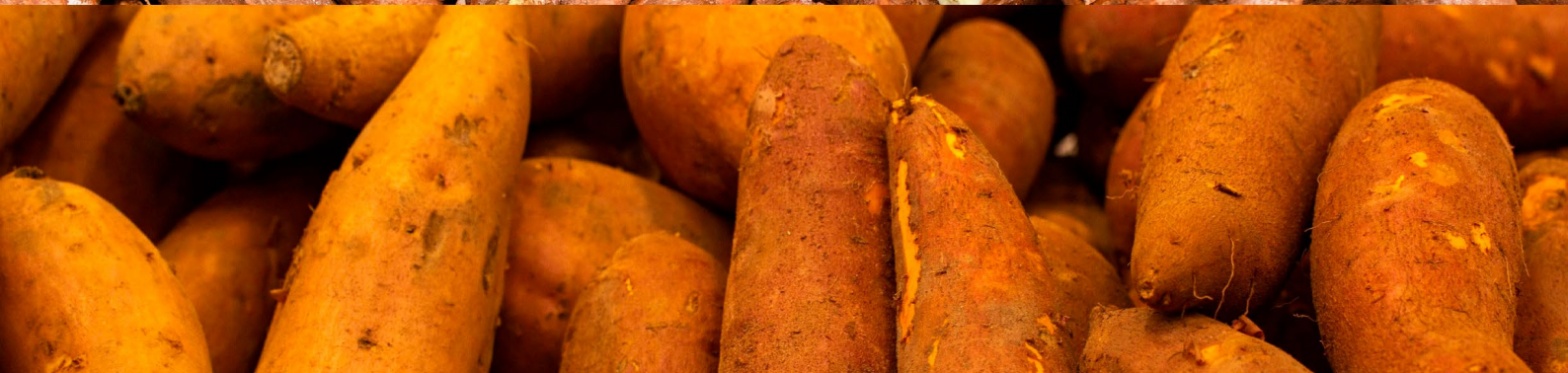


PAS 235:2022

Provitamin A carotenoids (PVAC) enriched maize grain, cassava and sweet potato roots – Specification



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Foreword

This PAS was sponsored by the Commercialization of Biofortified Crops (CBC) program, which is a partnership between the Global Alliance for Improved Nutrition (GAIN) and HarvestPlus, with funding from Netherlands Ministry of Foreign Affairs and German Federal Ministry for Economic Cooperation and Development. Its development was facilitated by BSI Standards Limited and it was published under license from The British Standards Institution. It came into effect on 31 July 2022.

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The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

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0 Introduction

0.1 General

HarvestPlus leads and coordinates a global effort within the Consultative Group on International Agricultural Research (CGIAR) network to improve nutrition by promoting biofortified staple crops. This effort focuses on catalyzing the development, production, delivery and consumption of foods that are rich in essential micronutrients, including vitamin A. In May 2018, HarvestPlus and GAIN launched a landmark partnership to accelerate progress towards improving access to biofortified seed, grain and foods via commercial channels with the Commercialization of Biofortified Crops (CBC) program.

The standard outlined in the PAS is meant to enable easier procurement of maize grain, cassava and sweet potato roots enriched prior to harvest with provitamin A carotenoids (PVAC). Processing after this point, which might reduce micronutrient concentration, is not covered by this PAS. Further processing and promotion to consumers is not covered.

0.2 Provitamin A carotenoids (PVAC)

Provitamin A carotenoids are naturally occurring compounds commonly found in foods which convert to retinol (vitamin A) in the body. Vitamin A deficiency is a public health problem in more than half of all countries, especially those in Africa and South-East Asia. The most severe effects of this deficiency are seen in young children and pregnant women in low-income countries [1]. Night blindness is one of the first signs of vitamin A deficiency. In its more severe forms, vitamin A deficiency contributes to blindness by making the cornea very dry, thus damaging the retina and cornea. An estimated 250 000 – 500 000 children who are vitamin A-deficient become blind every year, and half of them die within 12 months of losing their sight [1]. Vitamin A deficiency also contributes to maternal mortality and other poor outcomes of pregnancy and lactation. Vitamin A is important for several functions in the body. Even mild, subclinical deficiency could cause problems such as:

- a) Increasing children's risk for respiratory and diarrheal infections in children;
- b) decreasing growth rate;

- c) slow bone development; and
- d) decreasing the likelihood of survival from serious illness.

When consumed daily, PVAC enriched maize, cassava and sweet potato can contribute up to 50% of the recommended daily allowance (RDA) of vitamin A for women and young children who regularly consume these staples. The RDA is the average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%–98%) healthy people.

NOTE 1 See *HarvestPlus publication, Estimated Average Requirements Provided by Biofortification [2]*.

PVAC enriched crops contain high concentration of PVAC during harvest, however, several factors affect the concentration of PVAC after harvest. The highly unsaturated structure of carotenoids makes them highly susceptible to post-harvest degradation by heat, light and oxygen during storage. As such, while research has shown that PVAC concentration from PVAC enriched foods is higher than that from conventional crops during harvest, attention should be given to storage duration, methods of storage, nature and degree of processing, to ensure maximum retention of the available carotenoids at time of consumption.

Biofortified foods processed/prepared in households are typically not subject to high levels of PVAC loss; the general nutrition impact is high due to the relatively high "true PVAC retention". Processed commercial products might be subject to higher nutrient losses. The portion of edible food has relatively higher levels of PVAC, enough to produce an impact on the consumer, especially for cassava flour/granules and sweet potato flour/chips.

NOTE 2 See *Bioavailability of zinc, PVAC, and Provitamin A carotenoids in biofortified staple crops [3] and Food Biofortification – Reaping the Benefits of Science to Overcome Hidden Hunger – A paper in the series on The Need for Agricultural Innovation to Sustainably Feed the World by 2050 [4]*.

NOTE 3 See *published papers covering PVAC retention in foods made from each of crop [5], [6] and [7]*.