Registration of crop protection products: ensuring global safety
Dear Readers,

In Europe, manufacturers who want to gain approval for a crop protection product need to be able to prove, for instance, that the product will not harm bee populations if used correctly. In Japan, however, regulations also demand further studies on another insect: the silkworm. This unique feature of Japanese legislation reflects the particular importance that the moth enjoys in the Far East. This is because its larvae produce silk.

As these examples show, specific regional factors can have an effect on the registration of crop protection products. But basically it always comes down to a question of balance. How can society ensure that farmers are able to produce sufficient quantities of healthy food, fibres and feed? And how can we protect both consumers and the environment at the same time?

In this brochure, we would like to show you how this question is answered in various industrialized nations. In addition, we take a close look at the agriculturally important countries China and Brazil and explain how developing countries cope with the costly and time-consuming process of regulating crop protection products.

One essential driver for a diligent approval process is global trade: nations that export rice or coffee have to live up to the quality requirements of their buyers. In the EU, goods such as these are subject to either import tolerances or very low limit values set in accordance with the precautionary principle.

We hope you will find this brochure informative and look forward to hearing your questions and suggestions. Best wishes,

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In most industrialized nations, registration of crop protection products or their active ingredients are dependent on the risks they pose under genuine agricultural conditions. This so-called risk assessment focuses on factors such as the quantity of a substance that is actually used in agriculture.

Before manufacturers apply for registration of a crop protection product or an active ingredient contained therein, they will usually have carried out hundreds of studies and trials. Experts in laboratories investigate substances for around ten years. They study characteristics such as biological efficacy, toxicity, biodegradability and at which dosage levels they affect life in the soil, water and air. These investigations are carried out in accordance with the international principles of > Good Laboratory Practice (GLP). Following their internal studies, manufacturers must show that their product poses no unjustifiable risk to people, animals and the environment when used properly (for further information see the brochure “Minimize risk – maximize benefits”, p. 42).

In the USA, manufacturers of crop protection products require federal as well as individual state approval. This is provided for in US pesticide legislation: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The Office of Pesticide Programs (OPP) – a department of the Environmental Protection Agency (EPA) – is responsible for approvals at federal level. The office provides the industry with a guarantee that decisions on applications will be made within two years. During this time it assesses the health effects on consumers and users and determines the maximum dosage levels that people may be exposed to. The risks to the environment and nature are examined in an independent process. Here, EPA experts compare the concentrations at which a crop protection product is toxic to the levels that are expected to be found in surface and groundwater, in foodstuffs or in animal fodder. The OPP is increasingly critical of substances that take a long time to biodegrade. Only when federal approval has been granted can the producer apply in the individual states. One state that has particularly stringent regulations is California, which often takes more than a year longer to make its decisions.

As in the USA, Japan also assesses crop protection products and their active ingredients according to the risks they pose under genuine agricultural conditions. Here, the Ministry of Agriculture, Forestry and Fisheries coordinates the approval of crop protection products – a process that takes roughly two years. Evaluations of the toxicity, as well as consumer and user safety are provided by the Ministry of Health and the Food Safety Council (FSC). The Ministry of the Environment assesses the environmental impact. The legislator and the authorities in Japan pay close scrutiny to the approval processes in Europe and the USA. However, they have developed a fully independent process that has its own distinct emphasis. For instance, the Japanese pay particular attention to the maximum residue levels for their favorite foods: fish and shellfish.
Registration in the European Union
In the EU, the member states themselves decide on whether farmers are allowed to use specific crop protection products. However, before such a product is authorized, approval must be granted for any active ingredients it contains. This process is carried out at the European community level. For many decades, the similar principles were used as in the USA and Japan: if the risks posed under genuine agricultural conditions could be safely managed then the substance was approved. In future, however, the EU plans to introduce blanket bans on certain substances.

A crop protection product authorized for use by farmers in France may not necessarily be available in Great Britain or Germany. In accordance with EU law, registration is up to the member states. That means that if a producer wants to market a product in eleven EU countries then the product must be evaluated by all eleven. As a rule, the national authorities require one to two years to grant registrations – in some countries even more. However, before a manufacturer can even apply for authorization of a new crop protection product, the following question must be answered: when used properly, is its active ingredient safe for people, animals and the environment? Sometimes many years can pass before this decision is reached; years during which independent experts examine the manufacturer’s data.

