Has precision farming's moment arrived?

India needs to grow a lot more food, and do it sustainably to be able to meet its future food security and also keep its climate commitments. Precision farming is still nascent in the country, but could offer a way forward.

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Sustainable agriculture practices are the key to achieving India's climate commitments without compromising on the nation's food security goals. Despite being a leader in agricultural production, India's yields are lower than in other major agri-nations — the United States, China, and Brazil. This is attributable to climatic uncertainties, improper practices, excess pressure on resources, supply chain inadequacies, and other factors. Further, current conventional farming approaches are intensive in their use of energy, water and labour. What is needed instead is a more technology-driven, resource-efficient, and risk-free approach.

Precision farming could be the answer. It is a management concept for agriculture based on continuous observations, measurements and responses to data from fields, coupled with precise application of resources including nutrients, water, light and overall ambient conditions. The goal of the approach is to be able to define a decision support system to improve growth and yields, while preserving resources. The global precision farming market is expected to touch approximately USD 23 billion by 2030. India's precision farming landscape is presently at a budding stage with very little automation, but obvious potential.

Popular methods of precision farming include hydroponics (plants grown in nutrient solutions using a soil-less permeable alternative such as coco peat, perlite, rice husk, and wood chips), aquaponics (hydroponics process employing fish ponds supplying nutrients, viz. external application), and aeroponics (fine drops of water sprayed onto plants). Hydroponics, which is the most prevalent method, includes sub-variants — the Wick system, Deep Water Culture, Ebb and Flow system, Drip system, and Nutrient Film Technique — which require a green or polyhouse set-up.

Relevance

Presently, India's average agricultural cropping intensity is 140 per cent - i.e. each acre of land sees sowing more than once, by about 40 per cent . Cereals dominate the current production and consumption patterns. To increase the cropping intensity, a paradigm shift towards vegetables using advanced farming techniques is required. For instance, with horizontal hydroponic farming, the lettuce yield ranges between 11 and 55 kilograms per square metre (45 to 220 metric tonnes per acre of farm). This yield, which has been observed and proven, is an increase of 12–15 times over the conventional methods.

Picture : Precision farming using hydroponics.

High yields in precision farming are achievable as a result of reduced land preparation time (even going soil-less), ease of weed management, non-exposure to climatic vagaries, more cropping cycles, and reduced labour and technical constraints. Precision farming reduces water use by 90 per cent and emissions, allows efficient crop residue disposal, easier harvesting, and yields better quality produce — translating into better incomes and decarbonisation of food production.

However, automated processes make it more energy-guzzling than conventional practices. One possible solution is a greenhouse integrated with a transparent solar photovoltaic system, which can curb the overall power required to operate the greenhouse. The power saved in the process can be sold to electricity distribution companies (DISCOMs) — an additional income source for the grower. Precision farming requires niche expensive and non-subsidised fertilisers, but the fertiliser-use efficiency is higher compared to conventional soil-based farming.

Associated costs

In terms of investment, the entire set-up (greenhouse and growing system) requires about INR 50 lakhs to INR 2.5 crores per acre, depending on technical complexities. Given the structural and functional intricacies, the current precision farming set-ups require sizeable investments — necessitating sustainable options for greater adoption and inclusivity. Most greenhouses presently use galvanised steel (along with poly film sheets as sunlight filters) for structural support, costing INR 1,000–2,000 per square metre. One cost-effective option is a mix of natural materials such as bamboo, casuarina wood, and steel, thereby reducing investment by three to seven times.

Likewise, Deep Water Culture systems are cost-effective (INR 500 per square metre) compared to NFT systems (static unplasticised polyvinyl chloride systems (INR 1,000–1,500 per square metre) and mobile gully systems (INR 15,000 per square metre). Subsidising the technical equipment (similar to the 50 per cent government subsidy available for the structural aspect) could attract more farmers. Reusing growth media frequently and purchasing local seeds could further minimise operational expenses.

Going forward

Precision farming could give a nudge to climate-smart farming and improve resource utilisation efficiency to a certain degree. Yet, will India witness the scale-up in the precision farming space? With over 80 per cent of India's farmers in the small and marginal bracket, a precision farming roadmap is required. Such a roadmap would consist of low-cost hydroponic systems, business models tailored for various agro-climatic conditions, cropping patterns considering potential demand-supply, and most importantly, the willingness to switch towards a fresh farming approach. Additionally, robust capacity-building initiatives — partnering with institutions of excellence and other organisations engaged in precision farming — are vital in educating the farmer base. Yield stability would serve as a collateral while approaching potential lenders.

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