



## CROP CARE

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### Agri Spotlight

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### **Plant Nutrition Delivery Technologies: A way to Sustainable Farming Practice**

A balanced and timely nutrition to crops has always been significant in the overall development cycle to achieve optimum farm level productivity. One of the major lacunae linking to plant nutrition delivery is its sustainability. There is enough evidence of injudicious use of synthetic plant nutrient products thereby degrading soil, causing nutrient imbalance, and adversely affecting the crop productivity of the farmers, especially the smallholders. A huge untapped opportunity exists in plant delivery technology segment that have immense potential to optimize the nutrient usage thereby ensuring high productivity, earnings, and good quality produce for farmers. We discuss herein optimal farm-level technologies that can be offered by agri-companies and ways it can be adopted as sustainable farming practices to provide better nutrients to crops.

In the past two decades, the **Integrated Plant Nutrition System (IPNS)** has gained attraction due to a holistic approach towards an effective crop nutrient delivery system. Plant nutrient needs are met through a pre-planned optimal combination of macro and micronutrients, biofertilizers, and other nutrient resources. In this system, it is crucial to optimize these components at the local farm level according to the ecological, edaphic, social, and economic conditions.

Similarly, **Automated Plant Nutrient Delivery Systems** offer more precise nutrient delivery. There are other commercial systems in the market especially used as part of the smart greenhouse, hydroponics as well as aquaponics systems. These include Fertigation Systems, Plant Dosing Systems, and Nutrition Systems. These systems work on a similar mechanism where fertilizers and other water-soluble solutions are injected into an irrigation line. It also precisely measures pH, EC (Electroconductivity), and temperature via series of sensors that further helps the system to modify its nutrient prescription settings to ensure proper dosage for crops.

**Nutrient Delivery systems (NDS)**<sup>3</sup> is another tool that delivers broad-spectrum nutrient in a single application and have up to 350% efficiency in nutrient delivery as compared to conventional delivery products.



Such system leverages activator nutrient carrier technology that links with the nutrient elements and facilitates the transfer of nutrients in the cells of the plant and delivers the nutrients with two hours of application thereby enhancing productivity as the nutrients are now readily moved, or translocated within the plant.

In recent years, there has been growth in **nanotechnology-based stimuli-responsive release systems** to optimize the dose rate, increase efficiency by regulating and stabilizing the release of active ingredients in the soil, and aid plants to efficiently uptake nutrients by making them readily available. It includes the use of nanomaterial-nutrients to enhance agricultural yields. There are certain commercial nanoparticles of micro and macronutrients such as nano-Phos, nano-Cal, nano-Potash, nano-Zinc<sup>4</sup>, while there are other products specifically containing plant growth regulator and immunity enhancer<sup>5</sup>. The scope of these nanotechnology products lies in making the products sustainable by substituting the encapsulating synthetic polymers with biodegradable nature-derived polymers.

These technologies can be leveraged by farmers as it saves time by automatically delivering a precise amount of nutrients depending on the crop type and growing conditions. These systems have the potential to increase the farmer's income by avoiding excessive usage but also saves on labor costs. Apart from this, the farmers, as well as agribusiness companies, can very well be aligned with modern consumer demands of having good quality food products as well as protect the environment from getting damaged due to excessive use of agrochemicals. It will also allow companies to stay relevant and sustainable with their products to align to present stringent rules that focus on environmental and food quality concerns which significantly get affected by the use of conventional plant nutrient products.

Even after countless benefits, still, a lot needs to be done for such advanced plant nutrient delivery technologies' adoption & awareness at the farmer's level. Private companies, as well as NGOs, can play a vital role in disseminating technologies at the farm level. Incentivization is required from the government which can encourage more farmers to include such delivery systems that not only protect the environment but also significantly save the natural resources of the country.



