is often only any use to a population whilst they are under selective pressure from that rodenticide.

How does this affect us?

As rodenticide resistance increases, rodents need to consume more of a certain bait type before they succumb to the treatment. In some extreme cases, the amount of bait required to kill that population will be practically unfeasible inside a workable timeframe. The lack of mixing between populations at larger geographical scales, revealed in a study by Mohd and Haniza, is likely to intensify the effect of local selection pressure imposed by sustained anticoagulant use. Reversing these processes is therefore likely to be slow and difficult to achieve (Mohd Z.H. Haniza, et al., 2015). At this point it will be necessary to modify the strategy in order to circumvent the resistance.

In conclusion, there is evidence of resistance of varying degrees around the globe. The resistance to a specific rodenticide is proportional to the efficiency with which is binds to the VKOR enzyme. As the sensitivity of the enzyme to the specific anticoagulant molecule reduces, the amount of bait required to achieve a lethal effect increases. When the level of bait needed to elicit a lethal effect increases beyond a certain level it will become economically and technically more effective to swap over to an alternative active ingredient. In the rare instance that the resistance is applicable to both difenacoum and bromadiolone, then an escalation to brodifacoum, flocoumafen or difethialone should be considered - there is as yet no documented resistance to these molecules.

References

Boyle, C., 1960. Case of Apparent Resistance of Rattus norvegicus Berkenhout to Anticoagulant Poisons. *Nature*, Issue 188, p. 517.

Endepols, S. Klemann, N. Song & Y. Kohn, M.H, 2011. Field trials to assess resistance to warfarin and difenacoum of house mice in relation to the occurrence of variants in the vkorc1-gene before and after the treatments. 8th *European Vertebrate Pest Management Conference*, pp. 70-71.

J. Jacob, et al., n.d. VITAMIN K REQUIREMENT AND REPRODUCTION IN BROMADIOLONE RESISTANT NORWAY RATS. *Pest Management Science*, Volume 68, pp. 378-385.

Mohd Z.H. Haniza, et al., 2015. Large-scale structure of brown rat (Rattus norvegicus) populations in England: effects on rodenticide resistance. PeerJ.

Müller, C.R. & Rost, S., 2011. VKOR and anticoagulant resistance – mutations, models and mechanisms. s.l., s.n.

Sébastien Lefebvre, et al., 2016. Origin of the gender differences of the natural resistance to antivitamin K anticoagulants in rats. *Toxicology*.

Fogging water-based fogging mixtures with thermal foggers

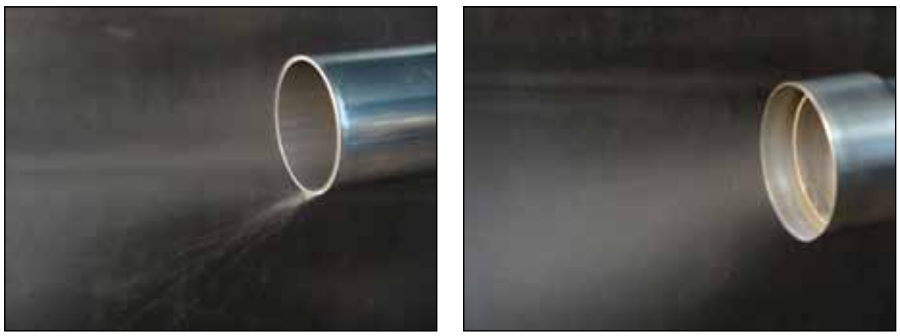
In recent years, as is the case in agriculture, more and more water-based chemical preparations are available for vector and pest control and other public health disinfection measures. Swingfog machines, equipped with the patented high performance fogging tube, now permit a fast and efficient application of water-based fogging mixtures at high flow rates, not only in agriculture but also for vector and pest control measures. This advanced technology saves on costly carriers like diesel oil or kerosene and moreover avoids environmental pollution caused by oily carriers. In indoor pest control activities, water based chemicals are especially favourable because the inhabitants do not have to clean up after the application, in order to remove the oily residuals that leave a film on every surface, which leads to a much higher acceptance of the application.

All thermal fog generators were originally developed for the application of oil-based fogging mixtures and were mainly used for vector and pest control measures. When oil-based fogging mixtures are used with thermal foggers, a good droplet spectrum of droplets between 0 and 40 µm is achieved. 80 to 90 % of the droplets are in the range of 10 to 25 µm and fulfil the requirements of the World Health Organization specifying a VMD (Volume Median Diameter) of less than 30 µm.

In agricultural pest control measures, almost all chemical preparations are water-based and the chemical has to be mixed with water. Because of the high surface tension of water, it is not possible to achieve a similar good droplet spectrum at reasonable high flow rates with these fogging mixtures, unless a considerable portion of special carriers is added.

Using water-based fogging mixtures at high flow rates and without adding special carriers, all brands of thermal foggers produce a wide droplet spectrum and a high number of bigger droplets that fall down in front of the machines, resulting in a puddle of fogging liquid. That results in a considerable amount of the chemical preparation not reaching the target, causing pollution and a waste of expensive chemicals. Furthermore, this loss leads to an under dosage of the chemicals used which helps building up resistances.

With its patented, high-performance fogging tube which is available for all their machines, Swingtec has solved this problem. Using a high performance fogging tube and without adding special carriers, the Swingfog SN 50 allows the application of water-based fogging mixtures with flow rates of up to 32 litres per hour and with Swingfog SN 81 and SN 101 machines up to 62 respectively 67 litres per hour. The droplet spectrum generated is comparable with the droplet spectrum of oil-based fogging mixtures with no large droplets are falling down in front of the machine.



Using water-based fogging mixtures at high flow rates and without adding special carriers, all brands of thermal foggers produce a wide droplet spectrum and a high number of bigger droplets that fall down in front of the machines (left). The addition of a new high-performance fogging tube from Swingtec solves this problem (right) producing a droplet spectrum comparable with oil-based fogging mixtures.

Comparing Blacklight and Blacklight Blue Bulbs

There is a belief within the US pest control community that using an insect light trap fitted with a mixture of regular and Woods glass coated bulbs (referred to as "blacklight" and "blacklight blue" respectively) catches more "night flying insects" (nocturnal flying insects) when the trap is visible from the building exterior. While these insects are not normally considered structural pests, they may enter structures through loading bay doors and other entrance ways in use at night, and are a potential contaminant for food manufacturers and food service providers.

This study was designed to concurrently capture night flying insects using three identical, two-tube insect light traps, each fitted with a different mix of bulb types:

- one with two regular uncoated ("blacklight") bulbs
- one with one regular uncoated ("blacklight") bulb and one coated ("blacklight blue") bulb
- one with two coated ("blacklight blue") bulbs

A comparison of the number and insect type distribution could then qualify the use of mixed bulbs for this purpose.

Procedure

Three new insect light traps (standard model Brandenburg Genus® Fli) were installed with 6 feet separation in a covered outdoor storage location, comprising three sheet metal walls and open on the fourth side (although protected by a chain link fence). The exposure to full sunlight should seriously reduce the potential for these traps to attract daytime flying insects.

Each trap was fitted with two 15 watt Brandenburg Electrosect bulbs, either standard, Woods glass coated, or a mixture of the two as outlined above. The traps were each fitted with a white standard Brandenburg Universal glue board, and turned on for approximately 24 hours. At the end of the exposure period the glue boards were collected and analyzed for capture count and insect type distribution.

The exposure was replicated nine times, with the bulb distribution rotat-

ed between the different light traps to eliminate positional influence (a total of three exposures for each bulb combination at each trap location). The trial ran from August through September 2015, and was located in northern Florida.

"Blacklight" (BL) or "Blacklight Blue" (BLB)?

All fluorescent bulbs work in essentially the same way, using a mixture of powdered phosphors that coat the inside of the tube to generate the light. Changing the phosphor mix alters the light frequencies produced and the apparent "colour" of the light output.

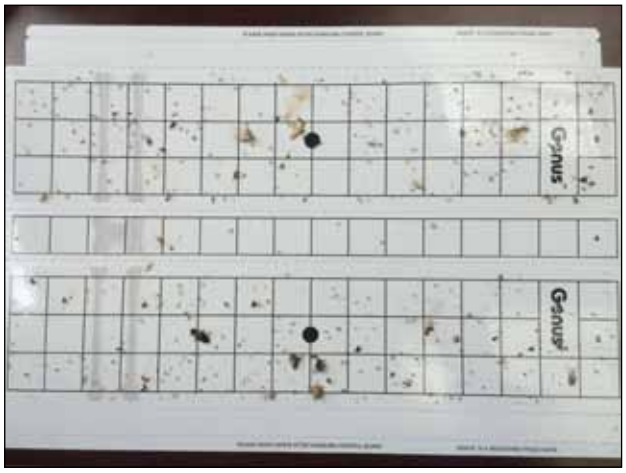
The fluorescent bulbs used in insect light traps use a phosphor mix that produces light mostly in the ultraviolet range, a wavelength just shorter than the visible range for humans (the colour violet is the shortest light wavelength people can see). This is because most of the flying pest insects see best in this light range, and so these bulbs appear "brighter" to them. These bulbs do produce some visible light, which makes most of them look pale blue to humans.

Some end users of insect light traps want to make them as inconspicuous as possible - they don't wish to remind their customers about flies. To reduce the visibility of insect light traps for these situations, the insect light trap bulbs can be coated with a special filter glass that blocks the visible light but allows the UV light that is attractive to insects to pass through. This filter glass was invented by Robert Wood, an American physicist working on secret communication using light during the first World War. Woods glass is a deep violet-blue colour, and insect light trap tubes coated with it produce almost no visible reminder that the trap is operating.

Results

The number of insects captured over the 24-hour period averaged 760 per glue board, with a high count of 1,696 and a low count of 276. The captured insects were sorted by orders, with a total of seven insect orders represented. (Table 1) The distribution of insect orders by bulb type was analyzed statistically. No statistical difference was found.

The total insect captures by bulb type was also analyzed statistically and, despite the numbers seeming to show a slight preference for the mixed bulb type configuration, no statistical difference was found. (Table 2)



Typical Brandenburg Universal Glue Board Result

Table 1: Distribution of captured insects by order.

Insect Order	Total Capture	%
Coleoptera (Beetles)	400	2.2
Diptera (True Flies)	12,436	68.2
Homoptera (Plant Hoppers)	2,468	3.5
Hemiptera (True Bugs)	132	0.7
Hymenoptera (Ants, Bees and Wasps)	1,928	10.6
Isoptera (Termites)	4	0.02
Lepidoptera (Moths and Butterflies)	856	4.7

Table 2: Distribution of captured insects by bulb configuration.

Bulb Configuration	Two BL	One BL + One BLB	Two BLB
Capture Count	6,116	6,744	5,364

Conclusion

The colours of light produced by these bulbs is identical, with the coating on the BLB bulbs just removing some of the visible portions of the light that is released. This has been shown to make no difference to the capture rate of common Houseflies (*Musca domestica*), which seem to find the visible part of the light output uninteresting. Tests with other species of filth flies such as Green and Blue Bottle flies (*Calliphora* and *Lucilia species*) have shown some statistical preferences for attraction to the BL bulbs over the BLB bulbs (*Brandenburg unpublished*), so there may be some flying insects that find the BLB bulbs more attractive than the BL bulbs. However, at least in the vicinity where the test was performed, the results suggest that there is no capture advantage in using either bulbs, on their own or in combination, for nocturnal flying insects.

Acknowledgements

Statistical analysis performed by I2L Research, an independent ORETO and GPL certified, and GEP registered research facility.

Brandenburg would like to express our many thanks to the staff of McCall Service, and specifically John Cooksey, who implemented the trial and provided data gathering and captured insect counts.

Hassle-Free rodent control for professional pest control

Jelle Appelman

The pest control industry is undergoing one of its biggest legislative changes in decades, and product choice looks like being more important than ever. In the UK, for example, legislation is being phased in which will effectively mean that only professional pest controllers who hold an approved CRRU training certificate can purchase or use products that contain rodenticides. In addition to this requirement for pest technicians to demonstrate 'proof of competence', the proposed new stewardship regime signifies a big change for many product suppliers whose formulations and labelling could be dramatically affected.

However, one successful rodent management product unaffected by changes in the UK and already established as a key tool in many European pest technicians' armoury is MouseStop, an animal friendly pest control paste developed in 1990. Successful established in the market for over 25 years, the product offers a highly effective proofing solution that is completely free from any biocides or pesticides. Its popularity can be attributed to a number of factors. Firstly, it is a proven pest control solution that is both animal-friendly and easy to install. Supplied in 300ml cartridges, the product effectively seals seams, cracks, joints and holes to prevent rodents and other small pests from entering a building. Once installed, the 'paste' develops a hard outer layer that is instantly waterproof, but it also has a soft, sticky inner core that blocks vermin if they try to gnaw at it. The formulation is compatible with many surfaces and because it can be applied using a standard mastic caulking gun, it is ideal for areas which are typically hard to reach. What is more, the performance is unaffected by extremes of temperature and the product can even be overpainted to match adjacent areas once the outer skin has hardened.

By sealing access areas such as cracks, joints, seams and holes, no rodent or pest will gain access.

Gaps should be filled with a layer of paste at least 10mm deep.

The versatility and flexibility of the paste makes it ideal for use in a wide range of locations. It can be effectively incorporated into both new and existing buildings and provides long-lasting protection in even the most demanding environments.

