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Impact of iron pearl millet seed distribution intensity on adoption, yield, and iron intake in India

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Abstract

Iron deficiency anemia affects millions in India, and biofortification of staple crops like pearl millet is a promising solution. HarvestPlus and partners have distributed iron pearl millet seeds, but the impact of varying distribution intensities is unclear. The districts were divided into high, medium and low (control) districts to examine the effects of low, medium, and high seed delivery intensities on adoption, yield, and iron intake using 2023 data. The total amount of iron pearl millet delivered to the districts between 2015 and 2023 was 250, 140 and 80 metric tons for high medium and control districts respectively. The analysis employs propensity score matching (PSM) and inverse probability weighted regression adjustment (IPWRA) to control for endogeneity bias. Results demonstrate that higher seed distribution intensity significantly increases IPM adoption rates by 11 % higher in high-intensity areas leading into 15 % higher area under IPM thus enhancing iron and zinc intake of 24 mg per person intake in high-intensity areas. However, higher seed delivery intensity is also associated with lower pearl millet yields of 830Kg per hectare in high-intensity areas. The results from heterogeneous analysis show that the effect of iron pearl millet seed delivery intensity varies with propensity score where farmers that have higher propensity scores are found in high intensity districts. More so the effect of medium seed delivery intensity varies with socio economic characteristics of the farmer. These findings highlight a complex relationship between seed distribution intensity, and nutritional outcomes. Specifically, while higher distribution intensity effectively promotes the adoption of iron-biofortified pearl millet and improves dietary micronutrient intake, it may come at the cost of reduced yields. These results provide valuable insights for optimising biofortification strategies and designing evidence-based policies for large-scale implementation.

Keywords: iron pearl millet, yield, adoption, biofortification, iron intake, seed distribution intensity