Within the EU, the evaluation of active ingredients is the responsibility of the European Food Safety Authority (EFSA), which works in close cooperation with the EU member states. The EFSA reports to the European Commission which then passes on the recommendation to the Standing Committee on the Food Chain and Animal Health (SCFCAH) for final approval. In this committee, the majority of member states must approve any active ingredient before it is added to a “positive list.” This list contains all substances that the industry is allowed to use in its crop protection products.

The registration of crop protection products at national level and the approval of active ingredients at EU community level are two clearly separate processes. However, it is not only in this respect that Europe differentiates itself from other industrial regions. Unlike in the USA, Canada, Australia or Japan, the EU’s risk-based evaluation will, in future, be subject to a preliminary hazard-based evaluation. EU regulation EC 1107/2009 will be in force beginning on June 14, 2011. This means that active ingredients will not be eligible for approval if laboratory tests have shown them to be carcinogenic, to cause changes to genetic material, or to be toxic to reproduction. These > cut-off criteria apply regardless of their dosage levels in a crop protection product and whether it may have undesirable effects in practice.

The benefits of this new system are clear: it will simplify and accelerate the complex process of evaluating active ingredients. Scientists, however, expect a certain degree of negative fallout in terms of productivity and the international competitiveness of European agriculture. In the future, farmers in the EU will have to do without crop protection products that are available – following likewise stringent testing procedures – to their counterparts in regions such as the USA and Japan.
Registration in Brazil
Brazil has developed from being a food importer to one of the world’s major exporters of coffee, soybeans and beef. This “agricultural superpower,” as the > BBC described it, also has aspirations to become a front-runner in terms of environmental and consumer protection. This is clear, for instance, by its cut-off criteria for crop protection products. These will remain applicable until the country’s authorities have introduced a risk-based approval process.

More than a third of all products exported by Brazil are produced by its agricultural sector. Agriculture is so important here that the president himself personally presents the annual Plano Agrícola e Pecuário (Agricultural and Livestock Plan, PAP). Luiz Inácio Lula da Silva, in office since 2003, plans to make Latin America’s largest country into “the world’s granary.” According to PAP agricultural plan, the government intends to “develop sustainable production methods and protect natural resources.” Consequently, a debate has been raging in Brazil for many years as to what “sustainable” actually means – just as it has in Europe. This discussion has focused on modern technologies and methods, including chemical crop protection. One good example of how these methods can save resources through higher efficacy is rice cultivation. According to FAO statistics, the amount of land devoted to this crop halved between 1987 and 2007. Higher productivity, however, more than makes up for the reduced area: Brazilian farmers now produce 120 percent more rice per hectare than in the late 1980s.

> BBC article: http://news.bbc.co.uk/1/hi/business/7567778.stm
> Agricultural plan (in Portuguese): www.agricultura.gov.br

Greater yields from smaller areas – to achieve this, modern crop protection products are essential. The government also realizes, however, that there is a risk associated with every benefit. This has been correspondingly reflected in the legislation. Since 2002, only manufacturers that have conducted their studies according to the principles of > Good Laboratory Practice (GLP) have been eligible for approval. The law also provides for the introduction of a risk assessment along the lines of the model in the industrialized nations. Building up the scientific and organizational structures for this system is not, however, something that can happen overnight. Consequently, the authorities are currently drawing up > cut-off criteria to preclude certain risks from the outset.

> www.inmetro.gov.br/english/glp/index.asp
> www.anvisa.gov.br/eng/index.htm
> www.anvisa.gov.br/eng/toxicology/tests.htm

This regulation has led to some manufacturers of crop protection products to refrain from applying for registration altogether. Active ingredients that can be legally used in neighboring countries are thus not available in Brazil. Scientists point to one likely consequence of this: with a lack of alternatives available, many pests will build up resistance against the remaining substances.

Russia closes the gap

Like Brazil, Russia wants to enter foreign markets for its agricultural produce and is striving to accelerate its accession to the World Trade Organization (WTO). To ensure that its agricultural products meet the quality standards demanded by potential customers, Russia has announced a number of measures including the adoption of European limit values for pesticide residues.
China’s new legislation
In former years, China has been hit by a number of food scandals. The government has taken action and in summer 2009 passed a new food safety law. This followed the introduction of a series of new crop protection regulations the year before. These are closely based on their counterparts in the USA and EU.