In addition to the standard product, there is also a new premium version that is reinforced with a mix of metal fibres. This helps provide an even more secure, impervious structure with the added benefit of making the product metal detectable. As a result, the enhanced product is particularly well suited to hygiene sensitive areas, such as food manufacturing and preparation facilities, where there is a requirement for all products used within the building, to be detectable. In this case, if a rodent were to gnaw a piece of the metal fibre reinforced product and subsequently enter the production process, the foreign object can be easily detected and rejected by metal detectors, avoiding any costly contamination.

The paste also blends in perfectly where an integrated pest management strategy (IPM) is being adopted. In particular, the premium's environmentally-friendly formulation contains natural herbs that provide a 'cleaner' chemical-free odour. This makes it an attractive option for indoor use, specifically because rodents have been shown to actively avoid alternative 'baiting' systems where certain chemicals or odours are present. As a result, MouseStop is an extremely effective proofing option that enables the user to humanely manage the problem of pests without having to resort to the use of chemicals.

Effective rodent control, in and around our buildings, continues to be critically important. However, the new UK legislation on rodenticides could be seen as somewhat of a game changer, as it now adds extra responsibility and potential costs onto the shoulders of the pest technician. When you add the fact that more and more building owners are demanding solutions that effectively manage pest problems in a safe, chemical-free way, the MouseStop product range has never been more attractive to today's pest control professionals.

■ For further information, please contact Jelle Appelman, iPest Control BV, info@ipestcontrol.com or visit www.mousestop.com.

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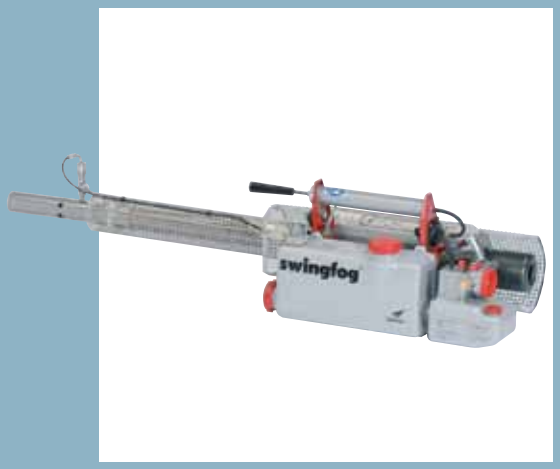

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Pest control industry meets at 13th Jornadas Tecnicas in Argentina

Among the speakers over the two days were Mirko Baraga (cleaning Control de Plagas), Alain van Lidth de Jeude (Rentokil-Initial), Milagros Fernandez De Lezeta (ANECPLA), Rodrigo González Llanos (Chemotecnica), Benjamin Gomez Guerrero (Econtrol)) and Roberto Sanchez (Rentokil Initial).

The annual Jornadas Tecnicas de Chemotecnica Argentina were again held successfully over two days (10th & 11th May) and welcomed 1,000 people to the facilities of the Catholic University of Argentina in Puerto Madero, Buenos Aires, Argentina. Most delegates came from Argentina, but visitors also travelled from Bolivia, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay and from Spain.

For the last 13 years, the technical conference has become a must attend for companies involved in urban pest control (PMPs) in Argentina and from all across Latin America. The quality of national and international speakers is one of its highlights.

With a complex and crammed agenda, several sessions were held in parallel, complementing the main technical programme that forms the backbone of the Jornadas. One of these activities, reflecting issues that are currently most central to health issues faced in Central and South America, was the International Conference on Dengue, Chikungunya and Zika, entitled 'Challenges in the control of Aedes aegypti', organized by the Fundacion Mundo Sano and attended by over 150 people. This special meeting was attended by Argentine government officials and representatives from Paraguay and areas affected by epidemics caused by Aedes aegypti. This special session was also attended by researchers and private sector pest control members.

Reflecting the theme from last years' NPMA-CEPA joint Global Summit Conference, the Argentine meeting also ran a workshop on IPM in the Food Industry to help improve specialization and professionalism in this sector.

Finally, the event included a symposium on developing industry associations in Latin America. General Director of ANECPLA Spain, Milagros Fernandez De Lezeta, explained the path followed by ANECPLA from its formation to its current situation, to lead the sector of Pest Control in Spain and Europe; while Alain van Lidth de Jeude, in the name of CEPA, gave a presentation, on how last year the pest management industry launched the CEN standard (EN 16636) for use across Europe and how this is now being rolled out under the CEPA Certified verification scheme. The Symposium was attended by colleagues PMPs from Uruguay, Chile, Peru, Mexico, Bolivia, Colombia and Argentina. Milagros also addressed pest management professionals to convince them on the advantages of participating in associations, certainly a presentation that is hoped will generate the growth of these Associations in the coming years.

Chemotecnica S.A., is a company that leads the industry of pest control in Argentina. It markets its products in more than 13 countries of Latin America and is proud to focus its activities on the professionalization of the sector with the ultimate goal of protecting public health and maintaining a high quality of life.

■ A video of the event is available at http://bit.ly/29GPCX8.

Wave if you can see me at the back 1,000 people attended the 13th Jornadas Tecnicas de Chemotecnica held at the Catholic University of Argentina, Puerto Madero, Buenos Aires, Argentina.

Ted Granovsky of Granovsky Associates, Inc., took to the platform three times over the course of the 3 days.

Formerly of Univar Mexico, Benjamin Gomez Guerrero, now of Econtrol considered the evolution of pest management worldwide and provided guidelines on how to generate growth in Latin America and Argentina.

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Innovations in insect baiting and its role in reducing insecticide load in urban pest control

Partho Dhang*

Innovation has influenced the pest management industry and over time, new discoveries in insect science, combined with inventions in tools and technologies, have improved the outcome of pest control. Innovation has also increased the safety of applicators and unsuspecting subjects who are closely involved in a pest control act. Also, innovation has led to reduced use of pesticides in the environment, which has far reaching consequences in urban locations.

Insecticide bait is one significant innovation which has changed how pest control jobs are now undertaken. Baits have provided a rational solution to urban health by controlling cryptic pests dwelling indoors and allowed treatment to inaccessible and sensitive areas. In addition, baits offer no odour, no translocation and no staining potential, which are the concerns of householders. Baits also leave lower or no residues. Furthermore, baiting is most suitable for treating sensitive locations where there is a high-density human population. However, the most significant aspect of insect baiting is its dramatic reduction of insecticide use within the vicinity of human occupation and a sustainable future (Dhang, 2015).

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History of insect baits

Modern food-based baits for large scale commercial use against insect pest, are little more than a decade old in development. This development was made possible because of advances in research on insect feeding behaviour and identification of various food chemicals and feeding stimulants. In the past, the process of bait preparation depended on mixing insecticide with a regular food or a food base. These were easy to develop and the earliest record of this bait can be found in the mid 19th century. Phosphorus, borax, boric acid and sodium fluoride were regularly used in baits in pest control (Mallis, 1969). A poisonous bait, using arsenic as the active ingredient in a matrix, was made available for controlling termites in 1921, in Australia (Lenz and Evans, 2002). The usefulness of baiting termites was again documented in the early 1930s, where straw dipped in a sugar and sodium arsenite solution was found effective against harvester termites (Kofoid, 1934). Another public use of bait for the control of termites, was the use of dechlorane (mirex) based bait. Mirex treated wooden blocks were used as baits for termite control in USA. The slower acting nature of mirex helped the process (Esenther and Beal, 1974).

The first large scale commercial use of baiting was possibly undertaken for the control of Mediterranean fruit fly in 1950s. Insecticide was mixed with protein hydrolysate as the attractant or food bait in Hawaii (Berenbaum, 1995). Modifications of this technique are still used for the control of fruit flies around the world. In 1957, U.S. Congress initiated a cooperative program aimed at eradicating fire ants in 126 million acres over a 12 year period. Various baits such as Kepone formulated with peanut butter bait and later mirex incorporated in soy corncob grit mixture were developed in 1960s and was widely used in the fire ant control program (Berenbaum, 1995). This was followed by the discovery and subsequent use of hydramethylnon in a food bait for cockroach and ant control in the 90s, opening up for more products to be developed.

Research on food stimulants, feeding stimulants and identification of suitable matrices in later years, helped commercialize more refined and sophisticated bait formulations. These formulations could be produced in large scale and helped transform insect baiting as part of integrated pest management (IPM). The field of baiting for insect pests was further helped by the discovery of insecticidal compounds which were not contact poisons. These were slow poisons, working purely as growth and metabolic regulators when ingested. The compounds were found suitable for bait development as indicated by their higher efficiency to cause mortality. In the 1990's, the commercial development of baits took a new dimension, that became a key component of IPM programs on a world-wide scale.

As social insects, ants and other hymenoptera lend themselves to control by baits, where the toxicant is taken back to the nest.

Baits for urban pests

The development of commercial baits for household pests had a serious boost for a number of reasons, such as increase in failure to control specific pests, unscrupulous chemical use and unavailability of new molecules. This combined well with public intent to reduce insecticide usage in urban areas. The effects of certain insecticides on human health and environment were coming to light, thanks to research

Baiting is most suitable for treating sensitive outdoor locations

advances in the field of analytical chemistry. Baits were found acceptable, as they limit the actual amount of insecticide usage, allow active ingredients of low mammalian toxicity to be effectively used, are target specific and easy to use. These made baits aesthetically acceptable to the public.

The major reason however for the shift and acceptance of baits was the detection of insect resistance, particularly in German cockroaches, against most contact insecticides. Furthermore, the withdrawal of persistent organochlorine compounds as barrier treatments against termites and the emergence of structural pest ants as difficult to control by conventional sprays, made baits popular. Baits suitably controlled large population of German cockroaches, ants and termites that are mostly cryptic in nature. A baiting approach was recognized as the best delivery system for these pest populations, since these insects continue to disperse the toxicant due to various elements of their social behaviours.

Horizontal transfer of baits toxicant

Baits developed for insect pests have not only been effective in killing the insect directly through ingestion, but also showed a killing effect on individuals which did not ingest the bait directly. The process termed "transfer effect or secondary effect" further enhanced the efficacy of the bait against insects which are social or live in groups. This transfer effect is best demonstrated in cockroaches, ants and termites because all these insect groups exhibit trophollaxis or proctodeal feeding. Termites and young development stages of cockroaches have an ethological similarity which may be the basis for many common behaviours such as proctodeal feeding. Similarly, termites and ants share the characteristic eusocial behaviour because they live in an organized society. To a greater extent, bait development has utilized these strong behavioural similarities to be effective.

Bait transfer in the German cockroach

Cockroaches have shown horizontal transfer of insecticides contained in baits (Kopanic and Schal 1997; Buczkowski and Schal 2001; Buczkowski et al, 2001). This horizontal transfer in cockroaches usually involves dead or dying donors or simply excretions left behind by the donors (Buczkowsk et. al, 2008). The process of secondary kill takes effect due the presence of unmetabolized, slow acting insecticide in the bait formulation, in the faeces, or oral secretions or it may simply remain in the body of the dead cockroaches. By the process of coprophagy and necrophagy, the insecticide is distributed within the infested location and brings about secondary kills. Transfer effects or secondary kill, increases the overall control efficacy of the bait; however, the efficiency of the secondary kill can be dependent on the active ingredient and other influencing factors such as developmental stage, strain and donor/recipient ratio (Wang et al, 2008).

Emetophagy, the ingestion of insect regurgitate, may also constitute an important mechanism by which fast-acting insecticides could be disseminated within a cockroach population (Buczwoski and Schal, 2001). Regurgitation in cockroaches coincided with the onset of paralytic symptoms after ingestion of fipronil bait. 4.5% of the ingested fipronil was recovered from the outer surface of adult cockroaches and of this >74% was regurgitated from the oral region during the first 12 hours. The remaining fipronil was excreted from the anal region for up to 48 hours. A time-lapse video analysis showed that first instars were highly attracted to these excretions and imbibed the liquid exudates.

Bait Transfer in Social Insects

Ants and termites have evolved as major structural pests in recent times all around the world. Managing social insects proved to be easier by baits, to suppress and eliminate the colony providing a long term solution.

Trophallaxis or exchange of liquid food between members of a colony is extremely well developed among social insects such as ants and termites (Wilson, 1975). In higher myrmecioid subfamilies such as Dolichoderinae and Formicinae, the exchange of food is frequent and prevalent enough to result in a fairly even distribution throughout the worker force of the colony (Wilson, 1975). In lower groups of termites, belonging to families Rhinotemitidae and Kalotermitidae, the members of the family feed one another by both "stomodeal food" (food originating from salivary glands) and "proctodeal food" (food originated from hindgut). Higher termites however do not demonstrate proctodeal food transfer (Wilson1975).

Studies have been published on the successful transfer of bait toxicant in the field to control ant populations (Collins and Callcott, 1998; Banks et al., 1992; Green and O'Dowd, 2009) and in termites (Su, 1994; Forschler, 1996; Peters and Fitzgerald, 2003; Peters et al., 2008). Bait transfer is also evident in higher groups of termite such as Macrotermes gilvus, an emerging pest in S E Asia (Dhang, 2011).

Advantage of baits in pest management

Baits have been integrated in modern IPM to effectively manage urban pests. Conventional insecticides are not often effective in managing structural pests such as ants and termites, because the disturbed colony frequently move out of the treated zone. Baits have provided a rational solution for such hard-to-control pests, treating inaccessible areas and saving cost. In addition, baits offer no odour, no translocation, and no staining potential (Naffziger, 1993). These also leave lower or no residues. Baits also present a unique opportunity to control populations of pests inside the structure with an exterior treatment (Williams et al., 1999). Furthermore, baiting is most suitable for treating sensitive locations such as high density human populations and close proximity to a fresh water source (Dhang, 2009). However, the most significant aspect of insect baiting is its dramatic reduction of insecticide use. Baiting could possibly replace the application off indoor

Baits can be used to lure flies into traps.

residual sprays against crawling pests. Thus, the full impact of baits on urban pest management is yet to be realized.

