

Marker Assisted Selection

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What is Marker Assisted Selection?

MAS is a process in which a marker is used for indirect selection of a genetic determinant or determinants of a trait of interest, i.e., abiotic stress tolerance, disease resistance, productivity, and/or quality. Using molecular markers, this technique selects plants with genomic areas implicated in the production of traits of interest. Because of the development and availability of a wide range of molecular markers and dense molecular genetic maps in agricultural plants, MAS can now be used to study traits influenced by key genes and QTLs. The number of target genes to be transferred and the distance between the flanking markers and the target gene are two criteria that influence the success of MAS.

Steps in MAS:

- (i) Selection of parents,
- (ii) Development of breeding population,
- (iii) Isolation of DNA from each plant,
- (iv) Scoring RFLPs, and
- (v) Correlation with morphological traits.

Applications of MAS:

- i. MAS is a very effective, efficient, and rapid method of transferring resistance to biotic and abiotic stresses in crop plants.
- ii. It is useful in gene pyramiding for disease and insect resistance.
- iii. It is being used for the transfer of male sterility and photoperiod insensitivity into cultivated genotypes from different sources.

- iv. MAS is being used for the improvement of quality characters in different crops such as protein quality in maize, fatty acid (linolenic acid) content in soybean, and storage quality in vegetables and fruit crops.
- v. MAS can be successfully used for transferring desirable transgene (such as the Bt gene) from one cultivar to another.
- vi. MAS is very effective in the introgression of desirable genes from the wild into cultivated genotypes.
- vii. MAS is equally effective in the genetic improvement of plants and animals.
- viii. MAS is useful in the genetic improvement of tree species where fruiting takes a very long time (say 20 years) because for the application of phenotypic selection we have to wait for such a long time.
- ix. MAS has wide application for genetic improvement of oligogenic traits as compared to polygenic traits.

Recent advances in molecular breeding such as the use of PCR based techniques [simple sequence repeats (SSRs) and insertion/deletion mutations (Indels)]; single nucleotide repeats (SNPs); Genomic sequencing (GS) and genotype by sequencing (GBS), etc. have extensively been used in crop improvement program throughout the world.

Varieties developed through Marker Assisted Selection

Varieties	Gene	Remark
Pusa Basmati 1 (IPB1) variety	QTL (xa13)-Chromosome 8 and QTL (xa21)-Chromosome 11	Bacterial leaf blight resistance from IRBB55
Improved Sambha Mahsuri (Improved BPT 5204)	xa5, xa13 and xa21	Bacterial leaf blight resistance
Vivek QPM9	opaque-2 from Vivek Hybrid Maize	High tryptophan, lysine and iron content
Improved Pusa RH10	xa13, xa21, pi54 and piz5	Bacterial leaf blight resistance and blast resistance



References:

- Das, G., Patra, J.K. and Baek, K.H., 2017. Insight into MAS: a molecular tool for the development of stress resistance and quality of rice through gene stacking. *Frontiers in plant science*, 8, pp. 985.
- Kumawat, G., Kumawat, C.K., Chandra, K., Pandey, S., Chand, S., Mishra, U.N., Lenka, D and Sharma, R., 2020. Insights into the marker-assisted selection and its applications in plant breeding. In-Plant *Breeding-Current and Future Views*, IntechOpen.