The Chinese food safety law of 2009 introduces a number of provisions including nationwide standards for the use of chemical substances, stronger punishment of violations, and more frequent monitoring of food products. The World Health Organization (WHO) has praised China for learning from the mistakes of the past. In a speech, Hans Troedson, the WHO’s representative in China, said: “The law embodies the general principles and requirements of a modern food law, in line with FAO [Food and Agriculture Organization of the United Nations] and WHO guidelines.”

The food safety law followed the introduction of new crop protection laws in 2008. These are mostly based on the standard processes in the USA and the EU, but also allow for local factors. The authorities in China, for example, place great emphasis on the ability of a crop protection product to survive storage periods of up to two years undamaged. After all, the distribution channels in the People’s Republic are often very long. China has adopted a regulation that also takes one of its own regional features into account: the industry is required to scientifically demonstrate that correct use of a crop protection product will not lead to any harm to the silkworm moth. Its larvae produce a valuable raw material: silk.

Studies carried out outside of the country for crop protection products that are to be approved in China already have to be conducted in accordance with Good Laboratory Practice. That means that foreign manufacturers only have a chance to access the Chinese market if they produce data to the same standards seen in the Western industrial nations.

The indications are that the Chinese government also intends to implement this for studies carried out within China. It is a step that could have serious consequences for the market, as GLP will separate the wheat from the chaff. This could spell the end for many domestic producers, however, as GLP is only possible for companies with modern laboratories and high scientific standards. Whether all companies actually provide a sufficient level of environmental and consumer protection will be difficult to monitor.

A practical approach in India

India is another country that orients itself to a great degree on the standards of the industrial nations. The authorities can call on highly qualified employees to check and evaluate the industry’s own studies. As far as the evaluation of active ingredients is concerned, India has opted for a scientific approach to risk assessment. In discussions with BASF, the authorities’ main argument has been that domestic agriculture is required to produce food for a population of more than a billion people. Excluding effective substances from the outset without any scientific testing would put production at risk.
Registration in South-East Asia
China is the world’s biggest producer of rice. But it needs its harvest primarily to feed its own huge population. Thus two smaller Asian countries play the leading roles in world trade: around half of the rice traded worldwide comes from Thailand and Vietnam. In view of the huge economic importance of this crop, it is not surprising that farmers in these countries protect their crops against pests.

The crop protection products used in South-East Asia are seldom subject to the same kind of strict approval system that is standard in the EU. The effort involved and associated costs would simply be prohibitive. Despite this, there are basic structures in place for approval. For instance, the states in the region only assess a substance after it has been registered in the USA, Japan or the EU. The industrial nations themselves produce large quantities of rice. Therefore they evaluate and register the products offered by the industry to protect these crops. Vietnam, Indonesia, Sri Lanka and Taiwan will not even consider approving a product that has not already been approved somewhere else.

The countries of South-East Asia also pay special attention to how well substances can be tolerated by fish stocks. For one thing, crop protection products are not allowed to have any adverse effect on mosquito-eating fish such as the paradise fish (Macropodus opercularis) that live in the paddy fields. For another, many farmers also raise fish to eat in the spaces between their rice crops. In other words, the crop protection must be compatible with the animals that are also a food source.

Nevertheless, even in South-East Asia there are still often cases of deliberate or accidental misuse of crop protection products. Regardless of how careful the government authorities act when it comes to registration, in the end it comes down to the correct and responsible usage (Good Agricultural Practice).

Short grain, long grain

Even statistics can throw up puzzling questions. How is it that Italy, according to the FAO, is both one of the largest importers of polished rice, yet at the same time one of the largest exporters too? It all comes down to the varieties. The EU is able to cover two-thirds of its rice requirements from domestic production. On the plains of Italy and Spain there are large areas dedicated to growing short-grain rice. Long-grain varieties, on the other hand, have to be imported into the EU from Asia – from sources such as India and Thailand. These products are subject to EU import regulations – including in terms of residues of crop protection products. Asian rice exporters must ensure that their growers adhere to the strict European limits. For residues of products not approved for use in the EU, the precautionary limit of 0.01 mg/kg applies (see p. 30/31). If residues were to exceed the precautionary limit, then European consumers would have no basmati rice. And Asian producers would be restricted to selling to other customers.
A broad spectrum between “not approved” and “banned”
In October 2008, Greenpeace published an analysis of herbs and spices in which the environmental organization tested to see where residue limits had been exceeded. The paper also revealed that a quarter of the substances discovered were “not approved” in the EU. Many newspapers modified this seemingly long-winded formulation into “banned.” But the two expressions certainly do not mean the same thing.