Termite bait is viewed as a more environmentally-acceptable alternative to soil termiticide which requires drilling of floors and injection of chemicals into the soil. A number of successful examples of public applications of termite baits in replacing liquid termiticides are available around the world such as in Chile (Smith et al., 2006); USA (Su et al, 2003, Ring et al., 2001), New Zealand, (Ross, 2005), Japan (Tsunoda et al., 2005), Australia and S E Asia (Peters and Broadbent, 2005). Termite baiting allows lower application of insecticides which is a novelty in situations where environmental pollution is a concern.

Conclusion

The innovations in insect baiting has widely integrated itself into modern IPM. It made pest control jobs more inspection driven, friendlier to environment, and precise. Though the technology is restricted to a few pests, it has made significant progress as a tool in urban pest management. Baiting is responsible for bringing about a drastic reduction in the use of toxic chemicals in urban areas and in the vicinity of people. The human component involved in baiting is possibly the single factor against its popularity among pest control practitioners. This could be resolved by training.

References

Banks, W.A., Las, A.S., Adams, C.T. and Lofgren, C.S. (1992) Available at http://afrsweb.usda.gov/sp2UserFiles/Place/66151015/publications/Banks_et_al-1992(M-2559).pdf (accessed on 12 Sept 2010.)

Berenbaum, M.R. (1995) *Bugs in the System, Insects and their Impact on Human Affairs*. Addison-Wesley Publishing Company Inc., USA.

Buczkowski, G. and Schal, C. (2001) Emetophagy. *Pesticide Biochemistry and Physiology* 71, 147–155.

Buczkowski, G., Kopanic, R.J. and Schal, C. (2001) *Journal of Economic Entomology* 94, 1229–1236.

Buczkowski G. Scherer, C.W. and Bennett, G.W (2008) *Journal of Economic Entomology* 101, 894-901.

Collins, H.L. and Callcott, A.M.A. (1998) *Florida Entomologist* 81, 407-415.

Dhang, P (2015) Role of baits in reducing the amount of insecticide in urban environment. CAB Reviews, 10, 003.

Dhang, P (2011). *Proceedings of the 8th conference of the Pacific Rim Termite Research Group,* Bangkok, Thailand, February 2011, pp. 63-67.

Esenther, J.P. and Beal, R.H. (1974) *Journal of Economic Entomology* 71, 604-607.

Forschler, B.T. (1996) *Sociobiology* 28, 459-484.

Green, P.T. and O'Dowd, D. J. (2009) In: Clout, M.N. and Williams, P.A. (eds.) *Invasive Species Management.* Oxford University Press, New York, pp. 153-164.

Kofoid, C.A. (1934) In: Kofoid, C A. (ed,) *Termites and Termite Control*. University of California Press, Berkeley, pp. 463-479.

Kopanic, R.J. Jr. and Schal, C. (1997) *Journal of Economic Entomology* 90, 1073-1079.

Lenz, M. and Evans, T.A. (2002) In: Wildey, K.B. and Robinson, W.H. (eds.) *Proceedings of the 4th International Conference on Urban Pests*, *Charleston, July 2002*, Pocahontas press, Blacksburg, pp.27-36.

Lenz, M., Kard, B., Mauldin, J.K., Evans, T. A., Etheridge, J.L. and Abbey, H. M. (2000) *International Research Group on Wood Preservation IRG/WP/00-10351*, 8.

Mallis, A. (1969) *Handbook of Pest Control: the Behavior, Life History and Control of Household Pests,* 3rd edn. Macnair-Dorland Co., New York.

Naffziger, D.H. (1993) In: Wildey, K.B. and Robinson, W.H. (eds.) *Proceedings of First International Conference on Urban Pests, Cambridge, England, June 1993*, pp. 465.

Peters, B. C. and Broadbent, S. G. (2005) In: Lee, C. Y. and Robinson, W.H. (eds.), *Proceedings of the Fifth International Conference on Urban Pest, Singapore, July 2005*, pp. 229-232.

Peters, B.C. and Fitzgerald, C.J. (2003) *Household and Structural Insects* 96, 1828-1831.

Peters, B.C., Broadbent, S.G. and Dhang, P. (2008) In: Robinson W.H. and Bajomi D. (eds.) *Proceedings of the Sixth International Conference on Urban Pests, Budapest, July 2008, OOK-Press, Budapest* pp. 379-383.

Ring, D.R, Morgan, A.L. and Woodson, W.D. (2001) *Sociobiology* 37, 293-300.

Ross, M.G. (2005) Responding to incursions of Australian subterranean termites in New Zealand. In: Lee, C. Y. and Robinson, W. H. (eds.) *Proceedings of the Fifth International Conference on Urban Pests, Singapore, July 2005*, pp. 233-238.

Su, N.Y. (1994) *Journal of Economic Entomology* 87, 389-397.

Su, N.Y. and Scheffrahn, R.H. (1996) In: Widey, K.B. (ed.) *Proceedings of the Second International Conference on Urban Pests, Edinburg, Scotland July 1996*, pp. 443-447.

Su, N.Y., Zandy, H.S., Ban, P.M. and Scheffrahn, R.H. (2003) *American Entomologist* 49, 20-32.

Tsunoda, K. (2005). In: Lee, C.Y. and Robinson, W.H. (eds.) *Proceedings of the Fifth International Conference on Urban Pests, Singapore, July 2005*, pp. 33-37.

Wang, C., Scharf, M.E. and Benett, G.W. (2004) *Journal of Economic Entomology* 97, 2067-2072.

Wang, C, Yang, X., El-Nour, M.A. and Bennett, G.W. (2008) (eds.) *Proceedings of the sixth International Conference on Urban Pests, Budapest, July 2008,* OOK-Press, Budapest, pp. 153- 159.

Williams, D. F., Brenner, R. J. and Milne, D. (2002) In: Robinson, W. H., Rettich, F. and Rambo, G.W. (eds.) *Proceedings of the Third International Conference on Urban Pests, Charleston, USA* pp. 195-201.

Wilson, E.O. (1975) In: Wilson, E. O. (ed.) Sociobiology, the new synthesis. Belknap Press of Harvard University Press, Cambridge, USA, pp. 206-208.

Building a better mosquito trap

Allison Linn*

Ethan Jackson, a Microsoft researcher who is leading Project Premonition. Photo credit: Brian Smale.

As the hot, humid weather descended on Houston's Harris County this spring, the county's mosquito surveillance team geared up for the busiest season in its fight to get ahead of dangerous mosquito-borne illnesses such as Zika. This year, however, the team had a new weapon in its toolkit: A sleek-looking mosquito trap that experts say marks the biggest innovation in trap technology in decades. "It's really 1,000 times better," said Mustapha Debboun, the director of Harris County Public Health's mosquito control division.

The prototype trap, part of Microsoft's broader Project Premonition research project, is designed to automatically do things entomologists previously had to do manually or not at all. For example, the new trap, which is being deployed in the Houston area for the first time this month as part of a pilot project, is designed to only collect the type of mosquito an entomologist wants to track, instead of a hodgepodge of mosquitoes, flies, moths and other critters that scientists then need to manually sort through.

The trap also can tell researchers what time each mosquito was trapped, as well as what the temperature, wind and humidity was when the mosquito flew in. And it's designed to withstand the rain, wind and other elements that can batter traditional traps and take them out of commission. "We'll have a plethora of data we never had before about the behaviour of the insects," said Ethan Jackson, a Microsoft researcher who is leading Project Premonition.

Debboun and his team at Harris County Public Health expect the traps to provide faster, more accurate information about where they can find the mosquitoes that pose the biggest health risk because they could be spreading diseases such as Dengue fever, chikungunya, West Nile virus, St. Louis encephalitis and Zika. That, in turn, will allow the team to target the areas of the vast county that need it most, saving time and money. "In a county with this size and scope, we don't have the resources to just cover the county and spray, spray, spray," said Les Becker, the deputy director and director of operations for Harris County Public Health. "We've got to figure out how to do it as efficiently as possible."

To gather all this information, the traps are using two small, battery-powered microprocessors, which gather data that can then be wirelessly downloaded and sent to the cloud. They're also relying on the latest advances in a branch

of artificial intelligence called machine learning for insights including the ability to differentiate between the mosquitoes they want to trap and the bugs they don't. For researchers who have been relying on decades-old traps to track 21st-century disease outbreaks, the trap is a huge leap forward.

"For a scientist this a dream come true," said Debboun, who contacted Microsoft and asked if Harris County Public Health could be involved after he heard about it last year. "This is something so new, so innovative, so technologically advanced."

Trying to make a difference

When Jackson and the rest of the research team launched Project Premonition last year, they weren't planning to immediately start tracking a public health issue like Zika. Instead, they expected to embark on a five-year research effort aimed at helping officials spot the next big public health concern before it hits major population centers.

"Project Premonition is designed to spot an outbreak like Zika before it really becomes a problem in the clinic," said Jim Pipas, the Herbert W. and Grace Boyer Chair in Molecular Biology at the University of Pittsburgh and one of the scientists working on Project Premonition. "It's an early warning system."

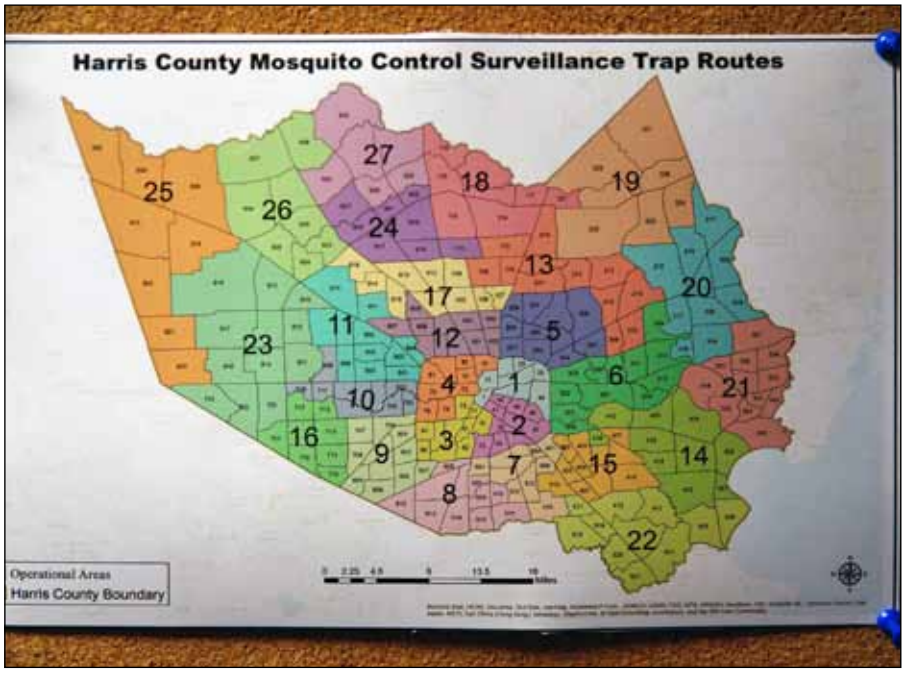
To do that, the researchers plan to first trap mosquitoes — using the new trap – in remote areas outside of big cites. Then, they'll use the latest advances in molecular biology and machine learning to analyze the contents of those mosquitoes for signs that a new and potentially dangerous disease is starting to appear.

The ability to proactively get a jump on fighting an outbreak like Zika before it becomes a major health threat is a huge advantage over the current system. Right now, public health officials are usually reacting to a disease outbreak only once it is so widespread that doctors are already spotting the harmful effects, such as the devastating birth defects currently linked to Zika. The project isn't aimed at curing these types of diseases. Instead, the goal is to stop people from ever getting them by mitigating their spread in the first place.

"This is not going to solve the Zika issue or the Dengue issue or the chikungunya issue," said Douglas Norris, a professor of molecular microbiology and immunology at Johns Hopkins Bloomberg School of Public Health who is working on the project. "But hopefully what this project will do is enhance our ability to detect them."

The development of that early warning system is still on track. But when the Zika virus started spreading, the researchers realized that even at this early stage of the project, their research could help with the more immediate public health threat as well. "Even though we're not ready to deploy, we're trying to see if we can make a difference," Pipas said.

Photo credit: Microsoft



Training traps and tracking Zika

The early versions of the mosquito traps that they are deploying in the Houston area will serve two purposes. They will help entomologists there track mosquitoes that could carry Zika or other harmful diseases right now, while also giving researchers the data they need to start bringing the promise of Project Premonition to life.

The first step is to train the new mosquito traps to do their job better. The system is designed to recognize which mosquito it is supposed to catch based on the flap of the mosquito's wing. But to do that it needs what experts call training data: Lots and lots of examples of mosquitoes and other bugs flying into the traps. That's what they are hoping to collect in Houston. That data can then be used to build an algorithm that uses machine learning to help the trap learn to correctly identify the mosquito it should be capturing, and to not react when other types of mosquitoes, or completely unrelated insects, try to fly into the trap.

Since each mosquito flies into its own individual box, the new traps also can record what time it flew in and environmental factors such as wind, temperature and humidity that were present at the time. That could help scientists understand the specifics of how a virus is spreading, such as what type of mosquito is infecting people and whether those mosquitoes are more likely to feed at night or when temperatures reach a certain point.

