Valorization potential of italian ryegrass and reed canarygrass based on proximate, carbohydrate and phenolics composition

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INTRODUCTION

Italian ryegrass- IR (*Lolium multiflorum*) and **reed canarygrass-RCG (*Phalaris arundinacea*)** are plant species within the Poaceae family, mainly cultivated for animal feed. Biomass of both species can be characterized as lignocellulose. Recently, these materials are increasingly being investigated for their valorization potential as novel industrial feedstocks, primarily for the production of bioenergy and biochemicals. The recovery of initially present bioactive compounds (phenolics) is still understudied.

The aim of this work to set a base for determining valorization strategies of IR and RCG in terms of proximate composition, with special emphasis on the carbohydrate fraction, and the content of phenolics.

MATERIALS & METHODS

The material was collected in September 2023 near Ludbreg, Croatia. Aerial parts were air-dried and milled using a coffee grinder. Proximate composition was established following AOAC protocols for determining **fat** (AOAC 920.39), **protein** (AOAC 976.05), and **ash** (AOAC 942.05) in animal feed, as presented in Vojvodić et al. (2016). **Lignin** was determined following NREL protocol (Sluiter et al., 2008). **Monomeric profile** of structural carbohydrates was determined upon complete acid hydrolysis of the alcohol-insoluble residue (AIR) and PMP derivatization of the obtained hydrolysate (Vojvodić Cebin et al., 2021). **Structural carbohydrates** were calculated as a sum of all dererminded monomers. AIR was prepared by successive (3x) extractions using 80% ethanol at 1:20 w/v, 80°C, 30 min and constant stirring. The obtained (first) extract was analysed for **free phenolics**, **total phenolics content** using Folin-Ciocalteu reagent and **antioxidant capacity** using ABTS and DPPH radicals. **Bound phenolics** were determined upon deesterification (alkaline hydrolysis) and C18 SPE extraction (Arruda et al., 2018). Both, free and bound individual phenolics were analysed using **HPLC-DAD** using biphenyl column and gradient elution (acetonitrile and water, both acidified with formic acid (0,1%, v/v)) at 0,5 mL/min flow rate and 35 °C; detector was set at 320 and 350 nm.

RESULTS

Lolium multiflorum (italian ryegrass)

