NIN Centenary Year

(1918 – 2018)

Empowering the Nation through Nutrition

Second International NIN Centenary Conference on

Aligning food systems for healthy diets and improved nutrition

November 11th - 13th 2018

आई सी एम आर – राष्ट्रीय पोषण संस्थान
हैदराबाद

ICMR - NATIONAL INSTITUTE OF NUTRITION
HYDERABAD

T3-P45

Heterosis and Combining ability studies for improving grain Fe and Zn concentration and agronomic traits in Sorghum [Sorghum bicolor (L.) Moench]

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Objective: Sorghum is a staple food for more than 300 million people in more than 30 counties. It is a rich source of micronutrients. Biofortifying sorghum with enhanced grain Fe and Zn is a major breeding objective. The present study was aimed at formulating suitable breeding program by studying gene action, heterosis and combining ability for improving grain Fe and Zn concentration in sorghum.

Materials & Methods: This study was conducted in Line × Tester mating design involving seven parents. Twelve hybrids were developed by mating three lines with four testers. The combining ability of the crosses indicated predominance of dominance variance than additive variance for the agronomic traits such as days to 50 % flowering, grain yield, grain Fe and Zn concentration except for plant height and 100 seeds weight.

Main Findings: Higher magnitude of SCA than GCA variance for grain iron and zinc concentration indicated the importance of non-additive gene action in these nutritional traits improvement. Hybrids showed heterosis for agronomic traits and for grain Fe concentration and limited heterosis for grain Zn. Most of the traits showed significant positive heterosis over mid parent value indicating the predominance of dominant gene action except the trait -100 seeds weight. Significant positive mid-parent heterosis for grain iron (Fe) indicated that there would be an opportunity to exploit heterosis in improving for grain Iron. But for Zn concentration, there is limited possibility for exploitation of heterosis. This study suggested that simple selection will improve plant height and 100-seed weight in sorghum but heterosis breeding is more useful for improving grain yield. While both parents need to be improved for improving grain Zn concentration there is good scope for exploiting heterosis for improving grain Fe concentration in sorghum.

Conclusion & Recommendations: We released first biofortified sorghum variety 'Parbhani Shakti' (45 ppm Fe and 32 ppm Zn) with higher yield (4 tha-1), higher protein (11.9%) and low phytates content (4.1 mg/100 g) and released in 2018. Biofortified sorghums complements the on-going approaches for combating dietary induced micronutrient malnutrition.

Keywords: Heterosis, GCA, SCA, Gene Action, Grain iron, Grain Zinc.

Registration Id: NINCONF804