"It collects a lot of data that normally we don't get," Norris said. "We can use that to figure out real-world solutions, like that bed nets might work."

Looking for new viruses

Back in the lab, the researchers also can look more closely at each mosquito to figure out what animal it was feeding on and what viruses it is carrying. The researchers are using the mosquitoes they'll capture in Houston this summer as training data for the system designed to spot potential disease outbreaks.

Jonathan Carlson, a senior researcher in the Nature and Computing group at Microsoft Research, said the system they are building is similar to the type of system used to classify web pages. But

instead of figuring out which web pages are about baseball versus football, this system is trying to figure out what viruses these mosquitoes are carrying and whether new or worrisome ones are emerging. The latest advances in both computer science and molecular biology are making it more practical for researchers to cull through the "soup" of mosquitoes and the blood they fed on to figure out what viruses and microbes might be lurking there. "The vast majority of genomes are unknown," Carlson said. "We have to figure out, what's in that soup?"

Next step: Drones

In addition to building better traps and developing analytics models, the Project Premonition team also is working on ways in which drone technology could be used both for the short-term goal of helping track the spread of Zika and other illnesses, and the long-term goal of mitigating the next disease outbreak.

In the short term, the researchers hope to use drones equipped with computer vision technology to look for areas where mosquitoes that could be carrying diseases are congregating. Using drones instead of people could be another way to save time and money.

In the long term, the researchers hope to use drones to transport and place their new mosquito traps in remote areas – instead of hiking several hours each way to do that manually. "It will be a revolutionary increase in efficiency," Pipas said. Back in Harris County, Becker said public health officials are already looking forward to other, longer-term benefits of Project Premonition. For example, some scientists have theorized that birds may be playing a role in the sharp increase in West Nile virus in Harris County, but they haven't had any source of data to really explore that.

The ability to figure out what animal a mosquito was feeding on, based on the Project Premonition data, could allow them to look into that research question. "What the data piece can do is allow us to ask questions that we've never been able to ask before," Becker said.

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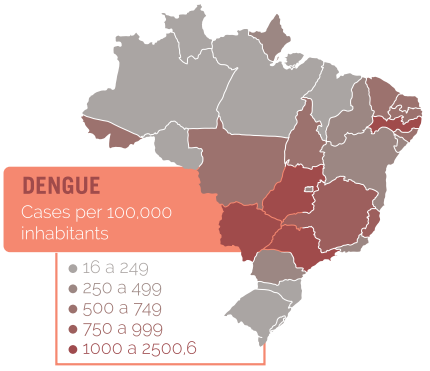
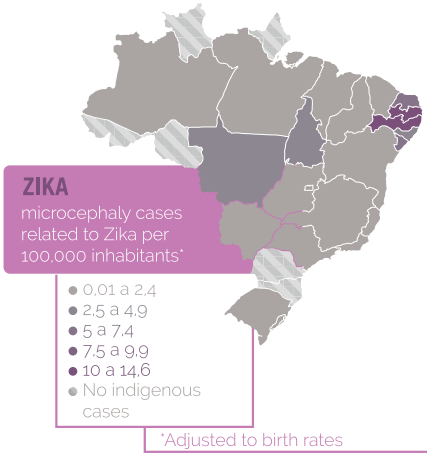
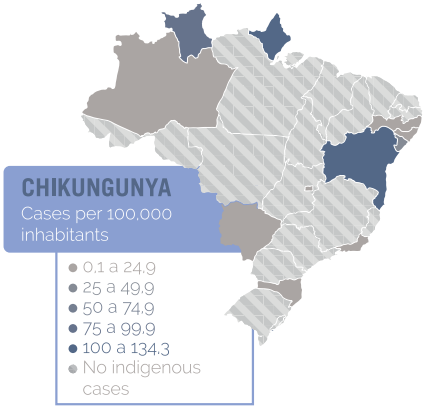
Controlling mosquitoes in Brazil

Fabio (Castle) Castelo*







The Mosquito Control in Brazil to combat the epidemic of disease: DENGUE, ZIKA and CHIKUNGUNYA - From the point of view of a Brazilian entomologist.

Why these diseases are "spread" so fast?

Through travel: Transport means evolved much in the modern world today in less than 8 hours you can cross-large distances between countries of the Americas. In less than 12 hours we managed to reach Europe and with a little more we come to Asia. This facility can easily have two scenarios:

Travellers carrying in their bags, among their belongings or goods infected mosquitoes that were trapped accidentally and who resisted the trip and came to a new area, which initiated the transmission cycle: Mosquito-man-Mosquito.

The other scenario is one or more travellers from transmission regions, who came infected and do not know, because usually these diseases have an incubation period of about 10 days you are infected and still has no symptoms. These people come and infect our mosquitoes, forming the man-mosquito-human transmission cycle.

By blood feeding behaviour (chopped): The long association of Aedes aegypti with the human species seems to have it endowed with certain ability to escape being killed by his victim during blood feeding. If the host produces some movement, even if mild, the female Aedes aegypti promptly leaves him looking for another victim or returning to attack it ceased after the danger of being hit. This peculiarity has great epidemiological importance, because one female Aedes aegypti infected can make several short feeds on different hosts and quickly spread viruses.

Only in Dengue, are known four family virus varieties of (DEN1, DEN2, DEN3, and DEN4). Each virus types with similar formation, but different performance characteristics. The four types have been recorded in Brazil. Also, we have to Zika, the Chikungunya and Mayaro (diseases also been found in Brazil).

Strictly speaking, a vaccine for one type of virus immunization does not give to another. For this reason there is a great difficulty to produce a truly effective vaccine. In case of symptoms or suspicion of these diseases, know that there is no specific cure, treat the symptoms of the disease and moisture are the most used methods. A doctor is essential, and prevent yourself is always the best solution.

Why fight the mosquitoes?

Not yet have an effective vaccine for preventive use against the disease, despite all the research efforts for development and production. While it cannot rely on this measure of control, the only vulnerable link in the epide-

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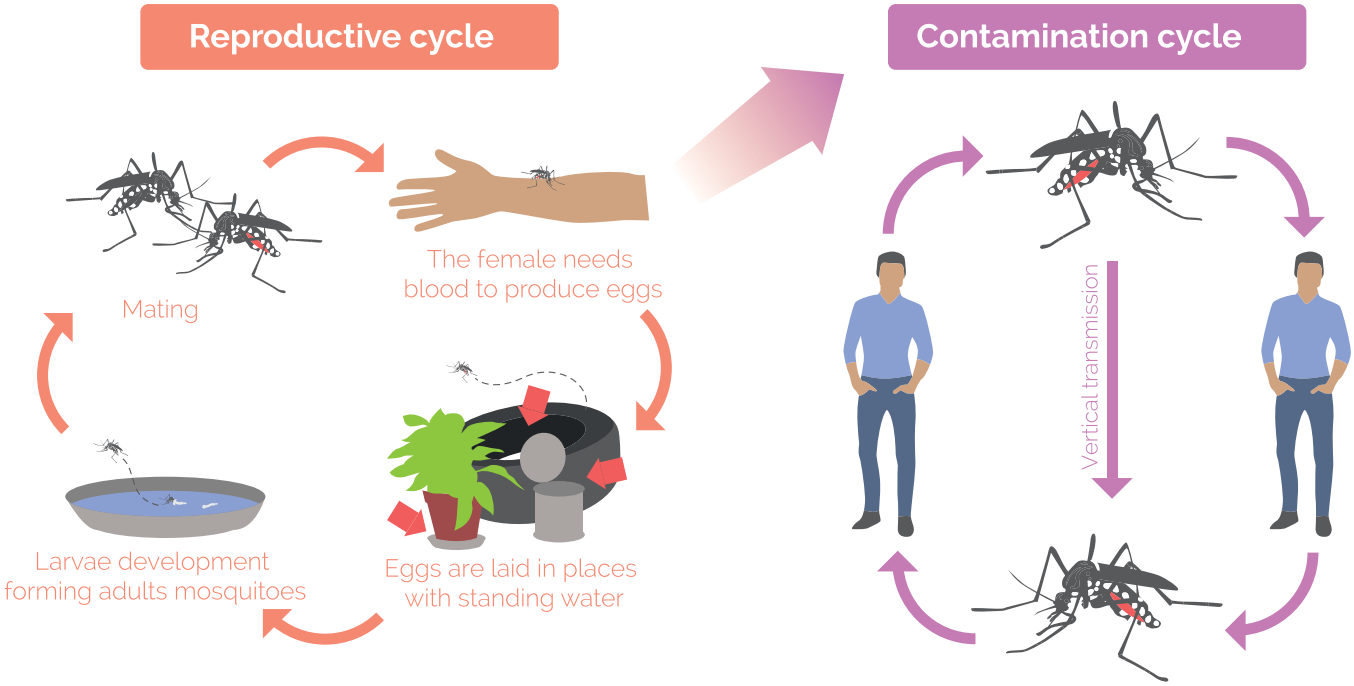


miological chain is the vector. The fight against the mosquito vectors should be directed to: the elimination of their breeding potential.

Because the "FOG - Fumigation" alone does not work?

The best method is to eliminate mosquito larvae. Because this immature form, they are concentrated in the water. That is, it is much easier to destroy the breeding or treat with larvicide a confined space than trying to achieve the same amount of mosquitoes flying and dispersed in the environment.

In addition, by their behaviour, the mosquito usually seek food and shelter in the house next to the man in shadow areas (under tables, behind curtains, in bookcases and cabinets) this behaviour makes it difficult for it to be achieved by smoke "fogging" because the car passes on the street outside.

Aedes mosquitoes - the eternal villains

The mosquito Aedes aegypti is usually measured less than 1 cm in diameter is black or a brown and white stripe has spread through the body and legs. Unlike ordinary mosquitoes, which tend to be more active in the day and early evening, Aedes has diurnal; it wont fly low, usually below half a meter, preferably pricking your feet, ankles and legs. You do not like heat, so it is most active in early morning and late afternoon.

The photophobia (have an aversion to light) it is often difficult to see, the larvae "flee" the light, plunging to the bottom of containers with standing water, which can lead to a false impression that there are no mosquito larvae in the environment.

There is another mosquitoes in Brazil, Aedes albopictus, also considered vector of these diseases, although the isolation of the virus in the mosquitoes have not yet been shown in Brazil, it is common to find this mosquito infected in Asian countries. Much like the Aedes aegypti that is created in ARTIFICIAL deposits, Aedes albopictus search NATURAL breeding (tree holes, bromeliads, plants that accumulate water inside) that is living in natural areas near or within cities.

How do professional control mosquitoes?

According to the rules of the Secretariat of Health Surveillance, Ministry of Health in Brazil, and following the instruction manual of FUNASA (National health foundation), the confrontation for control of mosquito vectors to the 03 main ways:

Focal treatment: It is the application of a larvicide product tanks for the positive immature mosquitoes, which cannot be removed mechanically.

Perifocal treatment: It consists of applying an insecticide layer of residual action on the outer walls of the depots at strategic points (tire repair, scrap, cemeteries, etc.) by manual spray, in order to reach the adult mosquitoes that land there at the time of home or spawning.

Treatment Ultra Low Volume - UBV: It consists of the space application of insecticides to very low volume. In this method the particles are very small, usually standing below 30 microns in diameter. Use should be restricted to epidemics like complementarily to promote rapid interruption of transmission of the disease, preferably associated with joint effort of cleaning and removing deposits.

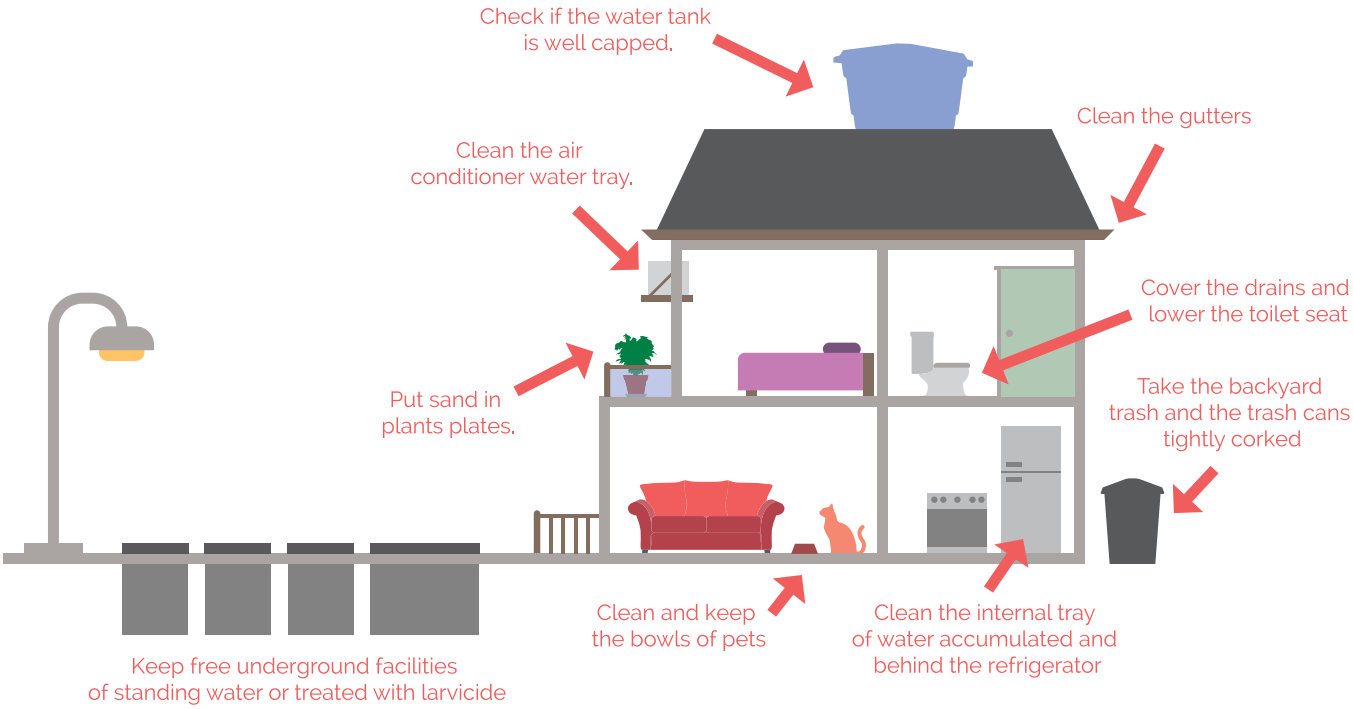
Although not described in the manual but considered important, there is the Treatment with intradomiciliary aerosol (Blocking technique of virus transmission):

It consists of the space application of professional insecticide intradomiciliary or in offices, in the hall of the companies, areas of elevators, using an automatic dispenser where every hour a fine mist of insecticide covers the environment killing mosquitoes. This technique causes 03 main actions in the mosquito behaviour: repellence, decreased bite of action and occasionally death.

