



Seeding Positive Impacts: How Business and Civil Society Can Contribute to the Sustainability of Chinese Agriculture

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About this Report

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Introduction

Product safety, farmer health, dead waters—each of these concerns is linked to China's agricultural supply chains. As farming becomes increasingly industrialized and commercialized, what role can the private sector play in making Chinese agriculture more sustainable?



China has one of the lowest levels of arable land per capita, due to high population density and large swathes of land that are unsuitable for agricultural production. In addition, the rapid rate of urban expansion means that arable land is continuing to shrink. Even as resource pressures increase, the practical and political objectives of maintaining national self-sufficiency in food production remain strong. Accordingly, agricultural production is becoming more intensive, with increasing impacts on environmental and human health. In response to growing public concerns over food safety and environmental degradation, government agencies and civil society groups are working to reduce the negative impacts of agriculture on the health of producers, consumers, communities, and the natural environment.

For companies sourcing agricultural products in China, this trend parallels their own concerns and initiatives to improve product safety and supply chain sustainability. As public awareness and legal enforcement have yet to catch up to the standards of global markets, the private sector plays an important role in proactively safeguarding consumers and working to minimize the impacts of their own supply chains.

As agriculture in China becomes more consolidated and commercialized, there are more opportunities for large-scale retailers and food processors to expand their operations and supply networks. However, companies operating in this context still face major interlinked challenges of product safety and negative environmental health impacts of current farming practices. Responsible companies are working to address these concerns simultaneously through a combination of strict standards, supplier evaluation and training, and innovative products and production methods.

This report highlights some of the key environmental health impacts of agricultural supply chains in China¹—from farm-level impacts related to pesticide and fertilizer use, to the processing and packaging of the final product—and business efforts to address these impacts. It also offers recommendations for companies currently in the process of establishing and refining their supply chain sustainability programs. Since the top priority for companies and consumers usually is product safety, much of the report describes the work that companies and civil society groups are doing to ensure that pesticides are used appropriately. As traceability and supplier performance in this area improve, companies also are expanding the scope of their sustainability efforts to address fertilizer overuse, water efficiency, wastewater discharge, and environmentally-friendly packaging.

Protecting Consumers

Traceability is the ability to provide consumers with a safe product that can be linked back to a trusted supplier who adheres to strict standards for production.

Restructuring Supply Chains for Traceability

Carrefour, Wal-Mart and others are building supplier relationships directly with farm associations. Under Carrefour's Direct Purchase program, the company now buys fruits and vegetables directly from more than 200 farm associations, and that number that is steadily growing.

TRACEABILITY

Companies sourcing agricultural commodities in China must contend with a highly fragmented supply base, and due to significant food safety concerns, one of the top priorities is traceability. Thus, companies are increasingly proactive about identifying exactly where the raw materials for their products are sourced, and how those products are produced and processed. This is simpler for some products than others, depending on the degree of specialization and scale of production—orchard fruit can be much easier to trace than vegetables—but the overall trend is that companies are making intensive efforts to collect and manage increasingly granular information about their supply chains, all the way to the farm if possible.

While technological solutions and improved data management are one component of the solution, some companies have taken steps to restructure their supply chains in a way that improves transparency. Several large retailers in China have been shifting their sourcing strategies to eliminate middlemen and purchase produce directly from farmers. Not only does this approach reduce the price of produce and improve traceability, but it also enables retailers to communicate their standards and expectations more readily to farmers, and provides an opportunity for other types of training.

PESTICIDES

Pesticide issues are a priority for companies due to the direct impact on consumers and the high level of public visibility and awareness. Consumer awareness of the risks and prevalence of pesticides is growing, and food safety concerns resonate in the wake of recent scandals over contaminated dairy products. Domestic media outlets frequently feature pesticide residue cases, such as nearly 10,000 kg of contaminated vegetables found in Nanning,² or the detection of illegal pesticides in shipments of cowpeas from Hainan.³

Background: Pesticide Pollution in China

Heavy pesticide use in China has caused serious environmental degradation, economic losses, and negative health impacts.⁴ The widespread use of pesticides means that residues are now ubiquitous in samples of air, surface and ground waters, soil, and food products, with serious potential risks to ecosystems and human health. With an estimated efficiency of less than 30 percent, pesticide residues are being transported to the environment through wastewater discharge, runoff, and leaching.

