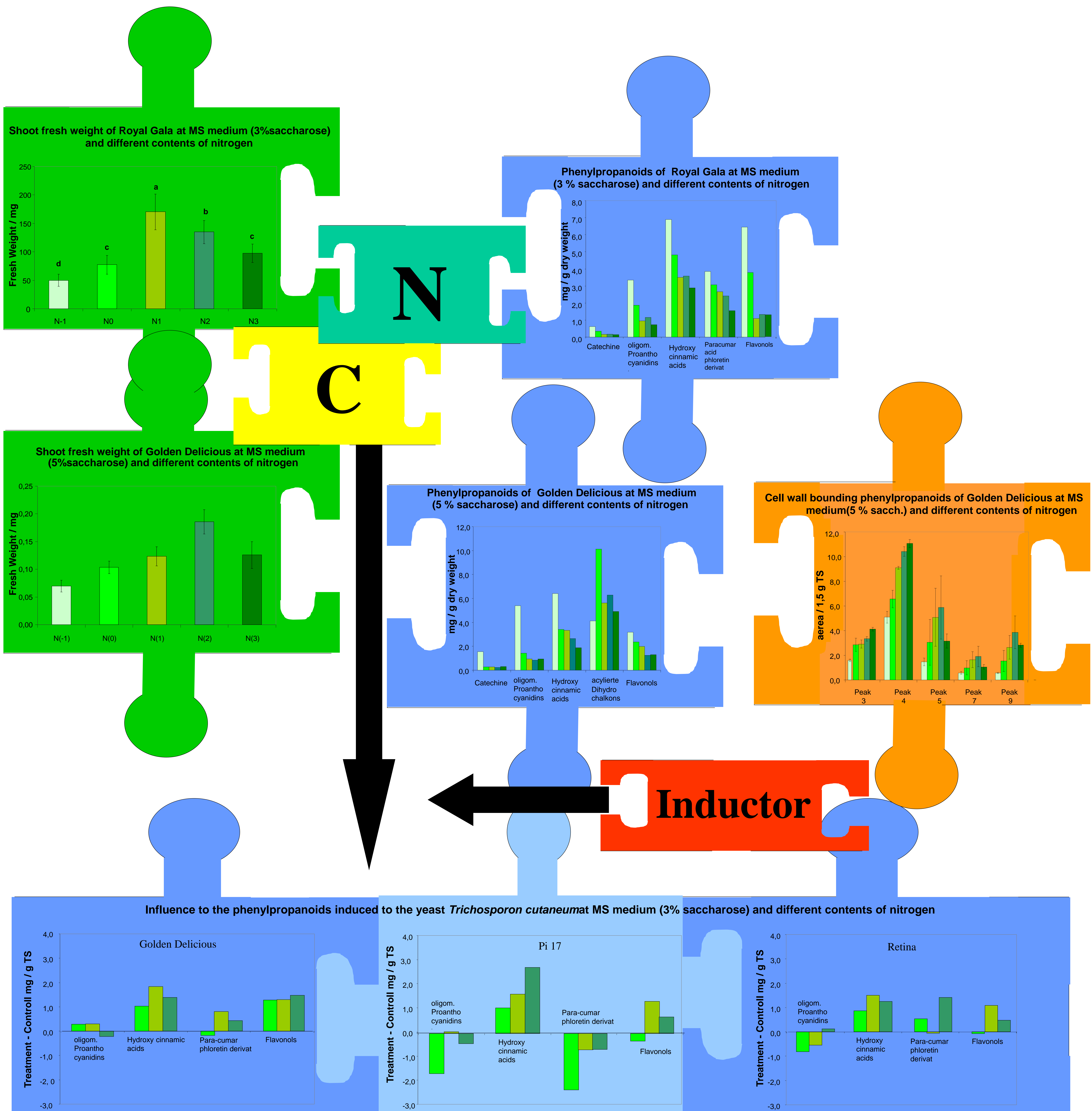


Influence of nitrogen content on growth and phenylpropanoide metabolism in apple in vitro cultures

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Influence of nitrogen content on growth and phenylpropanoide metabolism in apple in vitro cultures

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The involvement of phenolic compounds in resistance of the apple *Malus domestica* to agents like the scab fungus *Venturia inaequalis* has often been described in the past (Oydvin and Richardson, 1987). Especially the content of flavan-3-ols correlates with scab resistance in apple (Treutter and Feucht, 1990; Mayr et al., 1995a). The influence from PAL accumulation, a key enzyme of the phenylpropanoid biosynthesis, and therefore from phenylpropanoids is proved from Mayr et al. (1997). Because the phenol synthesis of plant tissues depends on environmental conditions like nutrient supply (Feucht and Schmid, 1988; Bauer et al., 1989; Bauer and Treutter, 1990) Lux-Endrich et al. (2000) were able to prove the influence from macronutrient supply to the content of phenolic substances under in vitro conditions. A decreasing content of all tested phenolic compounds with increased concentration of macronutrients were observed.

The aim of this study was to restrict the effect of one of this macronutrient, the nitrogen, to the phenylpropanoid pathway and therefore to the susceptibility to agents.