Watch out! Take cover!

In the case of suspected locations of these diseases, or simply the presence of local mosquitoes ideally always preventing, protects to the bites. Here are some tips:

- Vistorie your home and eliminate mosquito outbreaks.
- Where are you during the day? Stay tuned the measures taken in his work, day care, school, home, condo and home. Remember, the mosquito that transmits the disease bites from dawn to dusk, be careful where you spend your day is as important as taking care of your home. Protecting your customers, employees, neighbours, relatives, friends ... you collaborate with your health. Remember only the mosquito transmits the disease to poke someone sick.
- Wear long pants and closed shoes with half. The mosquito flies down, takes shelter in the shadows, especially under the tables. As usually bites the unprotected areas of the body, the highest incidence is in women, because they have the habit of working in skirts or sandals. The heat is great, but mosquitoes environments worth to protect.
- Use repellents. Always follow the medical advice in case of sensitivity and allergies, especially in children. Stay tuned the duration of protection described on the label.
- Beware of babies with older people who require special care. Use mosquito nets cot or bed whenever possible, clothing and repellents also help. Always consult your paediatrician.



- If you have questions and need help, hire a specialist, call ASTRAL nearest you. Learn more about the largest pest control company in Latin America in www.astralsaudeambiental.com.br

Have you heard of AEDESTRUCTION? This is the app about the mosquitoes and the diseases Dengue, Chikungunya and Zika. We talked a little bit about the common also Culex mosquitoes. Thinking about the people's welfare and aware of social its and environmental responsibility Astral (Franchising Pest Control Solutions Group, created in Brazil) Comes Out ahead again and has just launched a new public health project, an interactive and informative app on education in health, prevention and control of diseases and its vector, the Aedes aegypti mosquito.

The global pandemic of these diseases has alarmed every day and every- one must do their part so That It does not further deteriorate. And unique application of Astral comes to collaborating with society and global Authorities. Its main objective is to inform about dis- Eases showing Symptoms and preventive measures for non-proliferation of mosquitoes, all in a fun and interactive way. This application will be available for free for iOS and Android, way everyone will have access to information. In addition to Astral, Which is the only private company in the world to have an application on the subject, AIMS to release it directly to all customers and employees forming a network of more than 90,000 people connected only in Brazil.

With over 32 years in the market Astral has about twenty social responsibility awards accumulated. Who knows the company knows this is an inseparable guideline brand. The Aedestruction version will be released in English and will guide the prevention and control outside of Latin America, Which Also Suffers from the Aedes aegypti mosquito. The will be presented at ICE app (International Congress of Entomology). The study was Submitted and approved in the International Entomology Congress to be held in Orlando, Florida. The application will be online from in September 2016, before the summer, and the future updates will contain information on other pests and urban vectors.

Inspect your home and **eliminate mosquitoes** outbreaks.

Use pants and closed shoes with socls. The mosquitoe bites the **uncovered areas of the body.**

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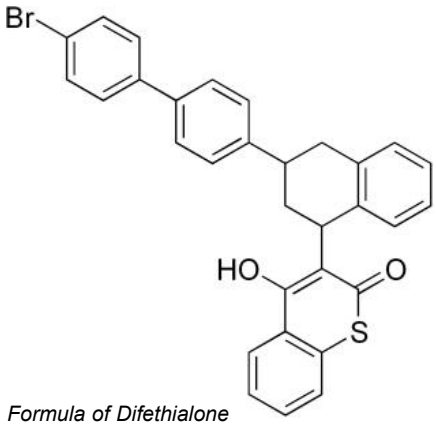
Use mosquitoes net in babies's crib or bed always as possible.

Difethialone: an efficient rodenticide active substance

Dr Romain Lasseur*



Formula of Difethialone

Rodents can have a large economic impact on agriculture (e.g. Common Vole, *Microtus arvalis*) and in urban area (e.g. House Mouse, *Mus musculus*) because of their attraction to sources of human food. Such rodents carry lot of disease and that is the main reason for employing permanent rodent control, specifically with anticoagulant compounds. Anticoagulants, formulated within a bait is not detected by rodent and the delayed action avoids bait shyness and allows users to achieve a high level of control.

From 1940 to 1980, new anticoagulant compounds were developed in order to increase control efficacy and to avoid the phenomenon of resistance that was occurring with first generation compounds (warfarin, chlorophacinone, diphacinone and coumatetralyl) in Brown Rat (*Rattus norvegicus*) and in house mouse (RRAC, 2015). The introduction of bromadiolone and difenacoum delivered an increasing efficacy in rodent control (with a lower LD50 than first generation anticoagulants arising from the lethal dose being reached after only one meal of bait by rodents).

The wide use of bromadiolone and difenacoum has led to another rodent genetic adaptation to the two compounds, particularly in brown rat and house mouse. However, resistant populations to such compounds remain geographically limited due to an apparent biological resistant cost. To face this second resistant wave, three last second generation anticoagulants have been developed; flocoumafen, difethialone and brodifacoum. These compounds are widely used now in commensal rodent control and demonstrate a very high efficacy without, up to now, reported resistant cases in the field (RRAC, 2015).

Difethialone was the last developed (1986) and is the only representative of the benzothiopyranone chemical family. The chemical formula is close to brodifacoum, with the presence of a sulphur atom in an aromatic ring as unique difference.

The sulphur atom, in an external position within the compound, is the major toxicological point, as this function allows the molecule to be stored in the rodent liver and as a consequence contribute to the efficacy.

For 25 years, this active ingredient has been used as a rodenticide and incorporated in bait with a 25ppm concentration. (Lechevin et al., 1988). This ensures that difethialone based bait can address regulatory changes that will appear in a near future. The Risk Assessment Committee (RAC) of European Chemicals Agency (ECHA) has proposed (21 March 2014) that the classification of all anticoagulant rodenticide are considered as "toxic for reproduction" if concentration is over 30ppm (http://echa.europa.eu/view-article/-/journal_content/title/rac-delivers-sixteen-clh-opinions). This decision could be published around June 2016. Direct consequence is that a large part of actual anticoagulant bait (except difethialone nowadays at 25ppm) available to consumers and over 30ppm will be forbidden if active is not deconcentrated.

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References

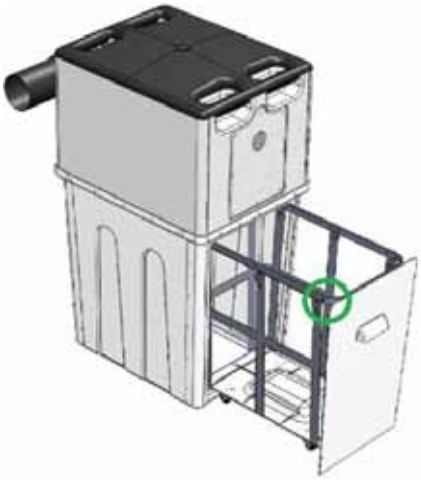
Lechevin, J.C. and Poche, R.M (1988). Activity of LM2219 (Difethialone), a new anticoagulant rodenticide, in commensal rodents. *Proc. Vertebr. Pest Conf.* Paper 13: 59-63.

RRAC (2015) RRAC guidelines on Anticoagulant Rodenticide Resistance Management. Technical Monograph 2015. Rodenticide Resistance Action Committee, *CropLife International*, Brussels. 29 pp.

Table 1

Anticoagulant	Generation	Resistance	Concentration (ppm)
Warfarin	1	YES (large)	100 to 250
Chlorophacinone	1	YES	50
Coumatetralyl	1	YES	50
Bromadiolone	2 (initial)	YES (partial)	50
Difenacoum	2 (initial)	YES (partial)	50
Flocoumafen	2 (last)	NO	50
Difethialone	2 (last)	NO	25
Brodifacoum	2 (last)	NO	40

Designing a better rat trap



SmartTrap showing hopper open

After watching a television program late one evening 'Life Under the Sewer' by Sir David Attenborough, Jonathan Round was intrigued by the never ending population of the Brown Rat (*Rattus norvegicus*) and the way it had developed immune to rodenticides. This was the beginning of an idea which has over the years evolved into the SmartTrap, an electronic trap that is continuous operating and requires very little maintenance.

Founded in 2015 by Jonathan Round, 4WorldDesigns based in Barnsley has built the SmartTrap concept which is intended to revolutionise the current pest control market by uniquely targeting vermin rodent species using camera recognition and chemical free organic bait. This technologically sophisticated approach aims to significantly reduce the number of accidental kills and eliminate the risk of further deaths to protected species through the rodent's food chain which arise when using common commercial poisons.

The Problem

The rise of the 'super rats' has been widely publicised by the British media, with evidence gathered by the University of Huddersfield, revealing a current population of around 150 million. This research also identified a growing number of rats with a genetic mutation causing commonly used poisons to be rendered ineffective. This increasing resilience to commercial poisons opens up a significant market demand for a new approach.

Existing rodent control methods

Bait stations: Current bait stations contain rodenticides. Most used today are anticoagulant compounds that interfere with blood clotting. Deaths typically occur between four days and two weeks after the rodent has fed on the bait.

Some of the core drawbacks of the commonly used rodenticides as a method of pest control include:

- If managed incorrectly, they do not discriminate what they poison resulting in untargeted animals being inadvertently poisoned.
- Animals have a prolonged death.
- Infected animals that are dying from the toxins can affect birds, raptors, foxes, badges, dogs and cats etc. There is a risk of accidental poisoning to adults, children and household pets.
- Rats can die in hard to reach areas resulting in the decomposing carcass producing unpleasant smells and risk of further infestations causing further disruption to businesses and homes.
- Getting the rat population under control can take several days or even weeks of rebaiting.

Spring traps: These are very effective on small mammals and do not require the use of rodenticides, however:

- they do not discriminate against other living species such as birds, voles etc.
- they can wound other animals
- they can harm children and adults
- they require regular servicing and maintenance
- they only have the ability to kill one rodent before the need to reset
- they do not keep the rodent contained once dispatched. The collection of dispatched rodents can be time consuming and ineffective if used on a wide scale.
- It is contested whether these traps actually provide a humane solution.

Electronic traps: These dispatch animals quickly and cleanly with no prolonged suffering. However, many electronic traps on the market do not have a built in safety switch or design to protect children and pets against electrocution resulting in significant safety concerns for areas where children and pets are present.

- If the batteries are not working at full capacity the shock will not be strong enough to kill the rodent as rats have the ability to restart their heart after a mild electric shock.
- This form of trap does not discriminate against other living mammal species such as rabbits, birds, voles etc.
- Many of the traps on the market are not suitable to be used outside in wet conditions due to the risk of fire.

Whilst the above forms of pest control methods have varying advantages including price, efficiency and accessibility the rising level of rodent tolerance to rodenticides and the increasing importance of conserving our environment and ecosystems is leading to a shift in consumer habits and attitudes.

How the SmartTRap works

The SmartTrap work best when sited in bin or garbage areas as these are provide food sources for rats and other animals. A wide flexi hose is fixed at the elbow of the SmartTrap which drapes down to ground level. At the opening of the hose is a tunnel with a camera mounted at the top. There is a steel mesh trapdoor which opens and closes electronically. The software within the trap will only open the trapdoor if there is the presence of a rat or other target is present. Animals are lured to the trap by means of a strong aroma of a non - toxic bait which is a blend of peanut butter and seeds.

Once the rat is lured inside the trap by the aroma it goes through a labyrinth that leads to the electrocution chamber. The rat is subject to two short pulses of electric current. The animal drops through a trapdoor directly into a bag lined hopper. The trap is battery or mains operated 110v

The advantages of the design are that it discriminates other animals from its target. The animals never get to the bait as the aroma is forced down a length of heavy duty hose. Animals walk up

the hose to the sorting chamber where it is weighed electronically. If an animal is under the weight of an adult rat it is immediately released unharmed through a hatch on the side of the trap. Rats then fall into a bag lined hopper which can contain up to 20 rats before being emptied

The system has the ability to records all species of animals that visit the trap and all rat kills. It provides a continuous record of animals denied entry into the trap. The data collection facility is considered as being of great benefit for the purpose of academic research and large organisations. The data will provide evidence of protected species population levels which will assist with conservation projects within the area where the trap is sited.