One example illustrates why: Greenpeace found permethrin in chili powder. The European approval for this substance in crop protection products elapsed several years ago and its manufacturers never applied for an extension. This was not because permethrin had been revealed as harmful to health. But rather because farmers had turned to other products instead. Nevertheless, permethrin is still around. It is used, for example, in anti-louse shampoos. And also to protect woolen carpets from insect damage. At the right dosage, permethrin can combat pests without posing any danger to the environment or consumers.

Unlike in the EU, American farmers are still permitted to use products containing permethrin. In the southern states, for example, such insecticides are used to combat the weevils that can infest the peppers that are used to make chili powder. US authorities have set a > reference dose (RfD) of 0.25 mg/kg for permethrin. This is the dose that a person could safely consume every day for an entire lifetime without being exposed to any associated health risks. The chili powder examined by Greenpeace was found to contain 0.02 mg/kg of permethrin – in other words, less than a tenth of the RfD. Nevertheless, the environmental organization was completely correct when it argued that the findings constituted a breach of EU law. This is because permethrin, like many other substances, is subject to the blanket precautionary limit of 0.01 mg/kg (see next chapter).

Greenpeace repeated its spice test in October 2009. This time the organization actually did find a substance that is expressly banned in the EU – DDT. But this does not mean, however, that spices are not allowed to contain any residues of this substance. DDT is still registered in many subtropical countries as an insecticide, primarily due to its effectiveness in preventing malaria. To enable these countries to export agricultural products to the EU, a so-called import tolerance is applied. Spices may contain up to one milligram of DDT per kilogram. Greenpeace discovered levels at around one-hundredth of the import tolerance in the curry powder they tested. Thus, the test results confirmed that there was no danger to consumers or a breach of EU law. Despite this, headlines like “Poison on the sausage” or “Spiced with poison” appeared in a number of newspapers.
Safety standards for foods imported into the EU
Crop protection products are tailored specifically for certain crops or pests and the climatic conditions in the respective growing area. For this reason, most registrations are only valid for a particular region and not worldwide. A very low, blanket limit value has been set for residues of crop protection products that are not approved for use in the EU – the so-called precautionary limit.

Bananas from Costa Rica require completely different protection from British apples. Therefore manufacturers of crop protection products usually only apply for registration in the regions where their product is actually needed. The sheer cost alone is a major factor. In the USA, for example, a manufacturer has to pay upwards of 600,000 dollars when applying for registration of a new active ingredient. Every subsequent national registration means immense additional expense and effort, can last many years and, of course, has an uncertain outcome. After all, there is no guarantee that an authorization will be granted.

Low-level residues of chemical crop protection products are sometimes unavoidable in areas where agriculture is trying hard to produce sufficient quantities of food or animal feedstuffs – for instance, in South America or Asia. Simply turning these foodstuffs away at the European borders is not a realistic option. Trade would come to a standstill. The EU institutions thus have to balance two different interests. On the one hand, they have the consumers demanding tropical fruits, coffee, rice or pistachios at reasonable prices in the supermarkets. On the other hand, imported goods have to fulfill the same high consumer protection standards applied to domestic produce. One solution is import tolerances (see p. 27). If no such limit has been set for residue levels, then the precautionary limit applies. In the EU, this is set at 0.01 mg/kg.

"Unlike the > limit values set by the licensing authorities for individual active ingredients, blanket maximum limit values are generally not scientifically based," states Professor Fritz Führ from the research institute Forschungszentrum Jülich in Germany. "They are derived from the > precautionary principle, in other words, they are politically motivated and tell us nothing about the actual risks to health and the environment that may arise if they are exceeded." According to current scientific knowledge, residues below 0.01 mg/kg have usually no adverse effect on human health and the environment, maintains Fritz Führ. Thus, consumer protection in Europe is more than adequately served.

