# AI Breakthrough for Ultra-Nutritious Fresh Crops

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## AI as a Breakthrough Technology for Healthy Fresh Crops with Predictive Nutrition Values

AI is currently one of the most hyped technologies. With AI—artificial intelligence—innovations can be realized across many application domains. The use of AI itself is not new; we are familiar with automated responses via chatbots or receiving additional suggestions when purchasing something on a website. What makes AI different today is that it now has access to much more powerful computing technology and advanced computational models. This allows large numbers of analyses to be carried out and actions taken within very short periods of time to achieve specific goals.

The intelligence of AI lies in the fact that when extremely large volumes of data are entered, computer systems learn autonomously based on rules formulated by humans. This is called machine learning. AI is considered an umbrella term for algorithms and methods that perform tasks once thought to require human intelligence, such as recognizing people or controlling a vehicle.
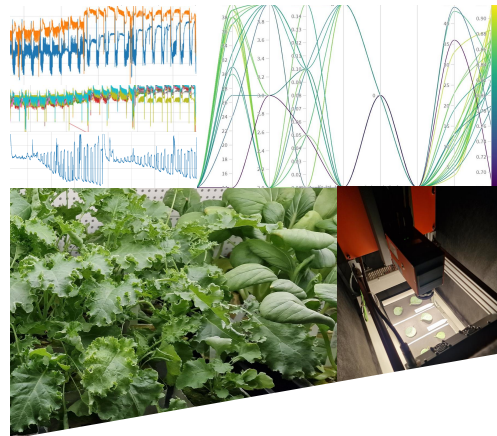
The strength of AI is that complex calculations across multiple data streams can be performed quickly and in real time—far exceeding individual human cognitive and computational capacity. Through the speed of analysis and machine learning, AI can arrive at decisions in complex situations or in response to intricate questions. AI makes it possible to dive much deeper into processes and to understand the interaction of data.

This brings us into the realm of so-called Deep Learning, which operates through artificial neural networks inspired by the biological brain. Deep Learning enables even more advanced applications, such as automatic data analysis and processing or rapidly scanning knowledge bases and producing well-formulated potential answers.

AI rightly receives a great deal of attention and high expectations. Nevertheless, it should not be underestimated that applying AI is no easy task. It requires bringing together interdisciplinary knowledge around a complex problem. It is no coincidence

that Big Tech companies and large enterprises invest heavily in this area. The question remains whether this also ensures that the potential of AI for good is fully realized.

We demonstrate that the innovative drive of a start-up like GrwNxt can revolutionize indoor agriculture with AI by focusing on healthy nutritional content rather than crop weight.



**AI for prediction of Functional Food Components (FFC) in crops**
A breakthrough in healthy food production

## AI for Good: Applying AI to Predict Healthy Nutrients in Crops

AI is not a simple push-button solution that delivers ready-made answers. A great deal of fundamental research is still required to apply AI to major challenges, such as how to grow crops and demonstrate healthy nutrients during growth—nutrients such as vitamins, minerals, and proteins. Can AI predict the development of nutrients during the growth process?

This requires interdisciplinary research combining diverse scientific disciplines and practical cultivation knowledge. An AI specialist alone can do little more than create computational models using data generated with experts from other fields through physical tests and experiments. Think of collaborations with experts in plant physiology, nutrition science, growth conditions, and optimal climate environments.

For the development of healthy fresh food, AI offers the opportunity to look at growth processes in a completely different way. Instead of starting with seeds and genetically manipulating them to achieve specific crop varieties—a process that can take up to 15 years—you can dramatically accelerate progress with AI-driven growth recipes.

At GrwNxt, this has led to the development of **Dynamic Digital Recipes (DDR™)**. No GMO or genetic manipulation of seeds or crops is required, because the approach optimizes the growth conditions around the plant rather than altering seed composition. This represents a major AI-for-Good breakthrough.

AI can process data from complex cultivation configurations to generate so-called **Functional Food Components (FFC)**—essential nutrients produced during growth.

Previously, this was not possible because hyperspectral camera technology had not yet been applied to detect FFCs, and AI models capable of interpreting wavelengths and assigning nutritional values did not exist. Now that this has become possible, it opens enormous opportunities for growing healthy fresh crops.

Moreover, AI enables autonomous control of crop growth within indoor environments. While this may sound like science fiction, it is already possible and has been tested. This allows hyper-local cultivation of nutrient-dense fresh vegetables in growth modules, transforming urban buildings into self-producing neighborhoods with accessible, healthy, and diverse food.

