



Colour as Nutrition: Profiling Anthocyanin and Antioxidant Capacity in Pigmented Wheat, Rice, and Maize Landraces

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Abstract

The relationship between pericarp coloration and nutritional quality in cereal grains has gained substantial scientific attention, yet systematic quantitative assessments across pigmented landraces remain fragmented in the literature. The present study synthesizes peer reviewed studies from 2010 to 2025 examining anthocyanin composition, total phenolic content, and antioxidant capacity in pigmented wheat, rice, and maize landraces relative to conventional non pigmented genotypes. Quantitative synthesis demonstrates that pigmented wheat landraces accumulate total anthocyanins ranging from 30 to 210 micrograms per gram of dry weight, with cyanidin 3 O glucoside and peonidin 3 O glucoside as the predominant molecular species. Purple and black rice landraces exhibit the highest concentrations among all cereals examined, ranging from 350 to 1,200 micrograms per gram, representing a 10 to 40 fold increase relative to milled white rice. Blue and purple maize genotypes contain 100 to 600 micrograms per gram, with acylated anthocyanin derivatives conferring significantly enhanced thermal stability compared to non acylated analogues. Total phenolic content follows an identical rank order, with pigmented varieties demonstrating two to five fold higher values than non-pigmented controls. Antioxidant capacity exhibits strong positive correlation with total anthocyanin concentration across all three cereal types, with pigmented rice achieving DPPH radical scavenging IC₅₀ values of 0.8 milligrams per millilitre compared to 4.5 milligrams per millilitre for white rice. The aim of this review is to consolidate current quantitative evidence on anthocyanin profiles and antioxidant functionality in pigmented wheat, rice, and maize landraces and to establish colour based screening parameters for bio-fortification breeding programs targeting enhanced nutritional outcomes in staple cereal crops.

Keywords: Anthocyanins; antioxidant capacity; bio-fortification; coloured grains; landraces; maize; pigmented cereals; rice; wheat