A good example for the influence of nitrogen supply and secondary pathway shows the reduced colouring of apple fruits caused to an excessive nitrogen fertilization. The reduced colouring is attributed to an inhibited anthocyanidine synthesis resulted to a decreased PAL activity. This synthesis of this enzyme is reduced by an excessive nitrogen supply.

In vitro plants from different kinds of apple are cultivated in modified MS medium with different nitrogen levels for using ammoniumnitrat and potassiumnitrat.

The leaf fresh mass production has a course like an optimum curve with an optimum at N1 var. (normal nitrogen level in MS medium). The influence from nitrogen to the phenylpropanoid pathway has an other course. An increased nitrogen supply resulted in a decreasing of all groups of phenylpropanoids. Catechine as well as phloretinderivates, oligomere proanthocyanidins, hydroxyzimtsäurederivates and flavonols decrease at increasing nitrogen supply in a continue course. But within the groups not all cases of phenylpropanoids are decreased in an increasing nitrogen supply. Especially the synthesis of some hydroxyzimtsäuren like a p-cumarsäure-derivat, a ferulyl-glucose and two not identified hydroxyzimtsäurederivates are stimulated by increased nitrogen supply in seven from thirteen kinds of apple. Some kinds of apples react with increasing accumulation of acylierte dihydrochalcone like p-cumarsäure-eriodictyol-derivat or p-cumarsäure-phloretin-derivat.

The role of these phenylpropanoide relating to resistance potential are unknown at this time.

Treatments of the plants with inductors stimulating the phenylpropanoid pathway resulted in different reactions in each group of phenylpropanoids. These reactions are influenced by nitrogen supply. The different kinds of apple are different in the level to react.

We think that these differences are transferable to resistance reactions. If particular phenole pattern correlate with resistance potential we could influence the defense reaction of apple plants against agents.