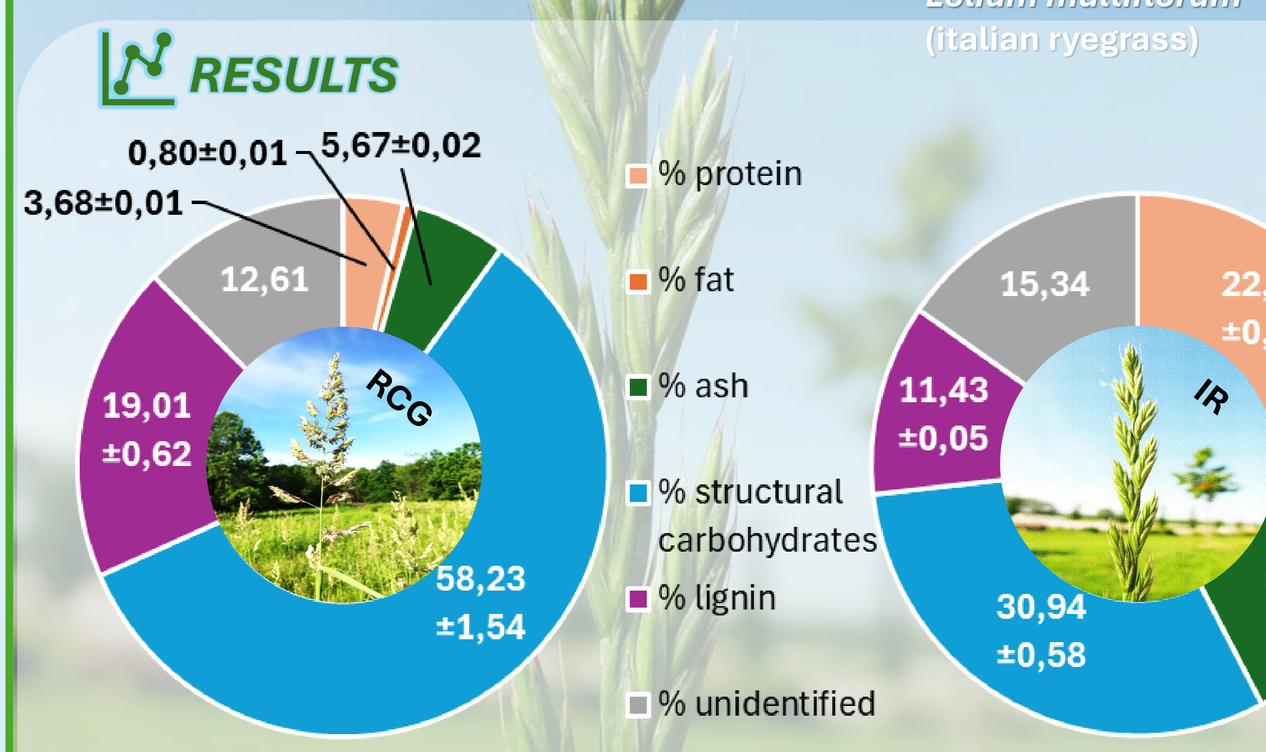
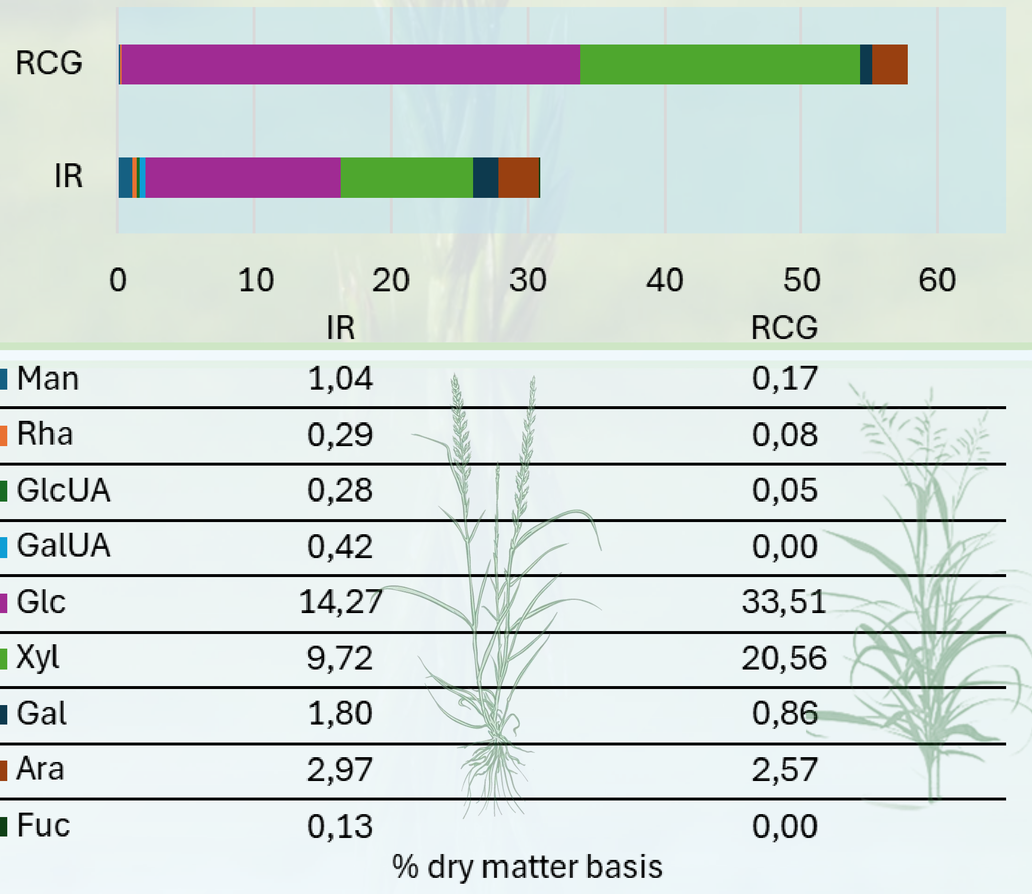


