Protein quantity and quality, and agronomic performance of quality protein maize and normal endosperm maize under different levels of nitrogen

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Abstract

Most farmers in sub-Saharan Africa produce maize under low soil nitrogen (N) fertility. Quality protein maize (QPM) which contains higher amounts of the essential amino acids lysine and tryptophan than the normal endosperm maize is being promoted in areas where maize constitutes the major source of dietary proteins. This study was, therefore, aimed at examining the effects of low N stress on protein quantity and quality, grain yield, and other agronomic traits of selected QPM and non-QPM maize varieties. Three QPM and 13 non-QPM maize genotypes were planted under a range of N levels at Harare, Zimbabwe in 2003 and 2004 and at Kiboko, Kenya in 2003. Significant genotype differences were observed in total grain and endosperm protein contents, lysine and tryptophan contents, grain yield, and susceptibility to grain (ear) rot. For both QPM and non-QPM genotypes, the quantity of total grain protein, and endosperm lysine, tryptophan and protein contents were influenced by N levels in the soil. QPM maize genotypes maintained their superiority to non-QPM varieties in lysine and tryptophan contents in all environments. QPM types had higher quality index than non-QPM varieties in all environments, reflecting the stable effect of the opaque-2 gene for protein quality across soil-fertility gradients and sites. On the average, endosperm tryptophan was 45% higher and lysine was 27% higher in QPM cultivars than in non-QPM varieties. The best QPM genotype out-yielded the non-QPM commercial variety under severe low-N stress at Harare, indicating the possibility of developing N-efficient QPM cultivars that may combine high yield potential and good protein quality under low-N conditions.