## Nutritious Food and Health

Nutrition and health are inseparably linked. The world does not suffer from a lack of food, nor is hunger the core problem. On the contrary, enormous quantities of food are produced. However, much of this food poses a threat rather than a benefit to a healthy lifestyle.

Most food enters the market as **ultra-processed food**, filling stomachs but offering little nutritional value while containing excessive salt, fat, sugar, flavor enhancers, and preservatives. For millions of people, industrially processed food—supplemented by ready-made meals, fast food, and snacks—is the primary source of nutrition.

Extreme crop selection has led to fewer nutrients in fresh produce, while fruit sugar levels have increased to satisfy consumer preferences. Even those who believe they eat healthily often fail to obtain sufficient nutrients.

For many people living in food deserts—especially in megacities—access to affordable fresh food is extremely limited. Long transport distances increase cost and spoilage risk. Climate change further exacerbates supply issues. The societal consequences of poor nutrition (malnutrition) are immense. The FAO has identified this as one of the world's greatest challenges.

## High Societal Costs of Malnutrition

The impact of unhealthy diets is evident in the sharp rise of lifestyle diseases over recent decades—obesity, cardiovascular disease, ADHD, and mental health problems. Medical costs continue to soar as societies attempt to treat these conditions through expensive surgeries and medications, followed by attempts to instill healthier lifestyles.

Ironically, the largest producers of ultra-processed food are also major investors in dietary supplements, diabetes products, and weight-loss programs. Investigative research shows that major food corporations profit twice: first from unhealthy food products and then from costly health solutions.

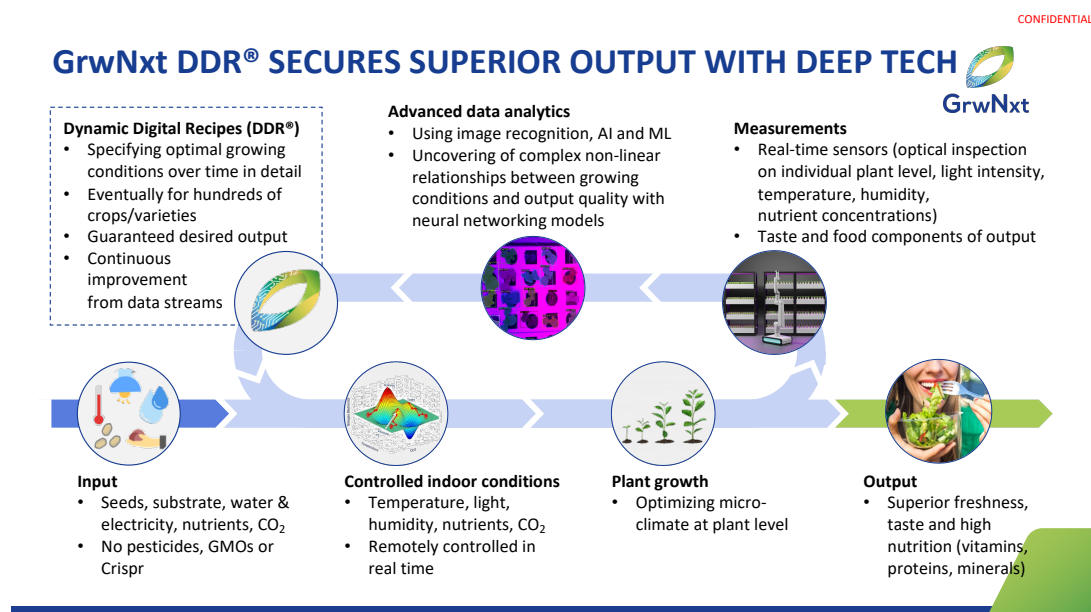## Trends: Declining Nutritional Value in Fresh Crops

Despite daily access to fresh vegetables in the Netherlands, nutritional content has declined dramatically over recent decades. Fresh produce contains more water and fewer nutrients, increasing yield and weight for producers but reducing health value for consumers.

More water leads to faster satiety while delivering fewer nutrients per meal. A seed company representative summarized this mindset bluntly: *"We are not interested in nutritional value, but in biomass and uniform yield."*

## The Need for Change: AI to Increase Nutrition in Fresh Food

If truly healthy fresh crops do not emerge from agriculture itself or from publicly funded research institutions, innovative companies must take responsibility. This is precisely what GrwNxt has done by applying AI to one of the world's most complex challenges: healthy nutrition for as many people as possible.