Figure 1. Proximate composition (% dmb) of IR and RCG



	IR	RCG
Man	1,04	0,17
Rha	0,29	0,08
GlcUA	0,28	0,05
GalUA	0,42	0,00
Glc	14,27	33,51
Xyl	9,72	20,56
Gal	1,80	0,86
Ara	2,97	2,57
Fuc	0,13	0,00

% dry matter basis

Figure 2. Monomeric profile of the structural carbohydrate fraction

Phalaris arundinacea (reed canarygrass)

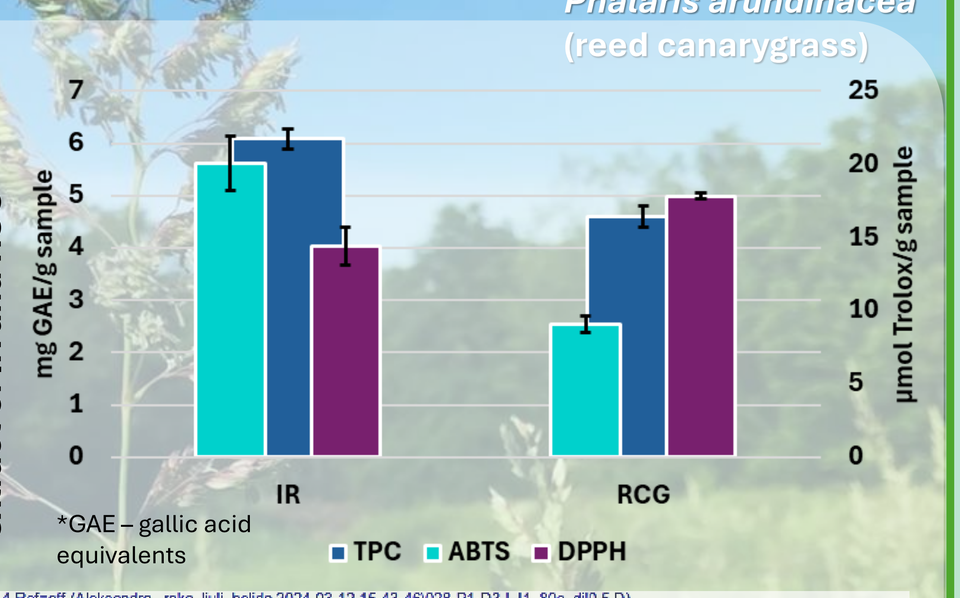


Figure 3. Total phenolics content (TPC) and antioxidant capacity of the 80% etoh extract of IR and RCG