Studies in China have identified negative impacts from pesticides including air contamination,⁵ excessive concentrations of pesticides in wells and drinking water sources,⁶ and long-term contamination of soils including high levels of heavy metals.⁷ All of these issues directly impact the health of farmers and surrounding communities, and current exposure levels have been linked with impaired childhood development, reproductive problems, and cancer.⁸

Inappropriate pesticide use—getting the timing or amount wrong—affects consumer health when fresh produce is contaminated by residues. Overuse impacts local ecosystems by altering population dynamics and threatening vulnerable species.

The Role of NGOs

NGOs can play a crucial role in raising public awareness, which then supports sustainability efforts of the private sector by shifting expectations.

- » Greenpeace ran a campaign against large-scale retailers to highlight what companies are doing to limit pesticide contamination of their fresh produce. Greenpeace tested fruits and vegetables for residues and publicized the results, asking the retailers to publicly commit to progressive policies on pesticide reduction.
- » The Yunnan-based NGO Pesticide Eco-Action Centre (PEAC) hosts educational events for urban consumers in Kunming to provide detailed information related to health issues and toxicity concerns. PEAC also sends SMS messages to its network with information on pesticide health impacts and methods for risk reduction.
- » Green Anhui has conducted a series of activities in Bengbu related to chemical safety with an emphasis on pesticides, including lessons for primary school students, various exhibitions that provided residents with information about chemical safety, and field visits to pesticide factories.

The use of banned and counterfeit pesticides is also a serious problem in China, as illegal pesticides make up an estimated 20-30 percent of products available on the market.⁹ Illegal organochlorine pesticides, which continue to circulate on the market, are of particular concern because of their chronic toxicity, persistence, and bioaccumulation.

Apply strict standards on product safety. The level of harmful chemical residues on vegetables sold to consumers is a primary concern for food and agriculture companies. Tests by Greenpeace of vegetables from local outdoor markets as well as large international supermarkets in nine different cities found widespread evidence of pesticide residues, including banned chemicals and combinations of up to 13 different pesticides.¹⁰ Because of the risk of contamination, most retailers and food processors conduct tests for pesticide residues in their products. Carrefour tests for 179 different pesticides and heavy metals—not just those which are restricted under Chinese government regulations—and requests that their suppliers provide evidence of which pesticides are being used on crops. Unilever also does fieldwork to survey which pesticides are available in local markets, to make sure that they are testing for the right chemicals. Other companies and collaborative groups apply strict standards and detailed guidance that suppliers must agree to follow. The Ethical Tea Partnership Standard, for instance, includes requirements for tea estates on pesticide selection and application.¹¹

Carrefour's shift to buying more products through their Direct Purchase program gives the company opportunities to work with farm associations directly to provide training on appropriate use of chemical inputs and food safety. For the company's own branded products, the "Carrefour Quality Line," there are even stricter standards and detailed production specifications. Carrefour also conducts stringent social and environmental audits of suppliers.

In addition to establishing standards and requirements for supplier practices, companies can provide guidance on how to implement those standards more effectively. Unilever has taken an innovative approach to helping suppliers reduce the use of low-quality and illegal pesticides. They suggested to a domestic tomato supplier that it create a centralized pool for farmers to purchase selected pesticides and fertilizers. This not only helped to ensure that high-quality products were being used, but also reduced costs through negotiation of a larger bulk contract. Farmers can use the inputs on credit, and then return the investment at harvest time. Unilever uses their knowledge of strict export regulations and product quality and efficacy to provide advice to suppliers on which pesticides should be selected for inclusion in the bulk purchase.

Raise consumer awareness and stimulate demand for safe products.

By educating customers about product quality issues and the safeguards that are in place, companies can help to create and maintain demand for improved performance. One way is to publicize the types of policies and protocols that are being used to protect consumers. A few NGOs in China have also been active with campaigns about pesticide residues and product safety, which boosts consumer awareness and demand for both improved regulation and certified products. Opportunities exist for companies to cooperate and even partner with NGOs and media.



"We're really not the same!" Greenpeace pamphlet educates consumers on pesticide policies of different supermarkets in China.

Food Safety Regulations

National Chinese government regulations on food product safety establish the precise limits on pesticide residue that must be met for products to be sold domestically.

