

## Plant Breeding at the Age of AI and Big Data:

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### Artificialintelligenceinplantbreeding:

Artificial intelligence (AI) in plant breeding involves using computer algorithms to analyze plant data, predict plant traits, and automate breeding processes, ultimately accelerating the development of improved crop varieties. AI helps breeders make more informed decisions, identify promising plant lines, and develop crops with desirable traits like yield, resilience, and quality.



Artificial intelligence mainly in plant breeding helps to analyse the whole genome at microscopic level helping the plant breeder to develop new varieties and develop society.

AI include computer operated tools like microchips, processors, systems which are organised and functions according to the programmed processes it is very effective with time saving technology

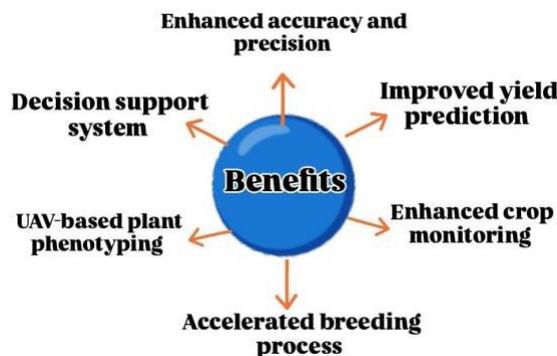
It is very important to note that AI work accurately with out any errors as programmed than human work but AI is not up to the mark as it needs constant development and lots of efforts are still required for development in plant breeding

### BenefitsofAI inplantbreeding:

Enhanced accuracy and precision: AI models can analyze complex genomic data and make accurate predictions about plant traits, allowing breeders to identify the most promising candidates with desirable characteristics early in the breeding process.

Improved Yield Prediction: AI systems can analyse climatic conditions, weather forecasting, soil type and soil fertility, type of crop and field suited to that with utmost accuracy .

Enhanced Crop Monitoring : A plant breeder can regulate the crop requirements in the field effectively by using AI to monitor crop health and growth in real-time, providing valuable insights for optimizing irrigation, fertilization, and pest control strategies.



**Precision Breeding :** AI-driven precision breeding allows for the identification and selection of specific changes needed to remove negative traits or enhance positive ones, leading to the development of tailored crop varieties for specific field conditions.

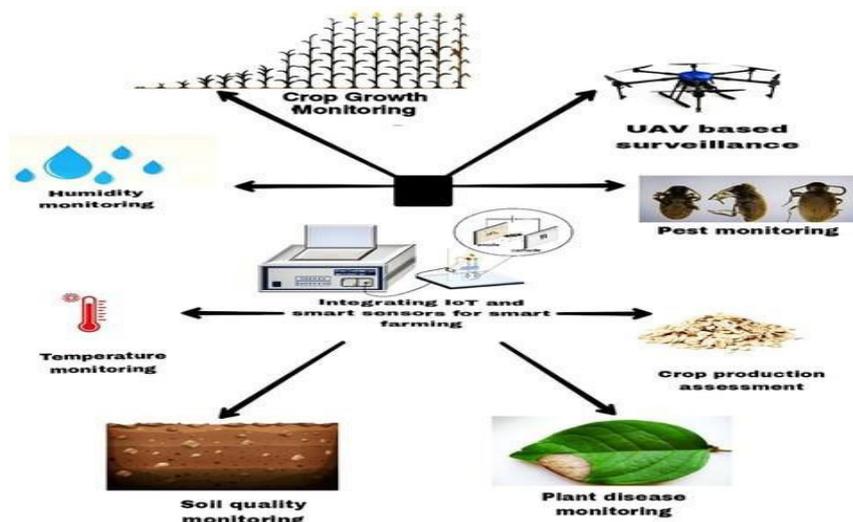
**UAV-based plant phenotyping :** UAVs can rapidly and efficiently capture large volumes of data from field experiments, overcoming the limitations of traditional manual methods.

UAVs (Unmanned Aerial Vehicles) are increasingly used in plant breeding phenotyping to collect high-throughput, non-destructive data on plant characteristics in large-scale field trials. This allows breeders to efficiently assess plant growth, development, and responses to various environmental conditions. By integrating UAV-based imaging with machine learning models, researchers can automate data analysis and gain valuable insights into plant traits, aiding in crop improvement and precision agriculture.

**Decision support systems :** Using a variety of data inputs, AI-powered decision support systems provide breeders insights and suggestions. These systems can detect prospective cross breeding combinations, recommend the best breeding practices, and allocate resources efficiently.

**Accelerated Breeding Processes:** With use of AI storage units it stores previous, present data and use in further easy and time saving development process which would be difficult for an individual to analyse effectively .

AI can also be used to predict the outcomes of breeding crosses, reducing the need for extensive field trials and saving time and resources. This allows for faster selection of superior genotypes and accelerates the development of new crop varieties with desired traits, such as disease resistance or high yield.

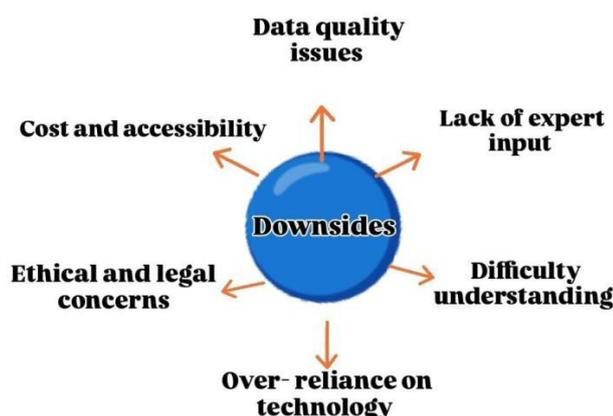


### AI powered plant breeding innovations:

1. AI is revolutionizing plant breeding by enabling faster identification and selection of desirable traits, simulating breeding outcomes, and developing novel breeding methods.
2. Artificial intelligence is transforming crop development by analyzing vast amounts of genetic data, predicting plant performance, and optimizing breeding strategies.
3. AI-powered tools are accelerating plant breeding by identifying plants with desirable traits, predicting breeding outcomes, and developing more effective breeding programs.
4. The integration of AI in plant breeding is enhancing the efficiency and accuracy of crop development, enabling breeders to produce high-performing varieties.
5. AI is driving innovation in plant breeding by developing new methods, predicting plant performance, and optimizing breeding strategies for improved crop yields.

### Using AI in plant breeding has its downsides, including:

1. Data quality issues: AI needs good data to work well. Bad data can lead to wrong results.
2. Lack of expert input: AI needs plant breeding experts to guide it, or results might not be useful.
3. Difficulty understanding AI decisions: Some AI models are hard to interpret, making it tough to trust their decisions.
4. Over-reliance on technology: Relying too much on AI might lead to loss of traditional breeding skills.
5. Ethical and legal concerns: AI in plant breeding raises questions about ownership, data privacy, and unintended consequences.
6. Cost and accessibility: AI technology can be expensive, making it hard for small breeding programs to adopt.



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**\*Artificial Intelligence in Plant Breeding\***

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