## Emerging trends in monitoring and detection of crop pests

With the increase in agricultural intensification and climate change, there has been an increase in the emergence of plant pests and disease outbreaks. Along with the native insect pests, global climate change has led to invasion of exotic insect pests that augmented the devastation of indigenous crops. Pests like Fall Army Worm (FAW) and locusts easily spread from one country to another which can reduce yields and also adversely impact the yield, both qualitatively and quantitatively. Early pest detection enables timely action by the stakeholders and helps in reducing the yield losses by 20- 40 % depending on the crop and its growth stages. Monitoring crops for potential threats manually is labor-intensive and imprecise. Advanced imaging and image processing technologies help farmers, and agronomists to automate and accelerate the pests/disease detection and monitoring process. To minimize the damage induced by pests in crops during growth, harvest and postharvest processing, as well as to maximize productivity and ensure agricultural sustainability, advanced pest detection and prevention tools are highly important. Below mentioned are some of the emerging trends in the crop protection industry:

**Drones:** Early pest detection and treatment applications are essential for effective pest management. AI-powered drones such as sensing drones and actuation drones can be used for detection of pest hotspots and for precise distribution of solutions to



establish IPM strategies. The multispectral cameras attached to drones capture farms at an insect-level which automatically identifies problems unseen to the naked eye. Drones have been recently used in India to track the movement of locusts and spray insecticides on the swarms, a cost-effective measure for the state agriculture departments.

**Spectral Remote Sensors:** The efficiency of IPM system depends on the accuracy of the pest population monitoring methods. Pest detection sensors are used to detect the presence of pests and can be of different types based on their mode of operation, energy consumption and the type of pests they sense. (Low-image/High image/Gas detection sensors).

**Automatic traps:** A novel approach to the integrated pest management in identification and monitoring of insect pests. Automated pest monitoring systems monitors all kinds of insects and can be lured into insect traps to provide an effortless pest monitoring system with limited resources. Such innovative technologies provides solutions to farmers and insights on real time pest situation in the field. Crop protection companies

are exploring opportunities to utilize such technologies.

**Thermal Imaging:** Thermal imaging is an emerging technology and has the potential to augment the success of IPM by identifying the density of pests and diseases. This technology is gaining popularity in detecting pests due to the reduced cost of the equipment and simplified operating procedures.

**AI-Driven-Sensing Devices:** Automating pest monitoring is a challenging task. With advancements in machine learning techniques, in particular deep learning, there has been a significant ability to accurately detect and classify pests, either in traps or remote sensing. In spite of these developments, the key factor preventing widespread adoption of these automatic pest monitoring systems is their lack of robustness to the wide variety of situations that can be found in practice. Also, there are challenges in using these technologies on smallholder farms. There is a need to build a comprehensive pest image database for different crops to bridge this gap.

While these tools/technologies are powerful, tailoring them to specific challenges faced by small holder farmers will enhance the effectiveness and minimize the environmental impact. Crop protection industry is utilizing Internet of

Things (IoT) sensors and AI to determine the type of pests and pest pressure on a crop. Few of the tools such as Climate FieldView™ and Threat ID enable the users to drop the geo pin of the area under pest/disease pressure or can even upload a photo of an infected leaf to rapidly identify pest and disease. Similarly, Fasal and Xarvio's scouting tool with its AI and IoT platforms warns the

farmers in India the possibility of pest outbreaks and aid in precise preventive sprays. The detection and monitoring of plant pests and diseases with the help of image processing techniques provide more accurate guidance to farmers for disease management resulting in improved efficiency and higher yields and also benefits the crop

protection industry players in significant improvement of their business. Companies can undertake crop-based approach to provide solutions that enable farmers to take data-driven decisions and bring down the input cost. The solution/technology can be expanded to potential markets having similar farmer profiles and climatic zones.

## Need for integrated weed management approaches to control weeds

Weeds are a barrier for plants to gain nutrition and are responsible for degrading the native eco-systems as they compete with crops for all the inputs and reduce productivity. They are one of the major constraints to plant production across the globe and account for around 32% crop loss<sup>1</sup>. In India alone the losses due to weeds accounted for around INR 80,000 crore in 2018<sup>2</sup>.

Advances in agriculture also have direct and indirect effects on weed control. With the newer approaches for weed control being introduced to tackle the evolving agricultural practices, the market size of weed control which was around INR 206 crore in 2018, is expected to witness a CAGR of 3.5% by 2025. Currently, herbicides are the major crop protection chemicals that are being used for controlling weeds. Although herbicides do not harm the crops, are cost-effective, easy to apply and



fruitful in controlling weeds, with fewer herbicides with distinctive and different modes of action available in the market and their extensive use has led to a rise in incidences of herbicide-resistant weed populations. There is an urgent need for a viable solution to resolve the menace caused by weeds. Currently, there are three potential ways being explored for handling weeds which includes:

**Herbicides:** Current herbicide research is focusing on the discovery of new target sites, better physicochemical properties and different modes of action. Bio-herbicides based on plant extracts and microorganisms is also catching lot of attention. Although there is huge potential for the use of nano-herbicides for targeted weed control, their commercial viability is yet to be reviewed as these airborne nanoparticles may pose environmental health risks both for plants and humans.