GrwNxt's mission is to develop AI-driven growth recipes that demonstrably increase vitamins, minerals, and proteins in crops. These **DDR® (Dynamic Digital Recipes)** continuously improve through machine learning, proprietary data, and real-time optimization during growth. This enables guaranteed production of crops with predefined nutritional profiles—without pesticides or genetic intervention.
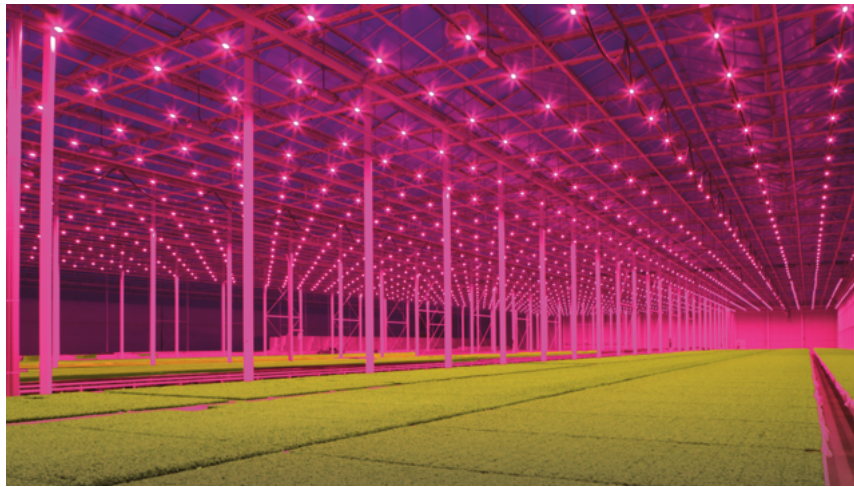


Source: GrwNxt, The Real New Thing. Deep Learning and Plant Science for DDR® in Indoor Fresh Food Production, Amsterdam, 2021, Figure 35, p. 84. Copyright GrwNxt.

## AI as an Accelerator for Nutritional Transparency

With AI, nutritional content becomes measurable and predictable—offering the transparency consumers increasingly demand. This enables a healthy food revolution powered by AI, without GMO, CRISPR, or genetic modification.

DDR® technology can be integrated into existing greenhouse infrastructure via SaaS models, enabling large-scale production. Currently, GrwNxt is developing this together with Koppert Cress, one of the most innovative growers, based in Monster, The Netherlands.
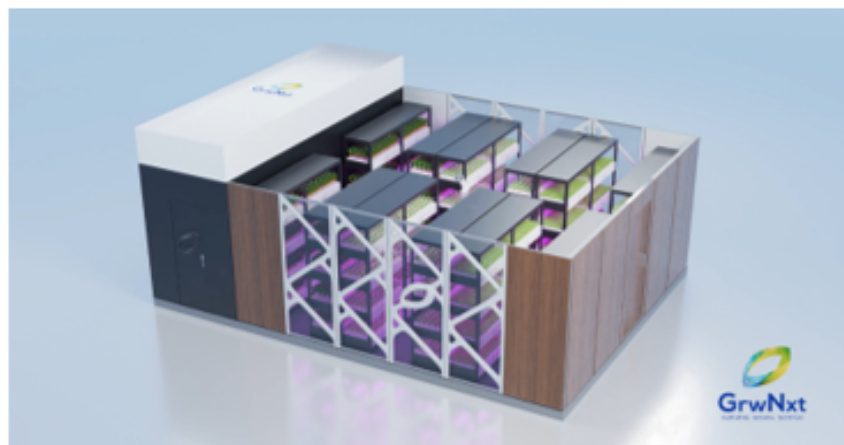


## AI-Driven Crop Production in GrwNxt Modules

The same technology can also be applied in smaller modules within existing buildings, enabling hyper-local food production close to consumers.



Indoor, climate-controlled growth modules enable safe food production directly within cities. Transport, storage losses, packaging, and nutrient degradation are eliminated. Local production improves accessibility to healthy food, helping to eliminate food deserts and reduce lifestyle-related healthcare costs.

With **AI for Good**, entirely new research pathways open—leading toward a healthy, energetic, and productive population on a sustainable planet.

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GrwNxt is winner of the AI for Good Award.