> *Knowing how adjuvants work is key to getting the most from them.*

Understanding adjuvants

Technical Adjuvants survey

As growers look to squeeze every bit of activity out of herbicides, the popularity of adjuvants has increased. *CPM* takes a look at some of the key principles behind the spray enhancer and speaks to experts to get an insight into how to get the most from them.

By Charlotte Cunningham.

Against a background of ever-changing agronomic pressures, getting the most out of agrochemistry is a key component in successful, profitable crop production.

And while efficacy is claimed to be declining across the spectrum, there are a number of products that fall under the 'spray enhancers' umbrella, which can be useful for growers looking to optimise the performance of chemistry.

Among those are adjuvants, however, these products themselves come in a number of different forms and all vary slightly by way of their purpose and suitability to different situations.

Adjuvants are authorised under Regulation (EC) 1107/2009, which defines them as: "substances or preparations which consist of co-formulants or preparations containing one or more co-formulants, in the form in which they are supplied to the user and placed on the market to be mixed by the user with a plant protection product and which enhance its effectiveness or other pesticidal properties, referred to as 'adjuvants'."

Adjuvants are not plant protection products (PPPs); but, as they influence the way PPPs behave and the effects they have, they are subject to regulatory control, according to the HSE.

Snake oil

"The use of adjuvants started back in the 1970s but, at the time, the phrase 'snake oil' was thrown around a lot," says Mike Thornton, agronomist at Procam. "There wasn't much data behind the products, but that's certainly not the case now and adjuvants can be a really useful tool for getting more from crop protection products."

David Howard, head of integrated crop management at Hutchinsons, agrees: "Adjuvants certainly have a place within the crop protection programme, especially where growers are using lower rates, or trying to keep residuals in the upper layer, for example. Finding where they fit is pivotal for seeing a benefit."

So where do you start when it comes to finding a product that will work for you?

According to Rob Suckling, commercial technical manager at De Sangosse, a sound understanding of both the function of an adjuvant and the issue a grower is attempting to tackle are the fundamentals of any product decision. "We've certainly noted a growing interest in adjuvants — but have also identified a knowledge gap in terms of how they actually work."

This was reflected in a recent *CPM*/De Sangosse survey, where respondents were asked to identify which type of adjuvant assists leaf cuticle penetration. Over half (58%) said oils, 26% believed wetters were a useful aid, and 7% reckoned stickers were the tool for the job. "Though the majority of growers correctly identified oils as the answer, the variation illustrates that a better understanding of different types of adjuvants is key to getting the most from them."

So what are the primary functions of oils, wetters and stickers?

"Starting with oils, adjuvant oils have historically been used to assist the penetration of foliar applied herbicides into difficult or waxy leaf surfaces," explains Rob. "They work by emulsifying leaf surface waxes which ultimately allows better transition of the herbicide into the plant, where it's then translocated to the target action site."

As it says in the name, the purpose of wetters is to reduce static surface tension of spray droplets to improve herbicide coverage — this can be particularly important

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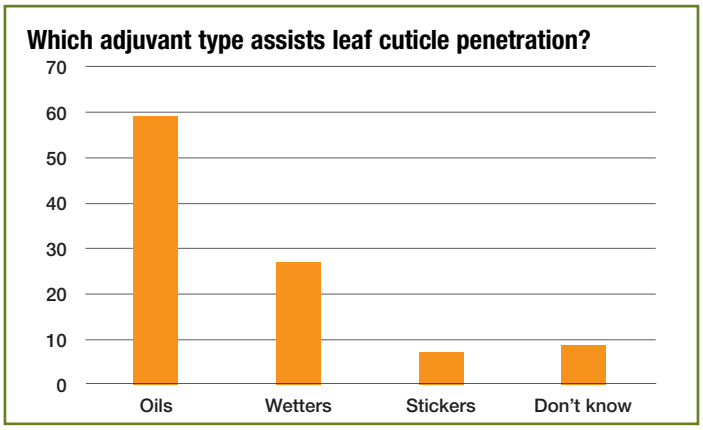
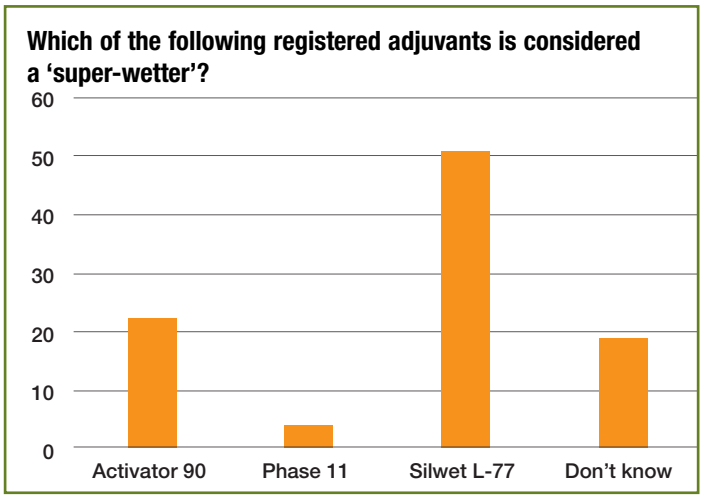




for chemistry like glyphosate, and other water-soluble products, he adds.