Remaining realistic: the EU’s import tolerances

Numerous substances that are used in other parts of the world are not utilized in Europe. If the EU has set no > maximum residue levels for these substances then the precautionary limit applies. Upon request, the relevant authority will, however, set an import tolerance. This can only be granted "if the residue level in the imported goods represent no danger to the health of consumers."

More information is available at [www.bfr.bund.de/cm/276/fragen_und_antworten_zu_pflanzenschutzmittel_rueckstaenden.pdf](http://www.bfr.bund.de/cm/276/fragen_und_antworten_zu_pflanzenschutzmittel_rueckstaenden.pdf).
Outlook: more cooperation during registration
Manufacturers of crop protection products often submit the same data packages to more than one country for registration. The different national authorities consequently end up carrying out practically identical evaluations. In the meantime, farmers are left waiting for an effective means to control pests. The Organisation for Economic Co-operation and Development (OECD) would like to see this waste of resources come to an end.

In 1994, the OECD states agreed to exchange their national assessments of crop protection products. By 2014 they plan to have:

- standardized the dossiers that chemical companies hand in with their applications,
- harmonized the format of the reports that governments draw up on pesticides,
- set up an electronic database to inform people about the effects of chemical substances, which potential dangers they might have, and how likely it is that people or the environment will be exposed to these dangers, and
- documented which residues of crop protection products are left behind depending on regional circumstances. Regions with similar climates or geologies can thus profit by exchanging their experiences.

A standardized format would not only help the OECD member states to save time and money, but would also be beneficial to developing countries. A number of countries in Africa, for example, only have limited regulatory resources for thoroughly evaluating crop protection products. They therefore look to the industrialized nations for guidance: if one or more of these countries have already subjected a product to sound scientific evaluation and issued corresponding registration, then they are often prepared to approve it for use in their own country. One good example of this is imazapyr. This is a substance that is approved in a number of countries, including New Zealand and the USA, and is a core component of a crop protection system used by BASF in cooperation with governmental and non-governmental partners in Kenya. The product is called StrigAway and is used to combat Striga, commonly known as witchweed. This parasitic plant regularly destroys between 20 and 80 percent of Sub-Saharan maize crops.

Manufacturers of crop protection products already recommend to emerging markets and developing countries that they use the industrial nations’ databases. The Brazilian National Association of Plant Defense (Associação Nacional de Defesa Vegetal) for instance, refers the government in Brasília to the Pesticide Handlers Exposure Database (PHED). This information collection run jointly by the US EPA and the Canadian Ministry of Health describes thousands of chemical substances that are used in agriculture. Even industrial nations such as Australia and Great Britain are enthusiastic users of this information. The PHED also answers questions that are often not covered by any European databases because the data is not relevant there: for instance, how do substances behave in regions with similar conditions to Brazil?

The various nations of the world all have differing opinions on how consumer and environmental protection can be balanced with the need to produce sufficient quantities of foodstuffs. Companies like BASF therefore work hand in hand with authorities around the world to facilitate approvals, and take regional and national factors into account in the process. Without leveling these differences, improved international cooperation will make it easier to corroborate the potential effects of a crop protection product. This will make the use of crop protection products even safer, which will contribute to the further success of agricultural production.

Outlook: more cooperation during registration
ADI (Acceptable Daily Intake): Limit value for the daily amount of a substance that people can consume for their entire life without any recognizable damage to their health. The ADI is calculated by dividing the > NOAEL by a safety factor of at least 100. If, for example, the NOAEL is set at 1,500 mg/kg body weight, then the acceptable daily intake for a human being would be 15 mg/kg body weight.

ARfD (Acute Reference Dose): Limit value for the amount of a substance that a person can consume within a single day without any recognizable damage to their health.

Cut-off criteria: The EU bans active ingredients that fulfill one or more of the so-called CMR criteria when administered in a high dosage. C stands for carcinogen (causing cancer), M for mutagenic (causing changes to genetic material) and R for reprotoxic (toxic to reproduction). Another exclusion criterion is endocrinological effects – these are effects on the hormonal system. This ban remains in force even if it has been shown that the effects only occur with extremely high dosages.

Good Agricultural Practice (GAP): A collection of general guidelines for agricultural production. This includes adhering to the basic principles for integrated pest control in a certain climatic zone, using only the amount of crop protection products required to achieve the desired effect, and respecting the upper limits for allowable residue levels in foodstuffs.

