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Effect of environmental conditions and water status on the bioactive compounds of broccoli

Research Article

Zoltán Pék[1,*], Hussein Daood[2], Magdolna Gasztonyi Nagyné[3], András Neményi[1], Lajos Helyes[1]

[1]*Institute of Horticultural Technology, Szent István University, H-2100 Gödöllő, Hungary*

[2]*RET Regional Science Center, Szent István University, H-2100 Gödöllő, Hungary*

[3]*Central Food Research Institute, H-1022 Budapest, Hungary*

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Abstract: Four experiments were carried out in 2010 and 2011 to determine how cultivation period (spring or autumn), harvest season (summer or autumn), and plant water status (irrigated or rainfed) influenced content and composition of broccoli cultivar Parthenon F1 with respect to sulforaphane and phenolics under field conditions in Gödöllő, Hungary. Sulforaphane content was significantly higher in the autumn harvests, regardless of irrigation treatments. Harvest season also influenced total phenolics content, with the highest values occurring in the spring season. Harvest season also affected trolox equivalent antioxidant capacity (TEAC) and this capacity was also the greatest in spring. Caffeic acid glucoside was a major phenolics component in both spring and autumn season harvests. The season and irrigation related changes in other phenolic component contents were also characterised in this study.

Keywords: *Brassica oleracea convar. botrytis var. italica* • *Phenolics* • *Sulforaphane* • *TEAC* • *Irrigation*

1. Introduction

Glucosinolates are the main bioactive compounds found in the *Brassicaceae* family. Interest has grown over the past few decades in these phytochemicals of broccoli (*Brassica oleracea* convar. *botrytis* var. *italica* L.) and the role they may play in plant protection with regards to the influences of abiotic and biotic factors, but also in potential effects on human health [1-4]. This rising interest is primarily due to experimental evidence suggesting a therapeutic and preventative effect of the dietary constituents of broccoli on cancer progression [5]. Sulforaphane is classified under the isothiocyanates, which are formed from the parent compound glucoraphanin. Only glucoraphanin, an aliphatic glucosinolate, can form sulforaphane when hydrolyzed by myrosinase [6]. Glucosinolates are located within the vacuole of plant cells of Brassica crops, as opposed to the location of the enzyme myrosinase, which is localized to the interior of myrosin grains [7], so tissue rupture is necessary to bring them into contact. Recent scientific studies reported two controlling mechanisms affecting glucosinolate metabolism in broccoli. The first mechanisms is the glucosinolate-myrosinase system which is aimed at protection from herbivores [8,9], and the second mechanism appears to be associated with protection from environmental effects [6,10-12]. Glucosinolates and their hydrolysis products play an important role in plant defence and plant-insect communication in Brassicaceae [8]. Sulforaphane is formed from glucoraphanin, by the action of myrosinase, when broccoli tissue is crushed or chewed [6].

Sulforaphane has been reported to have important anti-carcinogenic potential [13] in the case of several cancer types including skin carcinogenesis [14,15]. The effective indirect antioxidant role of sulforaphane has recently

* *E-mail: pek.zoltan@mkk.szie.hu*