The SmartTrap is viewed as a long term solution to pest control. Whilst other forms of pest control require replacement after every outbreak, SmartTrap is designed to last between three and five years. The hopper will only require emptying once 20 rats have been killed resulting in a reduction in maintenance hours and servicing costs compared with other products.

Consumers are now far more concerned with the impact of pest control methods on the wider environment, protected species and the food chain. With an increased knowledge of rodents growing resilience to traditional rodenticides alongside a rapidly growing rodent population, consumers are open to exploring alternative options to controlling their pest problems. As a result of this shift in attitude, the market demand and opportunity for the SmartTrap is growing at an astounding rate.

■ For more information, visit www.4worlddesign.com.

Footnote

The above text was taken from a recent issue of The Parliamentary review (http://www.theparliamentaryreview.co.uk/). Combining political commentary from leading journalists, with sector specific insight from the Prime Minister, Secretaries of State, Ministers and MPs, The Parliamentary Review is an guide to industry best practice and how sector leaders have responded to challenges in the political and economic environment. The Review has several editions, each focusing on an individual policy area all with a strategic aim of raising standards by highlighting best practice. The Parliamentary Review is sent to over 100,000 leading business executives and policymakers.

US government attempts to combat Zika virus

Rentokil North America has been awarded a contract by the U.S. Centers for Disease Control and Prevention ("CDC") to help control the species of mosquito that could potentially carry the Zika virus across the USA and its protectorates. The requirement of the programme is to provide pest control services until June 2018, subject to government review. As required, Rentokil will deploy its network of more than 4,000 pest control experts alongside its global technical resource to target affected or high-risk areas. Additionally, a key component of the contract includes support services that entail community outreach, surveillance and inspection, and support for the distribution of materials and educational information.

Andy Ransom, Chief Executive of Rentokil Initial plc, said: "I'm proud that Rentokil has been selected to support the work of the CDC throughout the USA. Across the world we combat the dangers to public health from mosquitoes such as Dengue fever in Asia, to Malaria and West Nile virus in Africa and the Americas. Our depth of expertise and experience in global mosquito control is simply unmatched."

■ Source: Rentokil-Initial

Label changes to all rodenticides

Pest controllers and farmers are being reminded that all product labels of second generation anticoagulant rodenticides (SGAR's) will need to be revised this year, in line with the CRRU (Campaign for Responsible Rodenticide Use) stewardship initiative. Rodenticide product labels will include a new phrase stating that the product can only be applied by certified individuals, who are able to demonstrate compliance. Bayer was the first company to amend all labels for their entire range of second generation rodenticide products. Four products that make up the Bayer Rodilon® range will all come to the market at the same time with this stewardship message, during July. "We know our products are essential to rodent control but we understand the need to address the wider environmental impact, in an industry led solution to responsible rodenticide use," says Richard Moseley, technical manager, Bayer. "We work very closely with CRRU and our commitment to rodenticide stewardship is crucial to ensuring that our products are used in the most responsible way possible," he adds. Remaining stocks of old label products that do not require proof of competence will be available for purchase until 1 October 2016, and can be used up until 31 March 2017. After that date it will be illegal to use old label products.

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Glyphosate given a limited EU go-ahead

Martin Redbond*

US farmer spraying Roundup Ready corn with glyphosate

Farmers across the EU will be able to continue using glyphosate following the recent decision to re-authorise the herbicide. The EU Health and Food Safety Commissioner, Vytenis Andriukaitis recently confirmed that the European Commission had finally agreed to extend the glyphosate license for a further 18 months, from 1 July 2016. Had they not done so, the EU license would have expired at the end of June and that would have forced manufacturers to phase-out products containing glyphosate. The EU standing committee on plants, animals, food and feed (SCoPAFF) had been expected to settle the matter back in March, but postponed the vote after France, Italy, the Netherlands and Sweden raised objections, mainly over the impact of glyphosate on human health. The European Commission then tabled two new proposals, both of which failed to convince the member states who then refused earlier in June to back a limited extension for glyphosate. Offered a 12- to 18-month extension, to allow time for further scientific study by the European Chemicals Agency (ECHA), the compromise proposal failed to win the qualified majority needed for adoption. Seven member states abstained, including France, Italy and Germany and 20 backed the proposal. Only Malta voted against. The EU appeals committee then met on 24 June to consider the re-licensing of glyphosate in the light of the EU member states' failure on three previous occasions to reach a qualified majority on the chemical's future but they too failed to obtain the necessary votes and declared a 'no opinion' result. The decision was finally passed back to the European Commission with only days to spare.

Opposition to the use of glyphosate has grown since 2015, when the WHO's International Agency for Research on Cancer said that the chemical was 'probably carcinogenic to humans'. However, many other safety bodies have challenged that claim, including the European Food Safety Authority (EFSA). As part of its ongoing registration review of glyphosate, the US Environmental Protection Agency (EPA) Cancer Review Assessment Committee (CARC) classified the herbicide as 'not likely to be carcinogenic to humans.' The EPA was the third regulator to publish its conclusion that glyphosate is not a carcinogen, since the IARC announced its classification in March 2015. EFSA determined in November 2015 that glyphosate is 'unlikely to pose a carcinogenic hazard to humans.' The Canadian Pest Management Regulatory Authority (PMRA) also concluded 'that glyphosate is unlikely to pose a human cancer risk.'

Monsanto says the conclusions by the EPA and the European and Canadian regulatory authorities are based on standard scientific principles and the overwhelming weight of evidence. "No pesticide regulator in the world considers glyphosate to be a carcinogen and the conclusion by the US EPA reinforces this important fact" said Hugh Grant, Monsanto's chairman and CEO. "Glyphosate has a 40-year history of safe and effective use. Unfortunately, last year's inconsistent classification by IARC generated unwarranted concern and confusion about this important agricultural tool. The rigorous assessment of the data by EPA builds on the sound conclusions of both the European

* Market Scope Europe Ltd., mredbond@aol.com

and Canadian regulatory authorities and once again makes it clear that glyphosate does not cause cancer."

Just like the argument about bees and the neonicotinoid insecticides, the contradictory findings on the carcinogenic risks of the glyphosate have pitted farming and chemical lobbies against citizens and environmental groups.

Monsanto said the delay had undermined the credibility of the European regulatory process and threatened to put European farmers and the European agriculture and chemical industries at a competitive disadvantage. It said the EU's risk assessment on glyphosate had been one of the most thorough evaluations of an agricultural product ever conducted. The risk assessment conducted by the rapporteur member state, Germany and reviewed by the European Food Safety Agency (EFSA) included more than 90,000 pages of data and 353 studies not previously reviewed by the EU. The assessment considered the best available science and found no evidence of unreasonable risk.

Monsanto is urging the European Commission to present, without further undue delays, a proposal for a full renewal under the regulatory framework. Over the coming months, it says it will be engaging with member states and other stakeholders involved in this process, to understand their concerns, answer their questions and share more information about glyphosate's long history of safe use. The decision to temporarily extend glyphosate's authorisation by 18 months ensures that European farmers, municipalities, gardeners and other users will continue to have access to the herbicide glyphosate, while a longer-term solution to the product's reauthorisation is found. However, there will be certain restrictions still to be clarified. These are likely to include the banning of glyphosate products containing tallow amine, other than for agricultural use and potential restrictions on the use of glyphosate in public areas and public open spaces.

Glyphosate, [N-(phosphonomethyl) glycine], was discovered in 1950 by a Swiss chemist, Dr Henri Martin, working for a pharmaceutical company. Because no pharmaceutical applications were identified, the molecule was sold to a series of other companies and samples were tested for a number of possible end uses. A Monsanto chemist, Dr John Franz, identified the herbicidal activity of glyphosate in 1970 and it was patented under the trade name Roundup. The product was first commercialised in Malaysia for rubber and in the UK for wheat in 1974. The first US approval, also in 1974, was for industrial non-crop use. In agriculture, glyphosate was first developed for weed control in stubbles in all crops. Later its use was extended to include additional applications including pre-harvest in cereals and oilseed crops.

Since its first introduction, glyphosate has become one of the most widely used broad-spectrum herbicides around the globe with a significant impact on worldwide crop production practices. For 'the impact of glyphosate upon the production of agricultural food and fibre throughout the world,' the scientist John Franz received the US National Medal of Technology in 1987.

In 1996, *Roundup Ready* (RR), genetically engineered (GE) herbicide-tolerant (HT) soybean, maize and cotton varieties were approved for planting in the US. This technological breakthrough made it possible to utilise glyphosate as a broadcast, post-emergence herbicide, thereby dramatically extending the time period during which glyphosate-based herbicides could be applied. Alfalfa and sugar beets engineered to tolerate glyphosate were first approved and commercially marketed in 2005 and 2008, respectively, but federal lawsuits citing procedural violations of the National Environmental Policy Act delayed full commercial sales until 2011 for RR alfalfa and 2012 for RR sugar beet.

The adoption of transgenic crops worldwide has been rapid and impressive, reaching 120 million ha in 2008 and continues to grow at a steady pace. Approximately 80% of the total area devoted to these crops has been planted with herbicide-resistant crops, virtually all being glyphosate-resistant (GR) crops. Thus, a single genetic trait, glyphosate

No till in olives using glyphosate for weed control

[N-(phosphonomethyl) glycine] resistance, accounts for most of the success of transgenic crops at this time. Wide-spread adoption of GR crops and glyphosate has had significant economic effects in agriculture, from replacement of previous herbicide markets to cost savings for farmers in weed management. Furthermore, GR crop technology has generally reduced the adverse environmental and health impacts of weed management. GR crops have been a boon to farmers who have adopted them, but overuse of this single weed management technology is jeopardising this safe, highly effective and economical

A Monsanto chemist, Dr John Franz, identified the herbicidal activity of glyphosate in 1970 and it was patented under the trade name Roundup. Glyphosate is now marketed by over 40 companies under an assortment of trade names. Global glyphosate demand was over 700 kilo tons in 2013 and is expected to exceed 1,000 kilo tons by 2020.

Glyphosate has become one of the most widely used broad-spectrum herbicides around the globe with a significant impact on worldwide crop production practices

tool due to the emergence of new weed species that are only poorly controlled by glyphosate and the evolution of resistant weeds.

In order to control weeds less sensitive to glyphosate, farmers typically increase glyphosate application rates and spray more often. In addition, next-generation herbicide-tolerant crops are, or will soon be, on the market that are genetically engineered to withstand the application of additional herbicides such as 2,4-D and dicamba. If used wisely, these tools can be integrated into resistance management and prevention strategies. Greater diversity in weed management technologies is badly needed to preserve the utility of the GR crop/glyphosate technology.

The estimated use of glyphosate, applied in a variety of forms including isopropylamine salt, ammonium salt, diammonium salt, dimethylammonium salt and potassium salt, in the agricultural sector rose 300-fold from 1974 to 2014. Non-agricultural uses rose less dramatically, by 43-fold in the same time period, because there have been far fewer new, non-agricultural uses registered. While its initial patent expired in 1991, Monsanto retained exclusive rights in the US until its patent on the isopropylamine salt expired in September 2000. Glyphosate is now marketed by over 40 companies under an assortment of trade names. Global glyphosate demand was over 700 kilo tons in 2013 and is expected to exceed 1,000 kilo tons by 2020. The global glyphosate market was valued at over US$5 billion in 2012.

Asia Pacific was the largest regional market in 2013, a trend that is expected to continue. This is mainly due to increasing adoption of GM crops and availability of arable land in India and China. On account of growing demand, Chinese companies have also entered the glyphosate market, leading to increased production activities in the region.

Over 2000 plant protection products containing glyphosate are currently registered in Europe for use on crops. Its broad-spectrum effectiveness and the simplicity of weed control have made it one of the most popular herbicides in agriculture, gardens and non-cultivated areas.

Removal of crop protection products threatens food supplies and the economy

Copa & Cogeca Secretary-General Pekka Pesonen said "Many crop protection products are being steadily phased out, which is pressurizing not only European farmer's livelihoods but also the environment, employment and the economy".

A new EU impact study reveals that if more crop protection products are removed from the market, quality food supplies will be put at risk and unemployment will rise, costing the economy billions of euros. The study, carried out by the consultancy Steward Redqueen and based on information provided by industry organisations, looks at the cumulative impact in the EU of having a hazard based legislative approach for assessing crop protection products, instead of a risk based one.

Speaking at a press event to launch the study, Copa & Cogeca Secretary-General Pekka Pesonen said "Many crop protection products are being steadily phased out, which is pressurizing not only European farmer's livelihoods but also the environment, employment and the economy. Moreover, many of the substances identified in the report are still being used in non-EU countries, putting us at a complete competitive disadvantage, with no advantage to the European consumer".

Explaining key findings of the report, Chairman of Copa & Cogeca, Phytosanitary Questions Working Party, Luc Peeters said "The study identifies 75 substances that risk being withdrawn from the market. And it shows that it will impact on the whole EU arable crops sector with yield losses of up to 40% estimated for some commodities. This will erode farmers margins and cut farm profitability by as much as 40% resulting in total losses of 17 billion euros in terms of overall farm profitability, the study shows. The seven staple crops identified in the report - barley, wheat, rapeseed, maize, potatoes, sugar beet, grapes - correspond to 1.2 million jobs and 30% of these are identified to be at medium to high risk of being lost. 24 speciality crops are also included in the report which relates to 300,000 jobs".

