Name of products:

Non-transgenic bread wheat (*Triticum aestivum*) lines with high level of healthy starch [High amylose (50-75%) / resistant starch (16-45%)]

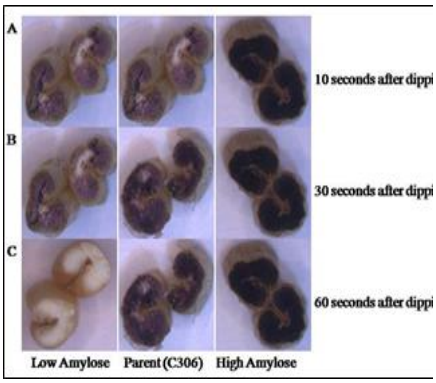

Figure 1: Color method (blue color intensity) used on half-seeds to detect high amylose mutant lines. Low amylose line (amylose content, AC, – 6 %), parent variety (AC – 26 %), and high amylose line (AC – 64 %)

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Country context: Improvement of wheat varieties of India or worldwide for resistant starch.

Scalability: The material is ready for scale up through multiplication.

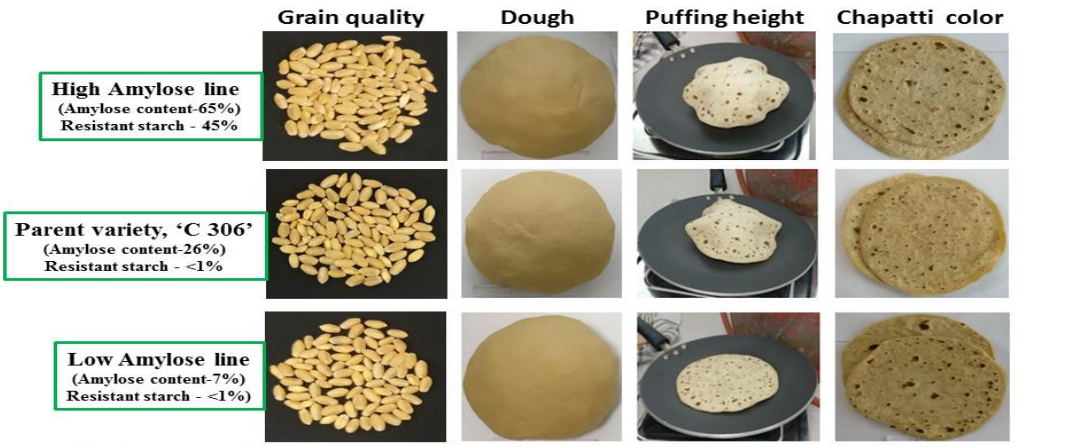
Business and Commercial Potential: It holds potential for commercialization for nutrition quality as resistant starch or healthy starch is consider under soluble dietary fibers.

Potential Investors to this technical innovation: Few multi-national food industries are working on development of resistant starch for good health

Stage of Development: High amylose/resistant starch lines are stable and ready to transfer.
Patent/IPR status: The lines will be registered.

Technology description: The traditional non-transgenic mutation strategy was adopted to generate a mutant population for identification of mutant lines showing variation in amylose content and resistant (healthy) starch. For this, the Indian bread wheat (*Triticum aestivum*) variety, 'C 306', a good chapatti variety, was treated with EMS (ethylmethyl sulfonate) and a set of 101 M6 mutant lines showing variation between ~3% to 76% in amylose content in grain starch and resistant starch from 0 to 41% was identified using color method (Figure 1). Twenty-one lines showed resistant starch (RS) content at least 10% in comparison to their parent variety with <1%. Eighteen out of 21 high resistant starch lines showed better performance in thousand kernet weight and yield. Some of them showed good chapatti quality (Figure 2).

Figure 2: Product evaluation of high resistant (healthy) starch wheats



Wheat lines (AC%)	Chapatti colour	Dough stickiness	Puffing height	Chapatti texture
High amylose-64%	White brown	Less Sticky	High puffy	Soft
Parent -26%	Reddish brown	Less sticky	Puffy	Intermediate
Low amylose-7 %	Brown	Highly sticky	No puffy	Hard

Background: Wheat flour is processed into a wide range of end-use food products, whose complex quality mainly depends on biochemical composition of grains. Starch affects the processing, cooking, and organoleptic qualities, and digestibility of starch-based food products. The wheat grains contain about 70% starch which requires to be improved into nutritive starch, for example, high amylose-starch or resistant starch for healthy wheat diets. Initial screening of Indian bread wheat varieties showed narrow variation in amylose content (22-30%) and no variation in resistant starch (<1%) in grain starch. A set of germplasm showing variation is pre-requisite for genetics and molecular knowledge of genes and their regulators underlying amylose variation and their interaction among with environment. To achieve this, a set of mutant lines showing variation in amylose and resistant starch were developed in Indian bread wheat (*Triticum aestivum*) variety through ethylmethyl sulfonate (EMS) treatment of seed.

Benefits and Utility: High resistant starch has been advocated for obese due to its low gycemic index, good health due to conversition of resistant starch into prebiotics (butyric acids) in large intestine by gut bacteria, preventive measure in colon cancer, help in high absorption of iron and calcium, oral suspension to prevent cholera (USA_FDA, 2015 guidelines), etc These lines are resources for wheat flour enriched in resistant (healthy) starch, good chapatti quality, and resistant starch extracted from wheat flour itself has tremendous market value.