There are three different food certification systems, all overseen by the Ministry of Agriculture: Pollution-Free, Green, and Organic (see box on p. 8 for details). Of China's 122 million hectares of farmland, 2.5 percent is certified as organic production, 8.2 percent as Green Food, and 17.3 percent as Pollution-Free. More than 70 percent of the country's agricultural land is not certified under even the basic standard.

The availability of organic produce and consumer demand for chemical-free produce is still quite low, due in part to the high price. Carrefour, for example, offers some organic produce in its stores, but it makes up a very small portion of sales (5.3 percent of vegetables and 0.08 percent of fruit).

Utilize the regulatory context to push sustainability forward. There are competitive benefits from a strengthened regulatory system and more effective enforcement of standards. Better regulation can sometimes be achieved through dialogue with relevant government agencies to improve standards and support for building capacity. Effective local-level enforcement of banned pesticides would help to ensure that farmers use approved chemical inputs in production. Support for stringent application and expansion of the food certification standards and systems would provide benefits for both companies and customers.

Chinese Food Certification Standards	
<p>Pollution-Free</p> 	<p>Produced in accordance with national food production technical standards and general health and safety requirements. Pollution-free food is supposed to be the baseline for all food products.</p>
<p>Green Food</p> 	<p>Promoted since the 1990s, Green Food has two grades: A and AA. The A grade allows limited use of chemical inputs, and AA is much stricter – no synthetic fertilizers, pesticides, food additives and other substances with negative impacts on environment and health are allowed in the production process.</p>
<p>Organic</p> 	<p>The Chinese national organic standard was established in 2005, and strictly prohibits the use of pesticides, chemical fertilizers, hormones and other synthetic substances, and genetic engineering. Conversion to organic production is also regulated and the process takes 2 to 3 years.</p>

In addition to support for relevant standards, companies also have opportunities to support implementation efforts and policy formulation by providing relevant scientific information and regulatory benchmarking. This is one area where NGO partnerships may prove particularly effective, as some NGOs engage directly with relevant government agencies to offer recommendations on policy. Greenpeace frequently provides comments and suggestions on regulatory issues; such as their recommendation that China ban pesticides that are outlawed in other countries. PEAC incorporates recommendations and policy advice for decision makers as one of its key strategies, providing relevant information such as international scientific studies that assess both benefits and hazards of different pesticides.

Innovate in product and method redesign to limit chemical use. Companies can also seek ways to innovate both in terms of product design (e.g. for agricultural chemicals) and methods of production, in order to help suppliers produce crops in a way that has less impact on environmental and human health. Unilever's main supplier of mushrooms traditionally mixed pesticide into the top layer of soil in order to limit competing fungus species, and this process left some residue present in the final product. When export requirements reduced the Maximum Residue Level, the mushrooms no longer passed the standards for the EU market. Unilever experimented with alternative methods and was able to substitute chemical fungicides with a non-toxic steam treatment to sterilize the

soil, along with more stringent procedures for soil handling to limit the introduction of other fungus species.

Demonstration sites are a helpful way for companies to introduce innovative products that reduce environmental impacts, in order to convince skeptical farmers that new techniques and products are worth trying. Syngenta is currently working with China's National Agro-Technical Extension Service Center (NATESC) to conduct demonstrations of product application in a rice cultivation system, providing practical evidence of the field results of new products that require less volume and frequency of application.



Protecting Farmers

Basic education on the use of personal protective equipment (PPE) during pesticide preparation and application is crucial for ensuring that farmers minimize direct contact with pesticides. This includes proper use of protective clothing, and bathing and washing clothes after pesticide application. As one of the simplest steps that farmers can take to protect themselves, many companies provide training on protective equipment and hygiene guidelines.

Safe Use Training

Third-party evaluation of the Safe Use training at selected project sites found substantial improvements in farmer practices. Participants in the training were more confident in product selection, and more likely to use appropriate methods for application, personal protection, and disposal. The evaluation also found that more precise use of products reduced the amount of chemicals that were applied, and thus actually reduced farmers' costs. Independent evaluation can be useful for quantifying impact and identifying areas in training content or approach that need to be improved.