Chairman of Copa & Cogeca Cereals Working Party Max Schulman said "We are already seeing the impact of the neonicotinoid seed treatment ban on EU rapeseed, corn and sunflower production. Yields are down and the area sown is falling, as some farmers are switching to other crops because they do not want to take the risk. This means rapeseed is being dropped from crop rotations which has a negative environmental impact. Resistance also builds up if there is no rotation in active substances. The problem is no alternative tools for crop protection exist and crops are being decimated by flea beetle attacks. Looking ahead, withdrawn substances are also unlikely to be easily replaced. Action is vital".

■ For more information, contact Copa – Cogeca, the European Farmers European Agri-Cooperatives, www.copa-cogeca.eu.

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Taking droplet size measurements to the field

Graham Matthews*

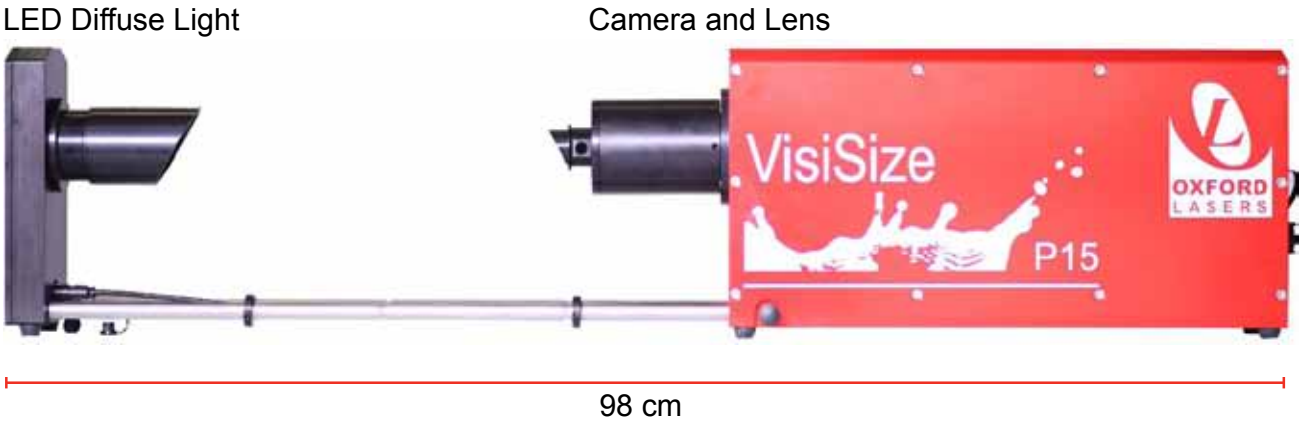

Figure 1: The VisiSize Portable with the LED diffuser positioned at maximum distance from the camera.

To most users of pesticides, the key information on the label is the dose of active ingredient or actual product to be applied per hectare. Little information has been given on the spray volume or spray quality required. Historically, many pesticides were applied in large volumes of water to wet all the plants surfaces. As much as 2000 litres per hectare (L/Ha) were often applied, especially on orchard crops, despite most of the liquid dripping off foliage and being wasted on the ground. However, with water not always readily available in many parts of the world, and also costly to take to fields, the majority of pesticides are now applied at what are generally referred to as low volume sprays (<200 L/Ha). In some cases, very low volumes (<50 L/Ha) of spray have proven to be equally effective. Effectiveness with lower volumes is partly due to choice of the correct droplet size, which will depend on the target pest.

Whereas a droplet size of 70-150µm may be appropriate for insect pests, larger droplets are needed in some situations, such as where spray drift needs to be minimal, so sprays with droplet sizes of >150µm are needed. Unfortunately, the hydraulic nozzles most commonly used to apply agricultural sprays, produce a range of droplet sizes. Advice on droplet size has depended on using a spray quality classification initially introduced by the BCPC in 1985, which compares the spectrum of droplets produced by different nozzles, with selected standards that differentiate between very fine, fine, medium, coarse and very coarse sprays. More recent versions of the classification have additional criteria and include extra coarse sprays.

Measurement of the droplet spectra, produced by nozzles, was a tedious and lengthy process, until the development of instruments using lasers and computer technology. There are now several systems commercially available but these have generally been limited and confined to special laboratories. The spectrum will vary between different instruments, depending on how the droplets are detected and the position of the laser beam relative to the spray. Reference nozzles are used to relate data to the spray quality criteria. Recently there has been interest in scaling down the equipment so that a portable version can be used to measure the spray droplet spectra in the field.

The new VisiSize Portable, P15 (Fig 1) from Oxford Lasers Ltd measures spray droplets using shadowgraphy and

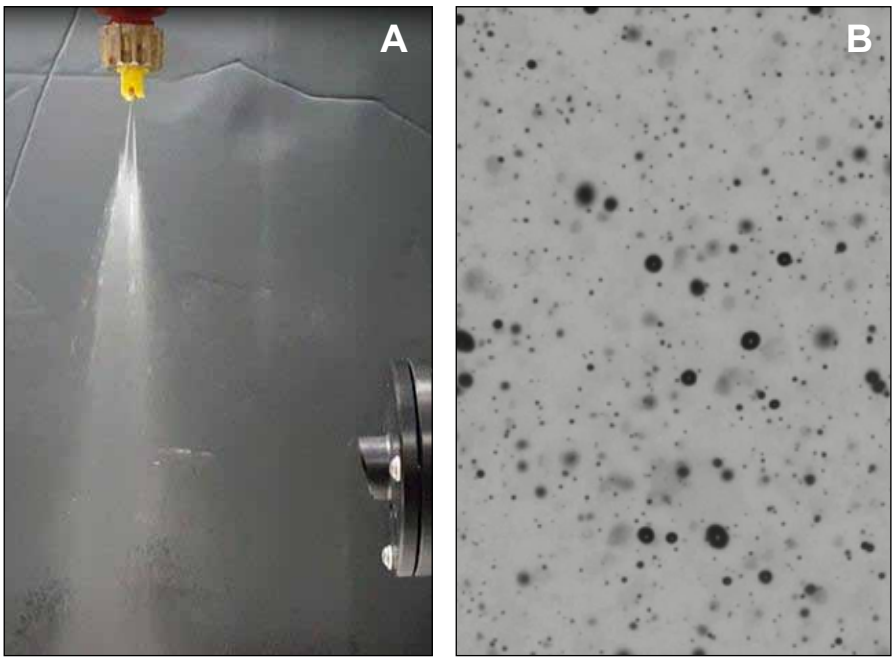

Figure 2: (A) Close up view of the -8002E nozzle with water in front of the camera of the VisiSize Portable and (B) An image of the droplets gained from the VisiSize Portable.

*Emeritus Professor, IPARC, Imperial College, London

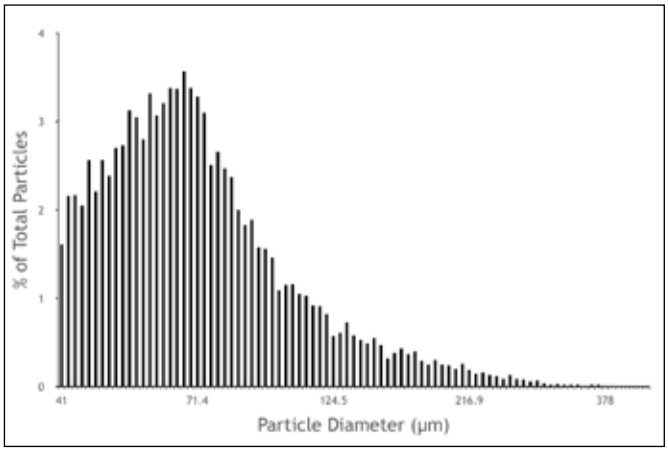

Figure 3: The diameter number frequency.

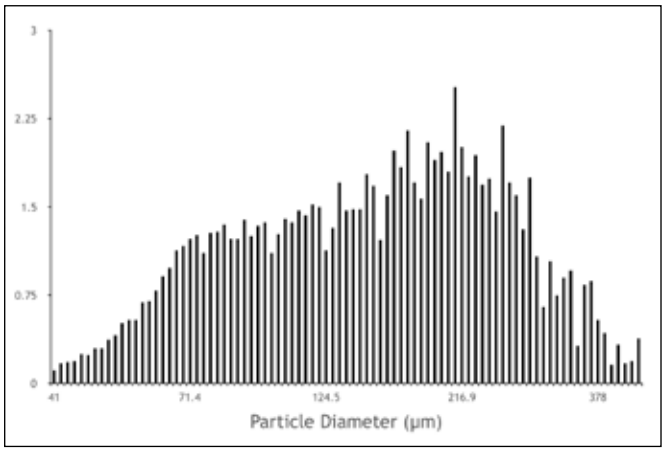

Figure 4: The diameter frequency by volume.

is designed to operate with a laptop. Spray from a nozzle is back lit with an LED diffuse light source. The image of the spray from the -8002E nozzle, shown in Figure 2A, highlights the typical blurred image of droplets taken without a short pulsed light source. The LED's short pulse length freezes the motion of the particles, allowing blur-free visualization of drop size and shape, as can be seen in Figure 2B.

The high resolution camera captures up to 15,000 droplets per second in real time mode. Images from the digital camera are transferred to a laptop and high-speed real-time particle sizing software analyses the images obtained, in order to build up the distribution of different sizes of individual droplets in flight within a spray (Fig 3 and 4). Software also allows for the velocity to be determined, hence the direction is provided. The high-magnification image-based measurement permits measurement of droplets without any motion-blur even close to a nozzle.

To demonstrate the new VisiSize Portable, water was sprayed from flat fan nozzle (8002E), operated at 1.5 bar pressure - a setting used for indoor residual spraying to control mosquitoes - was directed between the camera lens arrangement and the LED diffuse light source. A sample time of approximately 3 minutes allowed characterization of 10,000 droplets. This showed that the Volume Median Diameter (VMD) of the spray in the middle of the fan was 160.2 µm ± 1.3 µm (n=2) and the average velocity was 3.96 m/s at 20 cm from the nozzle (Table 1). The measurement was also completed with the Malvern Laser Diffraction particle sizer, providing a VMD of < 10% difference of 148 µm.

With such a lightweight portable instrument it is now far easier to check the spray quality of nozzles to ensure that the correct droplet spectrum is being produced when fitted on spray equipment.

Table 1: The statistical output data summary of one spray measurement, reported by the VisiSize Portable for the Flat Fan Nozzle -8002E

Diameter Averages (µm)	
Arithmetic Mean	79.3
Surface Mean	88.4
Volume Mean	100.5
Sauter Mean	129.9
Volume-weighted Mean	212.4

Diameter Spread (µm)	
Minimum Diameter	41.1
Maximum Diameter	450.5
Relative Span	1.39
Deviation	0.5
Sphericity	0.94

Volume Percentiles (µm)	
10%	70.6
50%	159.3
90%	292.7
GSD	1.81

Velocity (m/s)	
Minimum Velocity	0.215
Maximum Velocity	15.8
Average Velocity	3.96

Densities	
Particles/mm^3	0.03
Surface (mm^2/mm^3)	0.000772
Volume Density	1.67x10^{-05}

Fungicides for *Microdochium nivale* management in turf

Terry Mabbett*

Mechanical dew dispersal is an important part of any programme to minimize Micodochium nivale activity (Picture courtesy Syngenta)

Fusarium (Microdochium patch), caused by the fungal pathogen *Microdochium nivale*, is the most widespread and damaging disease of managed turf in the cool temperate world. This status is maintained both sides of the North Atlantic Ocean, in the USA and Canada on the one side and in the United Kingdom in maritime Western Europe on the other. However, comparison of a pathogen and its disease manifestation on managed turf, is fraught with difficulty and that for *Microdochium nivale* is no exception.

Huge differences and disparities between the north America on one side and Britain on the other mean much more varied climatic conditions and therefore pathogen host interactions for the former. A second conundrum is summed up in the immortal words of the playwright George Bernard Shaw about 'Americans and British being separated by a common language'. Finally, there is a distinct impression of a narrower gap in North America between academia and bureaucracy on the one hand and the people on the ground on the other. For me it furnishes a perception of a more democratic and pragmatic approach especially to the use of chemicals for the control turf pests and diseases.

Of course pesticide approval and use in the UK is under governance of the European Union (EU) in Brussels and therefore essentially beyond exclusive UK government control. Nevertheless, North American authorities appear much more liberal in their approach to the use of chemical pesticides on turf. As such, American greenkeepers have a much wider range of fungicide actives at their disposal, but by the same token, the authorities pay close attention the risk of resistance to a fungicide developing amongst fungal pathogen populations.

Microdochium nivale

As a foliar pathogen of turf grass the *Microdochium nivale* fungus is more versatile than most but still with favoured conditions for maximum pathogen activity and disease development. This fungus does best in maritime climates typified by cool, moist conditions and they don't come much more 'maritime' than in the UK, thanks to its position on the north-western edge of the continent and under influence of the North Atlantic Drift (Gulf Stream). Parochially, Britons regard the western most extremities of their islands as the maritime climate but in the wider scheme of things, including a European continental context, the whole country experiences a marked maritime climate. For *Microdochium nivale* to push into parasitic gear and cruise into disease mode, a temperature range of 0-15°C

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and a period of leaf surface wetness exceeding 10 hours are required. In reality these conditions can be met in any part of the British Isles and in any one place therein at virtually any time of the year.

