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## Marker-assisted selection of water efficient aerobic rice lines with intact Basmati grain characteristics

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Water scarcity has threatened the traditional way of rice cultivation. Conventionally, rice is cultivated in flooded conditions and it requires huge amount of water (5000 litres of water for producing one kg rice). Asia's irrigated rice fields produce about 75% of all rice harvested and account for more than 45% of the total diverted fresh water. To tackle the problem of water scarcity, research has been directed towards the development of "aerobic rice" varieties that combine the drought-resistant characteristics of upland varieties with the high-yielding traits of lowland varieties. Aerobic rice has advantage of the drought-resistant characteristics of upland varieties with the high-yielding traits of lowland varieties, grown in irrigated, flooded fields. In aerobic rice varieties, roots grow deeper and more profusely in comparison to shallow roots of 5 inches in conventional rice varieties which help in better absorption of water thereby eliminating the need for water logging and non-methane emitting. Aerobic rice system eliminates surface runoff, percolation and evaporation losses resulting in twice the water productivity of flood irrigated rice. Aerobic rice requires 50% or less of the amount of water used by lowland rice. In India, development of aerobic rice varieties was initiated at the University of Agricultural Sciences, Bangalore in 1980 using the available upland paddy and high-yielding rice germplasm and several aerobic rice varieties such as MAS946-1, PMK3, MAS25, MAS26 and MAS946 have also been developed for aerobic cultivation using conventional breeding and marker-assisted selection techniques in combination. Basmati rice breeding has been proven difficult because of poor combining ability, incompatibility with *indica/japonica* cultivars and high inter-group hybrid sterility. Introgression of desirable traits from *indica, japonica* or aus rice varieties into basmati rice is further complicated because of the need to keep all the basmati rice grain and cooking quality traits intact during the selection process.

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## Role of ADP-glucose pyrophosphorylase for thermo-tolerance in developing grains of Wheat (*Triticum aestivum* L. em. Thell)

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Wheat (Triticum aestivum L. cm. Thell) is one of the most important cereal crops of the world. Wheat is grown under sub-tropical environment in Indian sub-continent during mild winter that warms up towards the grain-filling stage of the crop. High temperature in the month of February-March is not congenial for grain development, thus leading to reduced yield. The main effect of high temperature after anthesis is a reduction in grain size. Starch accounts for 70% of the wheat grain dry weight. Reduction in the starch content accounts for most of the reduction in grain dry matter at high temperature above 18-22° C. There are certain key enzymes in process of starch formation in grains and in biosynthesis of its precursors i.e., sucrose in leaves. ADP-glucose pyrophosphorylase (AGP; EC 2.7.7.27), an allosterically regulated heterotetramer consisting of two large and two small subunits, catalyzes the rate-limiting reaction in starch biosynthesis in plants. AGPase uses the substrates glucose 1-phosphate and ATP to produce ADP-glucose and pyrophosphate. The positive allosteric effector of AGPase is 3-phoshoglycerate, whereas the negative allosteric effector is orthophosphate (Pi). Because AGPase is the rate limiting step in starch biosynthesis, an increase in AGP activity within the endosperm of wheat seeds should increase developing seed sink strength and overall plant productivity. In various studies, AGPase has shown positive correlation with the grain growth and starch accumulation in wheat which indicates that increasing the enhancing the efficiency of the enzyme would lead to faster grain filing.

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