While much of companies' work on pesticide issues emphasizes the final impact on consumers, farmers themselves are also significantly affected. Unsafe application techniques, a lack of basic protective equipment, and inappropriate disposal of used containers all contribute to high levels of exposure for not only the people applying pesticides, but also family members and local communities. The public health impact of pesticide use occurs at both ends of the supply chain, and companies have an important role to play in helping to educate farmers regarding their own safety and the safety of those around them. Most of this work currently occurs through training programs, often in partnership with academic institutes and government agencies.

PESTICIDE USE AND SELECTION

Through the industry association CropLife, several companies cooperate with China's NATESC to provide "Safe Use" training for farmers. Between 2001 and 2006, companies carried out 600 trainings in 109 sites, with participation of more than 40,000 farmers, technicians, and dealers.¹² While targeted at farmers, these trainings also are designed to include extension specialists and product retailers as they can serve as multipliers that share information with even more farmers through their daily interactions. CropLife China members include BASF, Bayer CropScience, Chemutra, Dow AgroSciences, DuPont, FMC, Monsanto, and Syngenta.

Safe Use Training Content	
<i>Pesticide selection</i>	Choose products that have low residues, low toxicity, and are environmentally friendly.
<i>Label reading</i>	Look for information on toxicity, target crops, pest spectrum, application timing, post-harvest interval, and safety requirements.
<i>Application time</i>	Apply pesticides in early mornings and late afternoons.
<i>Measuring pesticide</i>	Use precise methods to ensure accuracy and minimize mixing of chemicals.
<i>Protective equipment</i>	Wear protective gear such as gloves, long sleeves, and boots while mixing, loading, and spraying.
<i>Hygiene</i>	Don't smoke or drink when using pesticides, and wash your hands, bathe, and change and wash clothes after spraying.
<i>Container disposal</i>	Collect, rinse, and properly dispose of used containers.
<i>Sprayer maintenance</i>	Check for leakage and repair, and clean after use.
<i>Pesticide storage</i>	Store chemicals in secure locations.

BASF, Syngenta, Bayer CropScience and others also provide their own trainings to farmers. Since companies that produce agricultural chemicals often have large networks of sales and marketing professionals, staff members can also provide information on how to use chemicals safely and appropriately. Syngenta estimates that its employees have now trained more than 2 million farmers, technicians, and dealers. BASF produced a video on farmer safety that it uses during rural meetings; the video contains tips for recognizing pests, safe use, maintenance, first aid, and relevant laws and regulations. It has now been used to train more than 30,000 farmers in 17 different provinces. In addition to

One major challenge related to safe pesticide use is the predominance of illegal and fake products in rural areas. Sharing tips with farmers on how to distinguish between legitimate and fake products, and how to watch out for older banned substances, is an important piece of training content.

Syngenta partners with a Sino-German project that is currently testing different models with incentives for farmers to return empty containers to dealers. Another pilot project is sending the empty containers on to a cement company that can use the containers as a fuel source for its plants.

agricultural input companies, retailers like Carrefour and customers like Unilever also provide training on proper pesticide application for their suppliers. Through the Carrefour (China) Foundation for Food Safety, agricultural experts provide customized crop-specific trainings for farmers on the optimal use of chemical inputs, including personal hygiene.

Government agencies and NGOs also take part in efforts to increase awareness, and can be valuable partners for expanding the reach of information. The Pesticide Eco-Action Centre (PEAC) partners with government agencies and universities to offer training directly to farmers on pesticide selection and safe application of chemicals. PEAC provides general information on pesticides and health risks, facilitates participatory training workshops, and delivers trainings on practical alternatives for pest management to help farmers reduce the use of pesticides.

CONTAINER DISPOSAL AND SAFE HANDLING

Used pesticide containers are frequently discarded in fields, buried, or burned, further contaminating soil and surface and groundwater.¹³ A simple “triple rinse” can convert an empty pesticide bottle into non-hazardous waste, and the basic training organized through CropLife teaches farmers to collect used containers from the field and dispose of them properly. One of the activities organized by PEAC with their women’s group is to collect used pesticide containers from the fields and transfer them to a designated garbage facility.

When farm chemicals are unsafely stored and handled they pose a risk to community health, and in China pesticides are one of the most common means of suicide.¹⁴ Information on safe handling and storage can be thus be beneficial to communities, so most companies include not only detailed guidance on how to safely store pesticides, but also first aid training and technical guidance for rural health professionals on how to treat pesticide poisoning.