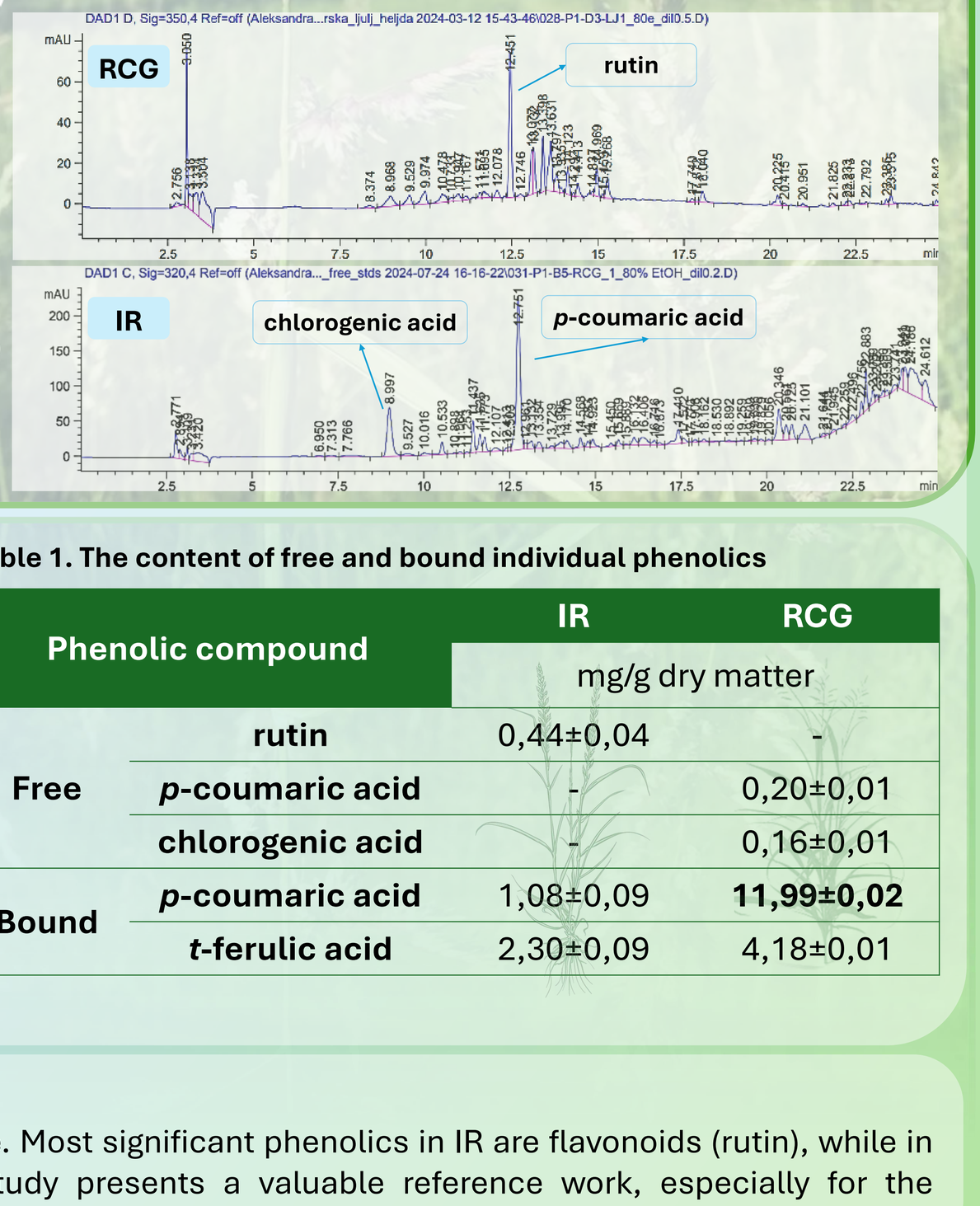


Fig.4 Free phenolics chromatograms of IR and RCG

Table 1. The content of free and bound individual phenolics

Phenolic compound		IR	RCG
		mg/g dry matter	
Free	rutin	0,44±0,04	-
	p-coumaric acid	-	0,20±0,01
	chlorogenic acid	-	0,16±0,01
Bound	*p*-coumaric acid	1,08±0,09	**11,99±0,02**
	t-ferulic acid	2,30±0,09	4,18±0,01

CONCLUSION

RCG is abundant in cellulose and (arabino)xylan-type hemicellulose. Most significant phenolics in IR are flavonoids (rutin), while in RCG hydroxycinnamic acids, especially *p*-coumaric acid. This study presents a valuable reference work, especially for the characterization of phenolics in italian ryegrass and reed canarygrass.

LITERATURE

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