North America presents a much more varied and considerably more complex situation. There are classic coastal maritime regions such as western Washington (US) and British Colombia (Canada) which closely match the UK climate but others too, where winter temperatures plummet to depths approaching -50°C (e.g. Minnesota) and where turf is covered for extended periods with deep layers of snow, and every year without fail.

Clearly there will be sharp differences in the physiological responses from both the host (grass) and the pathogen (fungus) to such starkly contrasting conditions, so it is not surprising that in North America *Microdochium nivale* is a single pathogen considered to cause two distinctly different diseases on turf, each with its own characteristic symptoms and inherent damage caused. They are known as Micodochium Patch, under cool, moist but snow free conditions and Pink Mold under snow cover and apparently triggered when melting begins.

Pink Snow Mold is recognised in the UK but usually as additional symptoms related to snow cover rather than an entirely separate disease. The low incidence of snow and the relatively short duration of snow cover for most areas, mean Pink Snow Mold is generally not an issue for most greenkeepers in the UK.

Vernacular variations

While north Americans may write 'Pink Mold' and the British 'Pink Mould', more central to the arguments around language, is an increased readiness in North America to upgrade common names in line with scientific changes. North Americans have long stopped calling the 'snow free' form of turf disease 'Fusarium patch' in favour of 'Microdochium patch'.

The fungus currently called Micodochium nivale has carried a lot of different scientific names since discovery in 1825 when initially named Lanosa nivalis. Since then, the fungus has been through a dozen different scientific names, with Fusarium nivale probably the most widely known and durable.

You might reasonably assume that once a fungus is identified, described and named, that is where the matter ends, but not so, because fungal pathogens are under constant name change. To be fair, information may come to light that makes change necessary but the ways in which such changes are carried out is equally important. North America appears to manage name changes more democratically and pragmatically unlike Britain where enigmatic instructions are passed down on 'Tablets of Stone' leaving practical scientists fuming and the 'guys on the ground' bewildered.

Describing a fungal pathogen named Micodochium nivale as causing a disease called Fusarium patch might not seem like a big deal until you realise there are dozens of other Fusaria fungal species still out there including some important ones causing their own particular diseases in grasses and cereals.

Early-stage Fusarium (Microdochium) patch disease development photographed at the very end of September 2015 in Ireland (Picture courtesy Syngenta)

Well-established and classic Fusarium (Microdochium) patch disease damage (Picture courtesy Vitax)

Pink snow mould (mold) has a tendency to develop more quickly under a slower and more prolonged snow melt

'Messages from America' on the factors predisposing to development of Microdochium patch disease (like 'fall' leaf litter left lying on the green) ring true for the autumn development of Fusarium patch in the British Isles

Management and control

Familiar bells start ringing in the UK when you go down the list of factors that favour *Microdochium nivale* disease development in North America and the corresponding cultural recommendations to minimise it.

- Excessive foliar growth and thatch development
- Restricted air movement and poor soil drainage
- Soil deficient in available potassium
- Don't apply nitrogen in the fall in advance of cold conditions
- Continue mowing until foliar growth stops completely
- Improve surface drainage, control traffic patterns and reduce thatch accumulation
- Prune trees impeding air movement and promptly remove leaves from greens in the fall

North American greenkeepers have a much bigger and much more varied fungicide arsenal at their disposal and an apparently firmer fungicide framework, formalised without 'fear or favour', with respect to fungicide efficacy and risk of resistance development.

The 'TurfFiles' website at North Carolina State University (NCU) lists over 30 different fungicide actives marketed as around 80 different commercial fungicide products for control of *Microdochium nivale* on turf, with each active or active mixture assigned a comparative efficacy rating and resistance risk rating.

Some of the fungicides, including those familiar to UK greenkeepers, are shown in Table 1 together with efficacy and resistance-risk ratings assigned. Among those actives not in Table 1 but on the 'TurfFiles' list are fungicides long since withdrawn by the EU (e.g. MBC or benzimidazole fungicides) and additional triazoles (DMI fungicides) which have never been approved by the EU for use on turf.

Some important and interesting observations from Table 1 are:

- Combining fungicides from different chemical classes, and therefore activities and modes of action into a single 3-way product, enhances overall efficacy

Table 1: A selection of fungicides for *Microdochium nivale* control in the United States*

Fungicide	Efficacy	Resistance risk	Class
Chlorothalonil + propiconazole +fludioxonil	++++	2	Nitrile + DMI + phenylpyrolle
Propiconazole	+++	4	DMI
Chlorothalonil + propiconazole	+++	3	Nitrile + DMI
Chlorothalonil	++	2	Nitrile
Azoxystrobin	++	6	QoI
Pyraclostrobin	+++	6	Qo
Trifloxystrobin	+++	6	QoI
Azoxystrobin + Propiconazole	+++	6	QoI + DMI
Iprodione	+++	4	Dicarboxamide

Key to Efficay

++++ Excellent control when conditions are highly favourable for disease development

+++ Good control when disease pressure is high, or excellent control when disease pressure moderate

++ Good control when disease pressure is moderate, excellent control when disease pressure is low

Key to Risk

2 Rotate (change) to a different chemical class after 3-4 applications; tank mixing not necessary

3 Rotate to a different chemical class after 2-3 applications; tank mixing not necessary

4 Rotate to a different chemical class after 1-2 applications; tank mixing not necessary

6 Rotate to a different chemical class after 1-2 applications; tank mixing with low or moderate resistance risk product recommended

*Source TurfFiles: North Carolina State University

- The risk of resistance development by QoI fungicides is extraordinarily high even by the standard set by systemically acting, curative and site specific-action fungicides in general.
- Inclusion of a contact acting, broad spectrum multi-site action, protectant fungicide like chlorothalonil reduces the resistance risk by 'covering' systemic actives in the mixture
- Efficacy may be sacrificed for a lower risk of resistance when a contact acting broad spectrum multi-site action, protectant like chlorothalonil is used as a 'stand-alone' fungicide
- The surprisingly high resistance risk rating given to iprodione given the active is a largely contact-acting and protectant fungicide (locally systemic with some curative action) and has a fairly broad spectrum of action.

Fungicide application is a crucial part of integrated programmes for the successful management of Microdochium nivale *in both the United States and the United Kingdom*

And then there were three

The 'Message from America' on the fungus *Microdochium nivale* is of a single pathogen causing two distinctly different turf diseases which are Microdochium Patch and Pink Snow Mold. However, when you include grass seed rot/ seedling blight caused by *Microdochium nivale* in the context of newly grass seeded areas the two diseases become three.

UK council trials alternative weed control

A UK town council that has gone completely glyphosate-free says it is having good success with alternatives, as the EU debated whether to allow the herbicide to be used in public areas. Glastonbury Town Council voted to ban glyphosate in June 2015, with the decision taking effect immediately and before it had trialled alternatives. The local authority had already stopped using pesticides in its own properties some years earlier however, as some of its street cleaning and other grounds maintenance was carried out by subcontractors, parts of the town were still sprayed with glyphosate.

After locals and councillors raised concerns about the environmental and health risks posed by glyphosate, it was agreed that the chemical should be banned while alternatives were found. A demonstration and trial convinced Glastonbury to settle on Foamstream, a weed-killing method created by WeedingTech. The process combines a hot-water spray with a plant-based foam additive that penetrates and collapses cell walls. It was agreed that the town would have to purchase and operate a machine itself, with the contractor making up the value of its original contract through hand weeding in the town.

A councillor who pushed for the ban, said alternatives were used at nearby farms, water and utility sites and all were all positive about their use of the hot foam option. A controlled trial was carried out comparing hot water, hand weeding and the hot foam, measuring the time taken for the treatments, dieback and regrowth. It quickly became clear that weeding by hand was exorbitant but the hot foam treatment appeared to take the same time as glyphosate to cover a similar area. The weeds died much quicker after the use of the foam and was effective even if it rained immediately after application, while glyphosate needed to penetrate to achieve the same effect.

Calculations showed that the treatment costs about 7p per linear metre for Glastonbury to use the hot foam, counting all costs such as diesel, foam, in-house council labour, the van and water, but excluding the purchase of the machine. By comparison, it would cost 23p per linear metre for a contractor to do same job, 26p for a contractor to use hot water alone and 32p for a contractor to hand weed. A full year of results is needed before Glastonbury can be sure of its choice but regrowth so far from the areas treated last summer has been minimal. The manufacturer claims that regrowth drops off the more that the system is used, as seeds in the ground are killed off during treatment, meaning costs should fall over time.

Since it takes only two weeks to cover the entire town, Glastonbury is now looking at whether it can hire its machine out to neighbouring parishes to recoup costs. The town would like to negotiate some clawback of the funds once clear figures have been obtained from the trials. The contractor is not obliged to agree to use a glyphosate alternative, having tendered based on the costs of using the chemical but even if they came to the conclusion that foam wasn't cost-effective or particularly easy to use, and the town council were keen and felt strongly, they were willing to put in the time, effort and money.

There is scepticism about the costs involved as well as the environmental impact of running a diesel machine and heating water. While the contractor's glyphosate spraying cost were in the order of hundreds of pounds, Glastonbury could spend up to eight times as much once hand weeding and the purchase of the foam application machine are included.

Those involved are watching very closely to see how the method performs as the weather warms. Several other local authorities have taken the decision to look at alternatives to glyphosate in recent months, including Edinburgh and Brighton. However, they have all said they want to determine whether alternatives are cost-effective before enforcing any ban.

■ For more information on the hot foam system visit http://weedingtech.com.

Hot foam being applied to weeds on a canal embankment. Heat is applied to the weed in the form of foam and hot water with the foam acting as a blanket, keeping the heat on the weed long enough to kill it. A wetting agent in the foam speeds up the transfer of heat into the weed's cell walls and the weed dies within minutes.

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International Pest Control calendar of events

Please find below a list of key international events in the world of pest management. If you know of a exhibition or conference that is not listed here, please send information to editor@international-pest-control.com. It is sadly not possible to list all the events in the pest control world, however we will aim to publicise as many as possible. If you have attended an event and believe the discussions might be of interest to our readers, we are also interested in receiving reports and photos that you are happy to share with our readership.

Date	Days	Event / Venue / Website
25-Jul-16	5	15th Int'l Conference on Rodent Biology / Olomouc, Czech Republic / http://rodensetspatium.upol.cz/
14-Aug-16	6	7th Int'l Crop Science Congress (ICSC) / Beijing,China / http://www.intlcss.org or http://www.7icsc.com.cn/
18-Aug-16	3	Pest Summit 2016 / Singapore / http://www.pestsummit2016.com/
22-Aug-16	2	9th Brazil Agrochemshow/Sao Paulo, Brazil/http://cac-brazil.com/index.php?s=/home/article/index/category/en_index
23-Aug-16	4	International Pest Risk Research Group (IPRRG) / EFSA HQ, Parma, Italy / https://www.pestrisk.org
27-Aug-16	3	PestWorld East 2016 / Goa, India / http://www.npmapestworld.org/education-events/upcoming-events/pestworld-east/
05-Sep-16	3	2nd Euroasian Pest-Management Conference / Technopark SLAVA, Moscow, Russia / http://www.pestmanagement.su/english/invitation/
11-Sep-16	5	20th Australasian Weeds Conference (20AWC) / Perth, Australia / http://www.20awc.org.au/
14-Sep-16	3	FAOPMA 2016 / Gold Coast, Australia / http://bit.ly/1SWhZS5
21-Sep-16	3	Natural Products & Biocontrol / Perpignan, France / www.biocontrol2016.com
25-Sep-16	5	2016 XXV International Congress of Entomology / Orlando, FL, USA / http://ice2016orlando.org/
04-Oct-16	2	The BCPC Congress 2016 - Changes in European Agriculture - How the Regulatory Environment Might Adapt/ Brighton, UK / http://www.bcpccongress.org/
18-Oct-16	4	PestWorld 2016 / Seattle, Washington / http://conference.npmapestworld.org/
24-Oct-16	2	CropWorld Global 2016/ Amsterdam RAI, Netherlands / http://www.cropworld.com/
24-Oct-16	3	Annual Biocontrol Industry Meeting (ABIM) / Basel, Switzerland / http://www.abim.ch/home-abim.html
02-Nov-16	1	PestTech 2016 / Birmingham, UK / http://www.npta.org.uk/pesttech
16-Nov-16	3	Parasitec 2016 / Paris Event Centre, Paris, France / http://france.parasitec.org/index.php/en/
17-Nov-16	1	Comparative Assessment and substitution of plant protection products / Saint-Amand ,Belgium / http://bit.ly/2afo1yz
30-Nov-16	3	Global Bedbug Summit 2016/JW Marriott Indianapolis, Indiana,USA/http://npmapestworld.org/education-events/upcoming-events/global-bed-bug-summit/
22-Mar-17	2	PestEx 2017 / ExCeL, London, UK / http://bit.ly/1EwYDPn
02-Apr-17	3	2nd Global Summit of Pest Management Services for Public Health and Food Safety / New York , USA / http://bit.ly/25nnLUt
09-Jul-17	4	9th International Conference on Urban Pests (ICUP) / Birmingham, UK

International Pest Control intends to be at the following events, we hope to see you there.

- FAOPMA 2016 Gold Coast, Australia 14-16 Sept 2016
- BCPC Congress 2016 Brighton, UK 04-05 Oct 2016
- PestWorld 2016 Seattle, USA 18-21 Oct 2016
- ABIM 2016 Basel, Switzerland 24-26 Oct 2016
- PestTech 2016 Birmingham, UK 02 Nov 2016
- Parasitec 2016, Paris, France, 16 Nov 2016

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