Protecting the Environment

The resource-intensive nature of agricultural production means that food supply chains have major impacts on the natural environment—especially at the farm and factory level. Taking a supply chain perspective, companies can look for many different ways to mitigate those impacts, including:

- » Reducing pesticide and fertilizer inputs to ease the pressure on local and regional ecosystems
- » Improving wastewater treatment in factories to protect water quality and aquatic systems
- » Optimizing transport to reduce carbon emissions

By addressing any or all of these issues, companies can demonstrate their responsibility to local and global communities, and also protect the resources on which they depend.

REDUCING CHEMICALS ON THE FARM

Appropriate and careful use of pesticides can help to protect consumers and farmers as well as local ecosystems. Because of this, many of the trainings and initiatives described above have beneficial side effects for the natural environment. Although overuse of fertilizer does not have the same immediate negative impacts as pesticide misuse, the long-term effects on soil and water quality can be significant. Thus, once companies have addressed pesticide use, one of the next big issues is nutrient management.

While many Chinese farmers still use organic fertilizers or compost from livestock and plant residues, heavy use of inorganic fertilizers is also widespread. Since fertilizers are perceived to have positive contributions to yield and income, they are often applied in excess of recommendations. The resulting pollution can have devastating long-term impacts on both terrestrial and aquatic ecosystems.¹⁵

Background: Fertilizer Pollution in China

Nitrogen fertilizer use in China has increased nearly 200% over the last few decades, and has reached one of the world's highest rates of nitrogen application per hectare (over 500 kg/yr for double-cropped grain and up to 4000 kg/ha for vegetable production).¹⁶ However, the average efficiency of uptake is only 30-35 percent,¹⁷ and the resulting nutrient-leaching and runoff affect soil and water quality, which in turn affect both ecosystem function and human health.

A recent national pollution census found that nutrient loading from agricultural pollution actually contributed nearly half of total Chemical Oxygen Demand (COD) in 2007.¹⁸ While much of this is from livestock and poultry production, the low efficiency of fertilizer uptake—less than 45 percent for nitrogen and 39 percent for phosphorus—means that nutrients from crop production are also ending up in rural water bodies.^{19,20}

The nutrient loading of water sources due to runoff can lead to eutrophication, which is now widespread in China's rivers, lakes and estuaries,²¹ creating "dead zones" by causing algae blooms and anaerobic conditions. Many of these algae produce toxins which are harmful to humans.²² Studies in China have also found high nitrate concentrations in drinking water,²³ which has harmful reproductive and developmental effects.²⁴

In a recent report, Greenpeace evaluated the effectiveness of government programs to improve fertilizer application. Researchers analyzed water samples from the Tai Lake area over a one-year period to estimate fertilizer runoff into the lake. This information was provided to the relevant government agencies to help inform their policy approaches.

Although pesticide and fertilizer inputs have some of the most significant and direct environmental impacts, other aspects of agricultural production are harmful to the environment as well. Plastic mulches are commonly utilized to extend the growing period and suppress weed growth. Plastic mulch can provide some environmental benefits by reducing the need for herbicides, but with a recycling rate of less than 30 percent, a huge quantity of plastic waste is being disposed in farmlands, releasing hazardous chemicals to the environment, destroying soil structure, and negatively affecting water and nutrient transport.

Other environmental impacts include a decline in overall soil quality, and deterioration due to heavy metal pollution and soil acidification.²⁵ Nitrogen fertilization also increases emissions of N₂O, a potent greenhouse gas.²⁶

Many of the same methods currently used to influence farmers' pesticide application can also be applied to fertilizer use (e.g. farmer and supplier training, product innovation). Some companies have begun to share nutrient management advice with their suppliers, promoting sustainable agricultural practices and helping farmers reduce their costs.

Farmers and company managers often misuse fertilizers because they are uncertain how to adapt general guidelines to their specific soil types and conditions. Even when these users have access to the results of soil lab tests, they may not know what the appropriate nutrient application should be. Unilever found that one of its suppliers was applying over 30 percent excess nitrogen fertilizer to its tomato fields. Not only did this negatively affect soil quality and water conditions, but it also cost farmers an extra 450 RMB per hectare, adversely affected yield and quality, increased the risk of crop infection, and delayed the ripening of fruit. In response, Unilever is developing specialized software that will help tomato farmers implement balanced application of fertilizer and reduce overuse. Users input the results of a soil test and the software will calculate the recommended timing and amounts of fertilizer application.