**Mechanical weed management:** Mechanical weeders will not only help mitigate the labour availability issue which is encountered in manual weeding but will also save time and effort for the farmers. They are effective but not very popular in India. Mechanical weeding is primarily done using either manual weeder, animal-drawn weeder or power-operated weeder. Amongst these, although the power operated weeders perform better, there is a scope for improvement in the battery operated and multi-row weeders.

Overcoming the shortcomings of the current mechanical weeders and using newer technologies, the new market trends in mechanical weeders overcoming the shortcomings of the current mechanical weeders and using newer technologies, the new market trends in mechanical weeders use precision agriculture, camera along with spray mechanism, robotic machines with motors, sensors and microcontrollers to detect weeds based on row per column, etc. The popular technologies such as Blue River Technology (BRT) which has been developed for agricultural machines that utilize machine learning to distinguish between weeds and plants as the machines drive over fields based on the size, shape and colour. These machines will prevent chemical overuse by spraying at the exact spot. In India some companies have developed and deployed robotic weeders and supply them under services model to farmers due to their higher costs<sup>3,4</sup>.

**Genomic approaches:** Genetic engineering is also being applied as a potential new technology for silencing the key weed genes or by genetically engineering the crops to enable them to kill the weeds reducing the need for herbicides<sup>5</sup>. The herbicide tolerant crops currently in the market show little evidence of enhanced invasiveness compared to the non-GM counterparts. The possibility of discovery of new modes of action for herbicides



through genetic engineering provides additional options for manipulating herbicide selectivity and creating entirely novel approaches to weed management which is promising. But the regulatory hurdles and acceptance of genetically modified product look bleak across all countries. There is extensive research ongoing for using RNA interference (RNAi) applied as a spray which makes the weeds more susceptible to herbicides. But there are few hurdles blocking the commercial implementation of RNAi herbicides including technical problems such as formulating RNA to achieve efficient uptake into the target plant as a sprayed product, development of methods for economical large-scale production of RNAs, development of resistance to RNAi herbicides and regulatory issues. Many leading crop protection companies are developing or acquiring RNAi delivery technology to overcome the glyphosate resistant weeds<sup>6</sup>.

Application of “Omics” technology which incorporates genomics, proteomics, transcriptomics & metabolomics understand invasiveness of weeds which will enable the development long term to integrated approach of are being researched and developed. Although these new technologies are promising, there is a long way before they become commercially available.

As several weed species are obstinate and are still difficult to control and with the vast number of serious weed problems rising across the world, only one method for weed management cannot be relied upon and the weed control technologies must constantly evolve before evolution and adaptation by weeds. Also, applying technologies such as precision agriculture and automation opens multiple possibilities for efficient weed management, through chemical/ mechanical mechanisms. To achieve the goal of meeting the food requirements, an integrated weed management approach as applied for pests must be explored and adopted through deeper understanding of weed science and concentrated efforts towards quick modelling, testing and commercialization by major private sector players for effective weed control.



### How Sathguru can help

 Tech Transfer

 Valuation of Technology

 Investment Opportunities

 Market Potential Assessment

 Business Plan Development

 Market Entry Strategies

# AGRI SPOTLIGHT

#### Subsidy hike on DAP fertiliser by 140 per cent- Relief to farming community

To ensure that soil nutrients are available to farmers in view of the rising global prices of DAP, Centre has hiked the subsidy on DAP fertilizer by 140 percent, from Rs 500 per bag to Rs 1200 per bag. DAP rates have gone up to Rs 2400 per bag in the global market and this move ensures that the domestic retail prices remain unchanged and offers relief to farming community

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#### First ever electric tractor tested in the country

The first-ever ‘electric Tractor’ has been tested at the Central Farm Machinery Training & Testing Institute, Budni (MP), has tested the in the Institute. As compared to the regular tractors, the electric tractor would be more environmentally friendly. With the promising results of the tests the manufacturer have made the test commercial from confidential.

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#### 75 villages in 8 Indian states to be benefitted with intensive modern farming

India and Israel have signed a three year deal to implement the “INDO-ISRAEL Agricultural Project Centres of Excellence” and “INDO-ISRAEL Villages of Excellence”. Strengthening India – Israel bilateral relationships, Israel will assist in developing the current Centers of Excellence (CoEs), set up new centres, ensure that these centres are self-sufficient, and encourage collaborations. Under this project Israel will modify methodologies to suit the scenarios in these 75 villages and will focus on installing and implementing modern Agriculture infrastructure, build capacity and create and enhance Market linkages.

