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Review

High oleic peanut breeding: Achievements, perspectives, and prospects

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ABSTRACT

Background: The nutritional quality, flavor, and shelf-life of both peanut products and its seeds are dependent on relative quantity of various fatty acids (FAs) like saturated, mono unsaturated fatty acid (MUFA) and poly unsaturated fatty acid (PUFA) present in its oil. High oleic (HO) peanut oils are extremely valued due to its superior nutritional composition for human health and augmented thermo-oxidative stability for industrial purposes.

Scope and approach: From the research perspective, noteworthy progress has been made during last three decades for the development of peanut lines having HO trait in its oil. In this review, the research achievements, perspectives, and prospects of peanut genetic improvement for HO trait is thoroughly discussed.

Key findings and conclusions: The research has helped not only understanding the genetics of HO traits and its genotype (G) by environment (E) interaction but also produced an enormous number of HO line throughout the world. Although, as of now, most of the high O/L cultivars developed are the outcome of traditional breeding efforts. But, with the advent of novel molecular techniques like CAPS and AS-PCR assay for HO peanut breeding program, it is extremely easy to achieve the traits through marker assisted selection (MAS) rather than through either conventional or genetic engineering approaches. The availability of peanut genome sequence and identification of different *ahFAD2* gene families is also expediting the research for the breeding of HO peanut genotypes.

1. Introduction

Consumption of edible vegetable oils at global scale has steadily increased from 87.8 million metric tons (MMT) in the year 2000 to 186.5 MMT in 2016 (USDA-FAS, 2017). This persistent augmentation in demand has been primarily due to the more use of edible oils in various types of food preparations. Nearly 80% of edible oils are derived from various plant species including annual oilseed crops like soybean, rapeseed, sunflower and peanut. Cultivated peanut (*Arachis hypogaea* L.) is an allotetraploid (2n = 4x = 40, AABB) crop which is being cultivated largely by the small and marginal farmers, mostly under low-input situations, in more than 100 countries (Bosamia, Mishra, Thankappan, & Dobaria, 2015; Sarkar, Thankappan, Kumar, Mishra, & Dobaria, 2014). Peanut is one of the major oilseed crops, grown over 25.45 m ha area, contributing to the bulk of total worldwide vegetable oil production (5.77 MMT) (USDA-FAS, 2017).

Peanut oil contains about 12 FAs, of which nearly 80% is composed of oleic acid (C18:1, Δ9) -a MUFA and linoleic acid (C18:2, Δ9, Δ12) -a PUFA. Further, palmitic acid- a saturated FA contributes nearly 10%, while remaining 10% are constituted of up to nine other FAs (Janila et al., 2016). The nutritional quality, flavor, and shelf-life of peanut seeds and its products are contingent on the presence of relative proportion of various FAs like SFAs, MUFAs and PUFAs in its oil (Derbyshire, 2014). The high proportion of linoleic acid in peanut oil is accountable for its low oxidative and frying stability, resulting in rancidity, off-flavors, and short shelf-life of manufactured food products (Mondal, Badigannavar, & Dsouza, 2010). Partially hydrogenated vegetable oils are preferred by the food industry so as to provide ample functionality for a variety of product uses such as high flavor, low-price, and consistent availability (Schwingshackl & Hoffmann, 2012). Numerous chemical and epidemiological studies have shown a strong association between partially hydrogenated fats or trans-FAs and cardiovascular disease risk (Mozaffarian, Katan, Ascherio, Stampfer, & Willet, 2006). Further, during storage, there are breaks in carbon

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