USING WATER WISELY

Water Used During Cultivation

Excessive water use for crop irrigation is a serious concern in China, particularly in regions suffering from scarce water resources or groundwater depletion. Many companies are promoting the use of drip irrigation, although this often uses plastic material which ends up as waste in agricultural fields. Other companies have responded by being more selective about sourcing decisions, and may choose to purchase certain crops from less water-constrained regions. Another alternative is to utilize crops or varieties designed to require less water. Some NGOs are working to improve the efficiency of water utilization in agriculture through crop substitution. The Society of Ecology and Entrepreneurs partnered with the Zhangjiakou Institute of Agricultural Science and Xun Tian Seed Technology Company to replace water-thirsty corn crops with millet. The results of a pilot project showed that yields were comparable and water used for irrigation was reduced by around one-third.

Water Used During Processing

Processing can require large amounts of water and intensive wastewater treatment. Many of the important agricultural zones in northern China suffer from water scarcity, and government agencies at the local and national level are pushing the industry to become more water-conscious. In Beijing the municipal government has called on intensive water users, including The Coca-Cola Company and PepsiCo, to improve their water use efficiency and to maintain high standards for wastewater treatment.²⁷

Beverage producers (juice, dairy, soft drinks, alcohol) and manufacturers of food additives and ingredients are already making efforts on water sustainability. Yili, one of China's largest dairy companies, has invested in advanced wastewater treatment facilities for its sites in Jinchuan (Inner Mongolia) and Shaanxi. The initial capital investment has enabled Yili to save costs on the treatment process while showing clear support for government water quality protection policies. Yili is also implementing different means of water re-use; the Jinchuan plant provides irrigation water for nearby farmland, and at the Taipuke plant in Shaanxi, treated wastewater is reused at the factory site for cleaning and irrigation.²⁸

Working With Suppliers on Wastewater Management

For companies with significant wastewater issues in their supply chain, clear support for suppliers is important for managing risk and reducing environmental impacts. Cadbury's supply chain in China includes xylose—a raw material used in xylitol, a key ingredient of chewing gum. Xylose production creates large amounts of wastewater that can be difficult to manage. In 2008, Cadbury organized professional assessments of the wastewater treatment plants of several of their 2nd-tier xylose suppliers. The audit results showed room for improvement in environmental performance and operational efficiency. Cadbury worked with BSR to support improvement of suppliers' technology and management systems. An initial survey assessed water quality standards and efficiency, and suppliers were invited to attend a full-day training which outlined the current regulatory context, common challenges, and technology and management solutions. Suppliers created action plans for improving their wastewater treatment practices, and Cadbury will follow up periodically to check for improvement. This project showed suppliers that Cadbury is paying close attention to environmental impacts, and gave xylose producers the chance to share challenges and learn from each other. Throughout the project, Cadbury focused on the value of increased efficiency as a mechanism to promote long-term sustainability.

The Chinese juice company Huiyuan is investing heavily in wastewater treatment, and is also looking for innovative ways to reduce its carbon emissions and reuse the organic byproducts of its juice processing. In its five condensed juice factories, Huiyuan is able to use methane produced by the wastewater treatment process as an energy source, thereby reducing its coal use by more than 12,000 tons per year. The company also reuses fruit residues such as apple puree and orange peels as raw material for a high-protein livestock feed.²⁹

An overall view of supply chain sustainability for food products should include the impacts of processing, transport, packaging, use, and disposal. While impacts from these phases do not have the same direct effect on farmers or consumers, these segments of the value chain present significant opportunities for companies to improve product sustainability—whether by taking basic steps to ensure legal compliance with environmental regulations, working to support government goals of improved water use efficiency and water quality, or making progress toward reducing a product's environmental footprint.



CUTTING CARBON

As with any consumer product, the material and design of food packaging can have a substantial effect on the total environmental footprint of the product. Reducing the weight and size of the package (and thereby cutting transport emissions), designing packages that can be reused or recycled easily, and using more environmentally friendly material for packaging are all ways that companies can make their products more sustainable. BASF has designed a fully biodegradable polymer that can be made into biodegradable plastic bags suitable for reuse or composting.

