HYBRID WHEAT:
CAN IT OVERRIDE THE PURELINE VARIETIES.

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Hybrid is an F1 generation obtained by sexual and somatic crossing of two genetically distinct parents. In both cross and self-pollinated crops, hybrid varieties offer increased yield and enhanced vigour, efficiency and quality, but hybrid varieties in cereals belonging to the self-pollinated crop domain have not been proven very good except for hybrid rice. It is possible to clearly explain the process of growing hybrid plant seeds. Two distinct varieties of the same plant are cross bred, each with specific characteristics. One plant has sterile female flowers, the other contains pollen and a new, special offspring is created by the fertilized plant is a hybrid.

HYBRID WHEAT IN INDIA

Earlier after the year, 2005 number of efforts were made by the ICAR to exploit the heterosis in wheat. For this, a hybrid network project was initiated by ICAR in India using the CMS method during 2009-10, but there may be no hybrid varieties evolved. Mahyco (a Maharashtra-based hybrid seed company) launched two wheat hybrids (Pratham 7070 and Pratham 7272) in 2002 using the CMS method for low-input cultivation. However, in 2020 a wheat variety MACS- 6478 doubled the crop yield for farmers in Karanjkhop, a village in Maharashtra founded by scientists from the Agharkar Research Institute (ARI), Pune-an autonomous institute of the Department of Science and Technology (DST). It matures in 110 days and is resistant to most races of leaf and stem rust. This is in contrast to the usual maturation after 140 to 150 days expected for commonly grown wheat varieties in northern India. This medium-sized amber grain contains 14 percent protein, 44.1 ppm (parts per million) zinc and 42.8 ppm iron which is higher than other cultivated varieties. Farmers have a yield of 45-60 quintals per hectare with the new variety compared to an earlier average yield of 25-30 quintals per hectare when cultivating Lok 1, HD 2189 and other old varieties but still there is a long way to go to override pure line varieties because recently, the Indian Agricultural Research Institute (IARI) has released a new pure line variety of wheat named PusaYashasvi which is also known as HD-3226. It has a higher genetic yield potential (at 79.6 quintals) as compared to other varieties of wheat. PusaYashasvi has a higher content of zinc, protein, and gluten (which contributes to the strength and elasticity of the dough). The best feature of this variety of wheat is that it is highly resistant against all major rust fungi viz. yellow/ stripe, brown/leaf, and black/stem.

SYSTEM OF HYBRID SEED PRODUCTION IN WHEAT

For a hybrid seed production program in any crop, male sterility and fertility restoration is needed. The female parents must be male sterile, which is achieved by manual emasculation is carried out until it's cost-effective. This is done primarily through either of the following methods.

(1) Cytoplasmic/genetic male sterility (including YA-type CMS)
(2)Artificial induction through chemical hybridization agent (CHA)
(3) Photoperiod/temperature treatment
(3) Genetic male sterility
(4) chromosomal sterility/XYZ system

FUTURE PERSPECTIVE OF HYBRID WHEAT

1. Heterotic gene pool identification:

The key bottleneck in the gene pool is the absence of ample yield heterosis is the commercialization of hybrid wheat. One should look for a world primary gene pool for this, which has not been used otherwise. The currently available Indian gene pool is largely a descendant of germplasm from CIMMYT. The success story of heterotic gene pools in maize can be taken into account in the identification of heterotic gene pools.

2. Creation of novel genetic variability for yield component traits from secondary and tertiary gene pools and its evaluation:

As evident through CIMMYT wide hybridization program in creating novel gene pool through synthetic hexaploids. This helps in generating new variability altogether different from the variability presently used in various national wheat-breeding programs. The through genetic analysis synthetic hexaploids are essential to identify heterotic groups, floral biology to increase outcrossing potential, resistance source of various stresses.

3. Improving the restoration of fertility through the accumulation of Rf genes:

In China to improve the restoration of fertility through recurrent selection or multiple crosses involving different restorers. In this case, the benefit of CHA facilitated male sterility for recurrent selection or poly cross mating may be taken. Biotechnical methods can also be used for Rf gene pyramiding and MAS recognition.

4. Search for heterosis in diverse gene pools:

Polyploid nature of the Wheat crop has been blamed for lack of heterosis and intergenomic heterosis has already been exploited. But success in rice hybrids would give rise to new hopes. Identification of large compatibility genes in rice has opened up avenues for the use of high heterosis inter-sub-specific hybrids. Due to comparative mapping and synthesis in cereals, heterosis between spring, winter and optional wheat cultivars, as in the case of rice, maybe more commonly used. Further understanding of Photoperiod (Ppd genes) and Vernalisation (Vrn) may aid in the generation of hybrids between spring and winter gene pools.

5.Fixation of heterosis by apomixis:

This can be a challenging goal in the case of cereals where endosperm is the main part in terms of economic significance. It may not be possible to grow proper endosperm by apomixes. However, some solutions could be given to advances in modern biotechnology. The only close relative of wheat with an apomictic gene is Elymus rectisetus, which may be well studied for this reason.