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#### State-of-the-art genetics coupled with proprietary tech to accelerate vertical farming

Collaboration between OnePointOne which pioneers in advanced technology in aeroponics and robotic growers with Sakata Seed America who have the latest genetics will quickly accelerate the status of vertical farming. The collaboration will also enable quicker data collection and quicker fine tuning of the breeding programs which will make the large scale usability of Vertical farming a reality. This will drive the innovations and advances needed to bring a more sustainable growth platform to the market at scale.

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### Indian rice exports to Philippines likely to boost due to 5% tariff cuts

For one year Philippines have announced the reduction on rice import tariff to 35% for in-quota purchases. The Indian rice import markets have faced an unstable trend and the high import tariffs have restricted the expansion of Indian rice markets in Philippines. This change when implemented will open up around half a million tonnes market for the Indian exporters.

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### Plant disease forecast platform - A new data intelligence tool

A plant disease forecast platform for advance disease warning and management advice to farmers has been launched by Yuktix, a provider of data intelligence tools for agriculture. The platform uses IoT technology and data analysis tool to predict weather linked plant diseases in advance. Using this platform for 24x7 weather and soil monitoring along with crop specific disease models advanced warning about impending diseases to plants can be delivered to grower phones.

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### Max-Ace herbicide-tolerant rice system being launched on limited scale

Limited launch of the Max-Ace Rice Crop Solution system planned by RiceTec and Adama plan that pairs RiceTec's herbicide-tolerant rice cultivars with Adama's proprietary herbicide. These will be done both on Max-Ace varieties as well as hybrids through 40 – 50 farm-scale demonstrations. The Max-Ace Rice Cropping Solution is in high demand for its outstanding grass weed control with Highcard herbicide in rice

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### Foliar fungicide delivers effective protection against ergot

Prosaro® PRO cereal fungicide developed by Bayer is extremely effective against Fusarium Head Blight (FHB), Deoxynivalenol (DON) and leaf diseases. This fungicide can be used on wheat and barley crops. Prosaro®. It provides multi-mode of action solution and has been proven to deliver higher yields even with high disease pressure, resulting in improved grain quality and less loss of grains. It is also the only foliar fungicide available in the market.

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### Non-GMO Herbicide resistant Cotton through Gene editing

Argentine companies, Bioheuris, and Gensus announced a partnership to develop herbicide resistance in cotton crop using CRISPR gene editing. Herbicide-resistant (HR) GMO cotton are already available for farmers in several countries. This technology enables to create HR traits by enhancing the performance of the crop's own genes.

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### Dutch Seed firm Bejo acquires a nonexclusive license to CRISPR-Cas9 IP from Corteva Agriscience and the Broad Institute

Bejo now has access to CRISPR-Cas9 intellectual property for genome editing for agricultural use. This will enable to strengthen its ability to develop more efficient vegetable varieties and contribute to meeting global food and sustainability challenges. They can now deploy this technology and explore new applications of this powerful tool in a wide variety of vegetable seeds, including brassicas, onions, carrots and other crops.

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### Farmers all set to realise premium price exporting GI certified Shahi litchi

For the first time since litchi got the GI tag, the first consignment of GI certified Shahi litchi was exported from Bihar to UK. This will not only help the farmers to fetch premium price, but also prevent other producers from misusing the name for selling similar goods. With litchi having minimal shelf life, ministry is encouraging to explore opportunities for exporting value added products.

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### Major advancement in the fight against the Tomato Brown Rugose Fruit Virus- TomaTech

TomaTech has succeeded in identifying the DNA markers correlated to the resistant trait and also filed for a provisional patent for the same. This breakthrough will accelerate the breeding program and commercialization of high resistance non- GMO tomato varieties & can be applied to develop a complete portfolio of resistant tomato varieties across all segments and can be adapted to both heated and non-heated green houses.

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## Blogs



**Agrochemicals - Sustainability Challenges**



**Why Indian farmers should adopt drones and associated technologies and how?**



**Embracing opportunities towards building a self-sufficiency in the agrochemical industry**

Reach us at [agribusiness@sathguru.com](mailto:agribusiness@sathguru.com) or [vijayp@sathguru.com](mailto:vijayp@sathguru.com)

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