Logistical innovations can help reduce the impacts of transport as well. By effectively organizing transport schedules and partnering with another company to create “balanced routes” in which freight trucks are fully utilized in both directions, a large bottling company in South China has been able to reduce its carbon footprint dramatically.

The environmental impacts of agricultural supply chains carry significant risks for companies. In the short term, they can threaten the stability of a supply network when suppliers fail to meet regulatory standards such as the ones governing wastewater management, and can negatively affect a company's license to operate if crop irrigation requirements conflict with local communities' water needs. In the long term, environmental impacts may even threaten the viability of the agricultural production systems on which companies rely. Thus, making products and processes more environmentally friendly is also good for business.

Recommendations for Companies

As awareness of product safety and environmental issues grows and consumer and government expectations continue to shift, companies must do more than just meet their basic responsibilities. China's citizens and civil society sector are demanding that human health and the environment are protected as well. This report has highlighted a number of ways that companies can address their supply chain impacts on farmers, consumers, and the natural environment.

Successful sustainability initiatives in China should consider the following factors:

Build partnerships to increase impact.

When sharing new information or skills with farmers, the sheer size of the rural Chinese population means that existing government networks are often the best way to maximize limited resources and disseminate information. The Ministry of Agriculture and rural extension education networks have provincial and local bodies that can cooperate in organizing trainings and information sharing. Working together with civil society organizations also can help businesses reach farmer and consumer groups more effectively and increase credibility overall.

Leverage existing business resources and functions.

Elements of sustainability programs can be incorporated into existing channels and relationships, a process that can create additional opportunities to build trust and dialogue with supply chain partners. Companies such as Syngenta and BASF have trained their sales and marketing associates to share information on safe pesticide use with farmers and retailers as part of their standard business practices. Existing quality assurance and compliance auditing systems can be expanded to include new product standards, selection criteria, and supplier development programs.

Look for linked business and environmental benefits.

Initiatives with sustainability benefits can often add business value as well, and can strengthen supplier relationships and improve management. The sourcing strategy of dealing directly with farm associations means that retailers such as Carrefour benefit from more fresh and lower-cost products. The same strategy also means the company can build relationships with suppliers that give it an opportunity for more influence on farming practices. Carrefour works with farm associations to help the associations comply with standards, and has been able to help them professionalize their management and financial skills. Unilever's innovative elimination of pesticides in their suppliers' mushroom production allowed them to take advantage of a lucrative export market. The recycling of fruit residues by Huiyuan will benefit the environment, and also may create a valuable new product for the company.

Involve the consumer.

Increasing public awareness and creating consumer demand for more sustainable products can be a highly effective way to improve agricultural impacts because these measures provide a long-term stimulus for other companies to innovate in a similar direction. Governments and consumers can be complementary sources of motivation for more sustainable agricultural production, processing, and ultimately food safety.

Share practical knowledge.

Internal resources and technical expertise can provide basic and practical information on agricultural practices to suppliers. Companies can provide legal consultation on relevant legislation that sets standards for pesticide use and heavy metal content of products. Unilever helped its suppliers to compile booklets on Good Agricultural Practices, which were then printed and disseminated to thousands of farmers. The booklets include content on pest and

soil management that can help farmers make informed decisions about chemical inputs and production techniques. Training content on pesticide use should be based on local context and current practices in order to maximize effectiveness.

Evaluate your impact and refine your approach.

Making the effort to evaluate and analyze the impact of your programs is well worth the investment, as it can identify inefficiencies and gaps and help to refine your approach. In the CropLife evaluations, researchers found that while many types of knowledge improved, after the training farmers still did not have a clear idea of the best way to dispose of used pesticide containers. Future curriculum design can take this into account.

Commit for the long term.

Customary practices take time to change, and particularly for agriculture, the annual cycle of planting and harvest means that uptake of innovative approaches will be a slow process. The use of clear evidence and persistent persuasion can promote a more responsive management strategy so that pesticide application is based on ecological thresholds instead of arbitrary prescriptions. Unilever has been working on pest and nutrient management with its suppliers for several years, and reports that suppliers are seeing gradual improvement. Year by year, chemical inputs are slowly being reduced, and the incidence of positive samples of pesticide residues are dropping.

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