And finally stickers which, when used correctly, can improve the adhesion and retention of spray droplets to the plant — i.e. helping it to 'stick', notes Mike. "This type of adjuvant can be really beneficial in scenarios where growers are worried about rainfastness, or if they're irrigating."

In the UK, oils and wetters are the two most frequently used types of adjuvants, adds Rob. "But when it comes to assisting cuticle penetration, while wetters can help, we're really focusing on oils here."

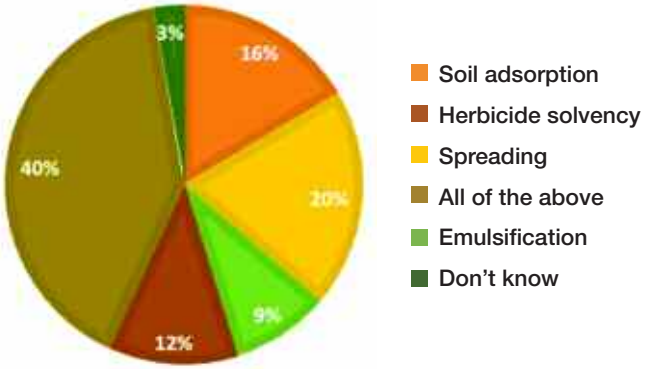
In terms of herbicide compatibility, 57% of growers said they would normally use an adjuvant with graminicides, while 40% said they'd often pair it with a broadleaf weed herbicide. "There's not one correct answer here but generally oils are used with graminicides e.g. cycloxydim," says Rob.

The research and data behind adjuvants has increased significantly since they were first launched, says Mike Thornton.

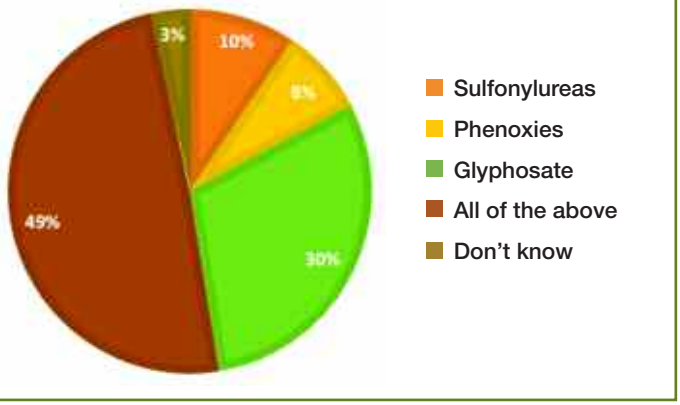
"But they can be useful for broadleaf control too — it all depends on the leaf surface and the nature of the pesticide."

Looking more closely at wetters, the survey asked growers to identify which of the following products could be classed as a 'super-wetter'. Over half (53%) said Silwet L-77, 23% reckoned it was Activator 90, 4% said Phase II and a notable 20% didn't know. ▸

What properties will enhance the effectiveness of a pre-emergence herbicide application?



Which herbicides are affected by hard water?



▸ So what exactly is a 'super-wetter' and what does this mean in terms of product functionality? "Here, we're thinking about the comparison between a standard wetter and a 'super-wetter'," explains Rob. "Effectively, certain wetters have the ability to reduce surface tension to a great extent. If we take something like Activator 90, which is a non-ionic product, it allows droplets to spread six or seven times more than when a product is used without it.

"In comparison, Silwet L-77 improves spray droplet coverage by about 100 times that of the same volume of water alone — thus giving it the 'super-wetter' title. This is possible because of the shape of the surfactant molecules and the ability to drastically reduce surface tension."

The performance and benefits of adjuvants is something that's been tried and tested in numerous trials over recent years.

In a pre-emergence setting, herbicide applications can be enhanced via manipulating a number of properties including soil absorption, spreading, emulsification, and herbicide solvency — as noted by 52% of growers.

And in independent trials, the performance of flufenacet, prosulfocarb, diflufenican and pendimethalin have all been improved when used in partnership with an adjuvant, explains Rob.

"Pre-ems like flufenacet can be enhanced particularly by adjuvant oils — especially when conditions are challenging. Adjuvants work in this situation by improving absorption and retention in the soil profile, as well as helping the product distribute more latterly.

"Adjuvants can also help improve the bioavailability of herbicides by improving access into plants — or more importantly, weeds.