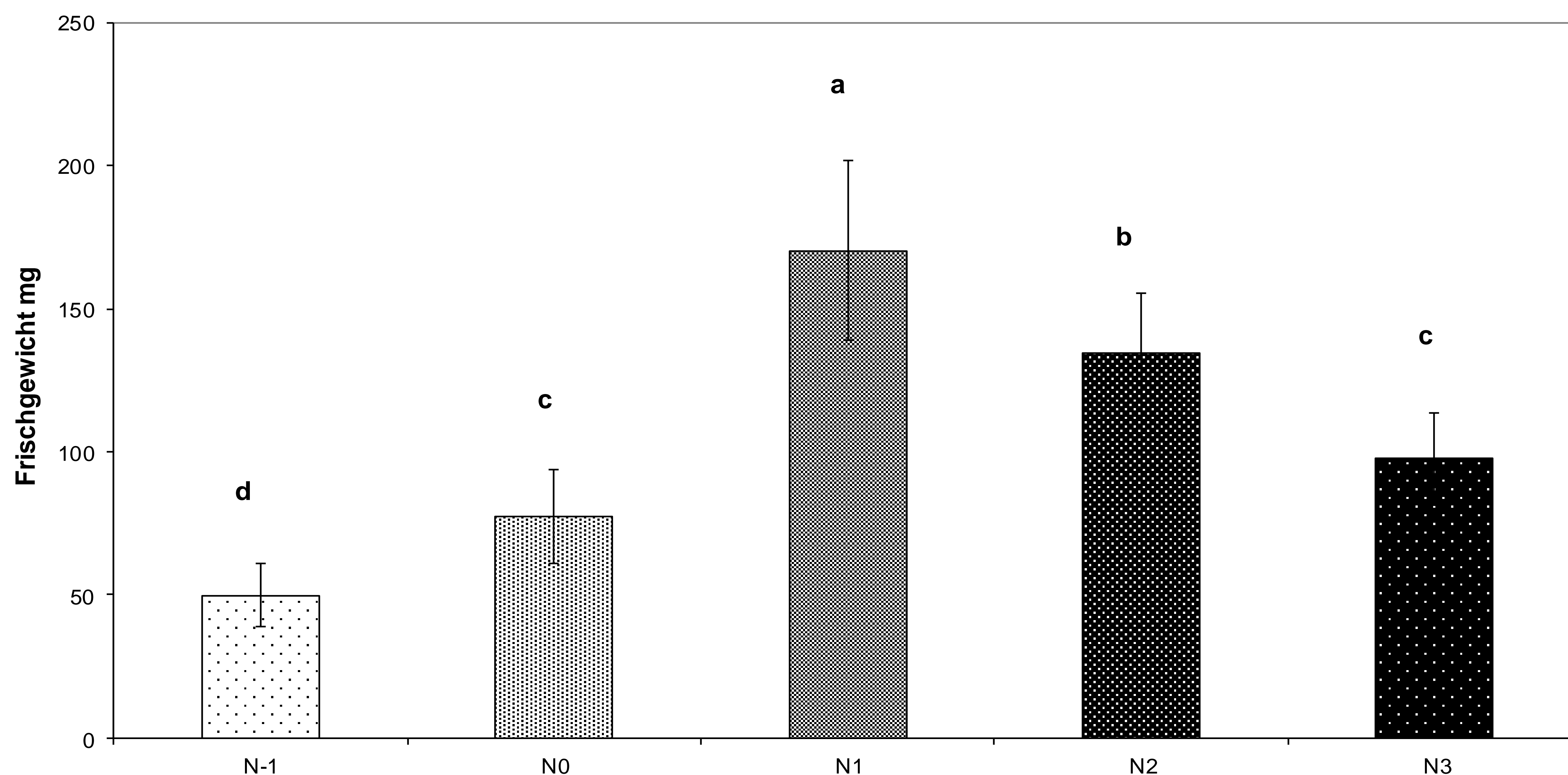


Abb.: Frischgewichtsverteilung bei in vitro kultivierten Kontrollpflanzen der Apfelsorte Royal Gala unter dem Einfluß verschiedener Stickstoffvarianten

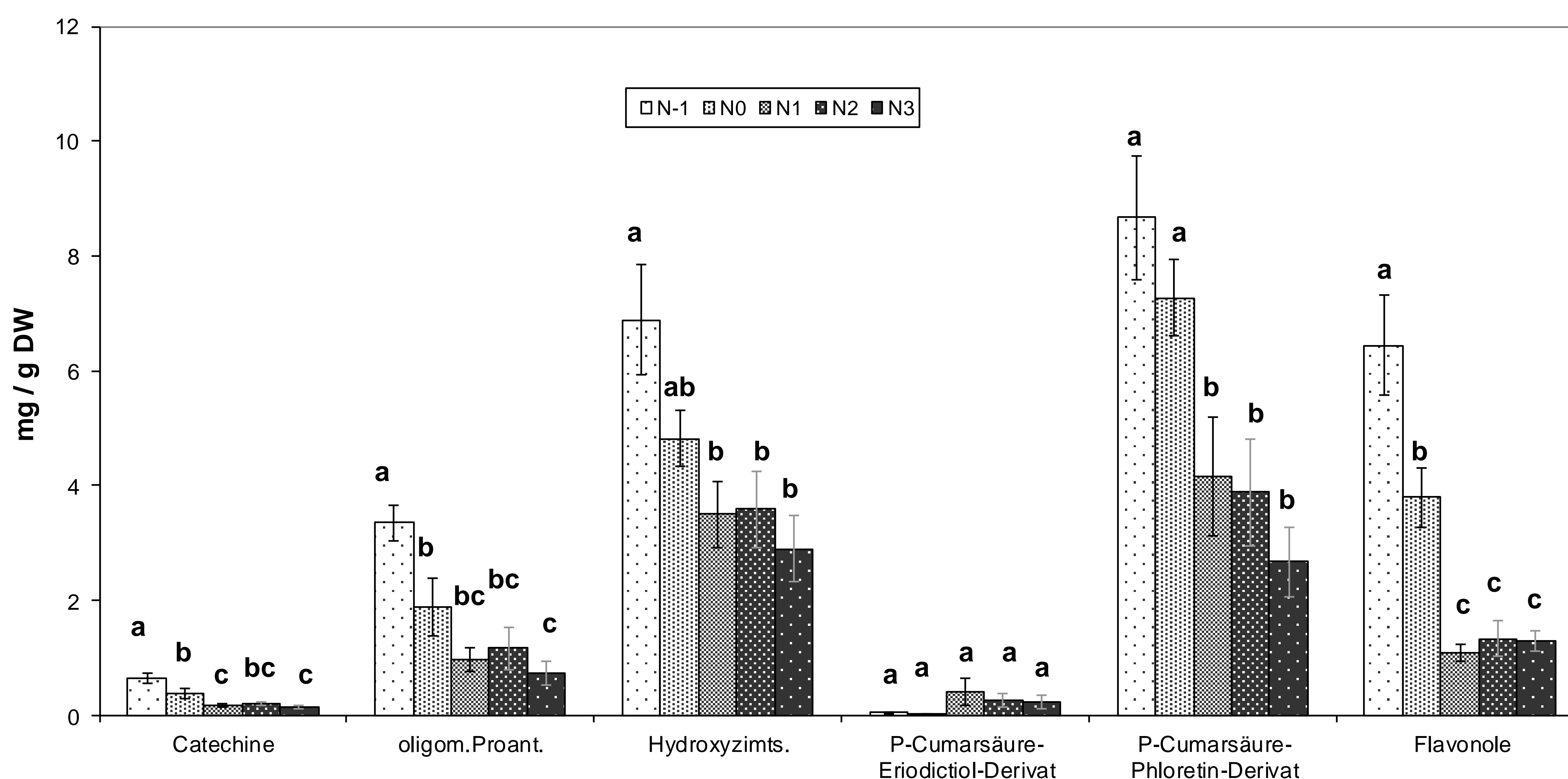


Abb.: Phenolische Inhaltstoffe ohne Phloretinderivate am ersten Entnahmeterrmin der mit Prohexadion behandelten Royal Gala in vitro Pflanzen unter dem Einfluß verschiedener Stickstoffvarianten

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