Good Laboratory Practice (GLP): A quality assurance system devised by the OECD which formally regulates the scientific analysis of chemical substances. The GLP not only makes the results of studies more transparent, but also the individual steps used. In the EU and many countries of the world, laboratories and research establishments must show that they have adhered to the principles of GLP. These include standards for organizations, personnel, rooms, test and reference substances, working instructions, results reports and archiving.

Limit value: To ascertain the hazard potential of an active ingredient, the authorities analyze data that manufacturers of crop protection products have derived from animal testing. During these experiments, scientists test to find out which effects high dosages of a substance can elicit. This is the basis for the so-called > NOAEL. To ascertain the human toxicological limit values > ADI and > ARfD, the NOAEL is again divided by a factor of at least 100. This method of deriving limit values is recognized by a number of worldwide organizations including the World Health Organization (WHO) and the Food and Agriculture Organization (FAO).

Maximum residue level (MRL): Residues of crop protection products in foodstuffs must be as safe and as low as possible for consumers. The MRL value – determined by the European Commission – indicates the maximum permissible residue level in or on food or feedstuffs. The values can be called up from the MRL database on the Commission’s website. http://ec.europa.eu/sanco_pesticides

NOAEL (No Observed Adverse Effect Level): The highest dosage of a substance shown to elicit no adverse reaction during animal testing.

Precautionary principle: This principle, which was introduced by the EU in 2000, is designed to protect consumers from potential dangers whose actual risk levels have not been sufficiently identified. The principle is applied to chemical substances when the EU has no solid information available. If the manufacturers have provided their data packages exclusively to non-European authorities, then the EU cannot assess the risks. Therefore, to be on the safe side, a limit value is applied to these substances that is substantially lower than any that has ever been worked out for the individual active ingredients.

Product stewardship: The responsible and ethical management of crop protection products throughout the entire product life cycle – from development and use to disposal in line with regulations. BASF works closely with clients, suppliers and users and supports, for example, training courses in numerous countries where farmers are taught the responsible use of crop protection products. To ensure that safety and environmental standards are maintained, even in the less developed countries, BASF has developed usage instructions for illiterate farmers. These use illustrations to show how crop protection products are to be used correctly.

Reference dose (RfD): The standard term for ADI used in the USA.
The manufacturer submits the dossier to the Office of Pesticide Programs (OPP), a department of the Environmental Protection Agency (EPA). The relevant divisions at the OPP (Health Effect Division and Environmental Fate and Effects Division) examine the possible effects on consumer health (residues, consumer safety, exposure) and the environment (environmental behavior, ecotoxicity, effects on endangered species). The OPP’s approvals division decides whether the active ingredient is safe (safety concerns, additional requirements, discussions with the benefit department). If it is, the Environmental Protection Agency (EPA) arranges for it to be registered in the individual U.S. states.

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Appendix: Registration Processes

**Europe**

- The manufacturer submits the dossier to a rapporteur member state (RMS).
- The RMS assesses the documents and produces a draft assessment report (DAR).
- If the active ingredient is safe for humans, animals, and the environment, the RMS proposes that it should be included in the positive list.
- The European Food Safety Authority (EFSA) consults the other member states about the active ingredient (peer review process).
- The EFSA discusses criticisms in writing and lists any remaining questions (EFSA conclusion).
- The European Commission proposes whether the active ingredient should be listed (positive list) or not.
- All member states vote on the active ingredient at the Standing Committee for Food Safety and Animal Health (SCFSAH).

**Brazil**

- The manufacturer submits the dossier to three federal ministries.
- The Ministry of Agriculture (MAPA) checks whether the substance works as it should.
- The Ministry for the Environment (IBAMA) examines its impact on the environment.
- The Ministry of Health (ANVISA) assesses the health risks.
- The Ministry of Agriculture permits national registration.
- In addition to national testing, the substance must be registered with the individual federal states.
Your contacts

The content of this brochure has been compiled by a large number of registration experts from different countries.

We hope the information provided here is helpful and stimulates further discussion.

We are keen to hear your viewpoints and answer your queries. We very much welcome your feedback and look forward to hearing from you.

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- Crop protection – that’s for sure!
- Minimize risk – maximize benefits
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- Biodiversity and agriculture

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