"We've been trialling various adjuvant formulations over the years and looking at their usefulness as an aid to pre-em herbicides since 2012. This has been examined over a variety of conditions, seedbeds and application types and the evidence we've been able to draw is that there is an average uplift in performance of 5-10% when an adjuvant is used."

Thinking ahead to this season, Rob adds that oils may be useful once again. "Seedbeds are going to be difficult this year — particularly on heavy ground where blackgrass is prevalent — and growers will no doubt face time constraints when spraying herbicides. The use of an adjuvant oil may prove to be particularly beneficial where water volumes are sub-optimal."

Hutchinsons has also been carrying out studies with one of De Sangosse's products and has observed a difference in terms of pre-em performance,

Adjuvants vs water conditioners

While both adjuvants and water conditioners both fall under the spray enhancers umbrella, there are some key differences between the two products.

The majority of respondents (89%) to the survey correctly identified that water conditioners are not considered an adjuvants — so what exactly is their purpose? "In a nutshell, water conditioners work simply by sequestering calcium and magnesium ions that make water 'hard'. These charged substances, known as cations, affect the performance of agrochemicals by 'locking up' some of the active ingredient."

Mike adds: "To put it simply, adjuvants optimise the efficacy of a pesticide, whereas water conditioners — unsurprisingly — target just water."

There are differences from a regulatory perspective too. "For example, water conditioners don't need to go through a registration process, but adjuvants do," adds Rob.

Half of growers noted that sulfonylureas, phenoxies and glyphosate can all be affected by hard water. "We've known glyphosate is affected by hard water for a long time, but there's increasing awareness around the implications water quality can have on other key herbicides," he says. "SUs and phenoxies are a prime example of this.

"Using a water conditioner ensures that pesticide components in the spray tank remain in a biologically active form and don't precipitate as salts as the spray droplet dries on the leaf surface."

Product-wise, 89% of growers identified ammonium-sulphate as not being a true water conditioner.

However, De Sangosse's product X-Change is — the efficacy of which has been proven in a series of trials. "In independent trials, the effectiveness of a Roundup product when mixed with hard water, containing 380ppm of $CaCO_3$ equivalent, was found to be improved when the water conditioner X-Change was added. "However, in addition to this, X-Change offers other beneficial properties."

The pH of the spray solution can also affect chemical efficacy and alkaline spray solutions can cause hydrolysis — where the molecules in the active solutions are degraded into inactive products, he adds. "But by adding X-Change into the tank first, ahead of the agrochemical, the pH is reduced to around 4.6 — preventing hydrolysis from occurring."

Another benefit of X-Change is its humectant properties. Humectancy reduces the rate of chemical crystallisation by slowing the drying process. "This gives the plant more time to absorb the pesticide, as its maintained in a fluid state for longer," concludes Rob.

There's a place for adjuvants, says David Howard, but finding where exactly they fit is imperative for justifying any investment.

explains David.

"If we're looking at residual performance with regards to keeping product and spreading it evenly in the active zone — that top 5cm — then the enhancing properties of adjuvants can come in handy — particularly when using something like flufenacet for blackgrass control.

"However, it's not quite as clear cut as just adding an adjuvant to the tank mix and hoping for a benefit — factors like chemical formulation and soil conditions come into it too. And effectively, any adjuvant used has to support that.

"We've looked into De Sangosse's product Byte and have certainly seen a difference compared with untreated plots. However, we've found it works mainly where soil moisture is available — illustrating the importance of taking into account the conditions at the time of application."

So what kind of an uplift can growers expect?

"For most growers using this kind of chemistry, blackgrass is the real focus. With such a weed, every percentage point counts and when we looked at Byte, we saw an average 7% uplift depending on herbicide partners.

"This doesn't sound a lot, but if this is what takes you into that 95%+ control then it's worth the investment." ■

De Sangosse Academy

For those looking to improve their adjuvant knowledge, De Sangosse runs a regular academy programme to help do just that. "Knowledge transfer is key to getting the most out of adjuvants, and the Academy programme arms growers with an understanding of legislation around adjuvant usage and the legal implications," explains Rob. "It also provides training on the difference between adjuvant types, their modes of action and where they fit in crop protection programmes, providing a greater insight into how adjuvants can improve pesticide efficacy."

Growers wanting to register interest in the Academy can do so by getting in touch with De Sangosse directly.

Winner announcement

Congratulations to our winner Richard Brewis from Northumberland who responded to the *CPM*/ De Sangosse survey on adjuvants and has won the fabulous prize of a DJI Mavic Mini Fly More Combo drone.

Richard responded to the survey and completed the tie-breaker question, which asked respondents to detail what they believe getting the secret is for getting the best out of adjuvants.

His answer was: "Know what you are trying to achieve then pick the best product to help you do this."

The answer demonstrated the importance of matching products to the on-farm challenge, which impressed the judges.

To take part in the next survey, make sure we have the correct details for you by emailing *angus@cpm-magazine.co.uk*