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Changes in protein composition of chickpea genotypes under organic and conventional cropping systems

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Introduction

Chickpea (Cicer arietinum L.) is the third most important legume crop in the world and in the Mediterranean basin, and its seeds are a good source of protein (18–26%) and high quality aminoacids (Ghelfi et al., 2017). Seed proteins, mainly consist of two major groups: 11s legumin and 7s vicilin and convicilin (cupin). Few studies are available on the differences in chickpea protein composition in relation to environment and agronomic management. To this aim a set of different genotypes, grown under two contrasting crop managements, were investigated for agronomic traits and protein composition.

Materials and Methods

Field trials, under conventional (CCS) and organic cropping systems (OCS), were carried out at CREA-CI, Foggia (41°27'30'' N, 15°30'60' E), during two consecutive crop years (2013/14 and 2014/15). Details of meteo data are reported in De Santis et al (2021). Eight genotypes were compared: Calia, Kairo, Nero Senise, Pascià, Principe, Reale, Sultano and Vulcano. Grain yield (GY, kg ha^{-1}), grain weight (GW, mg), water-holding capacity (WHC, g g^{-1}), protein content (PC, %) and composition, in terms of 7s vicilin to 11s legumin ratio (7s-V/11s-L) were assessed (De Santis et al., 2021). Means were separated by Tukey's HSD ($p \leq 5\%$) and principal component analysis (PCA) was carried out by JMP.

Results

Agronomic management showed a significant impact on GY, which was two-fold higher under CCS vs OCS (Table 1), with a moderate effect on GW. While PC was not influenced by management and crop year, protein composition was strongly influenced with a marked negative association between GY and 7s-V/11s-L, being this latter ratio +82% higher under OCS, as showed in Table 1 and by multivariate analysis (Figure 1). The same negative association was found between GW and WHC. Black seeded Nero Senise and Sultano resulted the most productive genotypes, both under CCS and OCS.

Conclusions

In the current study for the first time, at out best knowledge, agronomic traits were put in relation with chickpea protein composition under a GxExM experimental design. The marked difference both in yield and in protein composition between CCS to OCS confirmed the need to select suitable genotypes for organic cultivation in order to improve crop productivity and health quality.

References

Ghelfi, R.et al., 2017. Pulses production in Italy: Trade, marketing and policy issues. Ital. J. Agron.: 12, 891.

De Santis M.A. et al., 2021. Influence of organic and conventional farming on grain yield and protein composition of chickpea genotypes. Agronomy, 11: 191. DOI: **10.3390/agronomy11020191**.

Table 1. Mean effect of genotype, management and crop year on yield and quality parameters.

Factor	Level	GY	GW	PC	WHC	7s -V/ 11s-L
		kg ha-1	mg	%	g g-1	Ratio
Genotype	Calia	982 bcd	328 b	23.4 bc	1.43 b	2.02 a
	Kairo	1215 ab	316 b	24.0 abc	1.36 b	1.89 b
	Nero Senise	1426 a	239 c	23.6 abc	1.64 a	1.43 c
	Pascià	1005 bcd	407 a	22.4 c	1.34 b	1.29 d
	Principe	1190 abc	374 a	25.2 a	1.36 b	1.24 d
	Reale	901 cd	414 a	23.3 bc	1.36 b	1.45 c
	Sultano	1368 a	309 b	23.5 bc	1.42 b	1.33 d
	Vulcano	780 d	300 b	24.1 ab	1.41 b	1.31 d
Management	CCS	1527 a	328 b	23.7 a	1.43 a	1.06 b
	OCS	689 b	344 a	23.7 a	1.40 b	1.93 a
Year	2013/14	792 b	324 b	23.8 a	1.40 a	1.38 b
	2014/15	1424 a	348 a	23.6 a	1.43 a	1.61 a

Values of each parameter followed by different letters are significantly different according to Tukey's test.

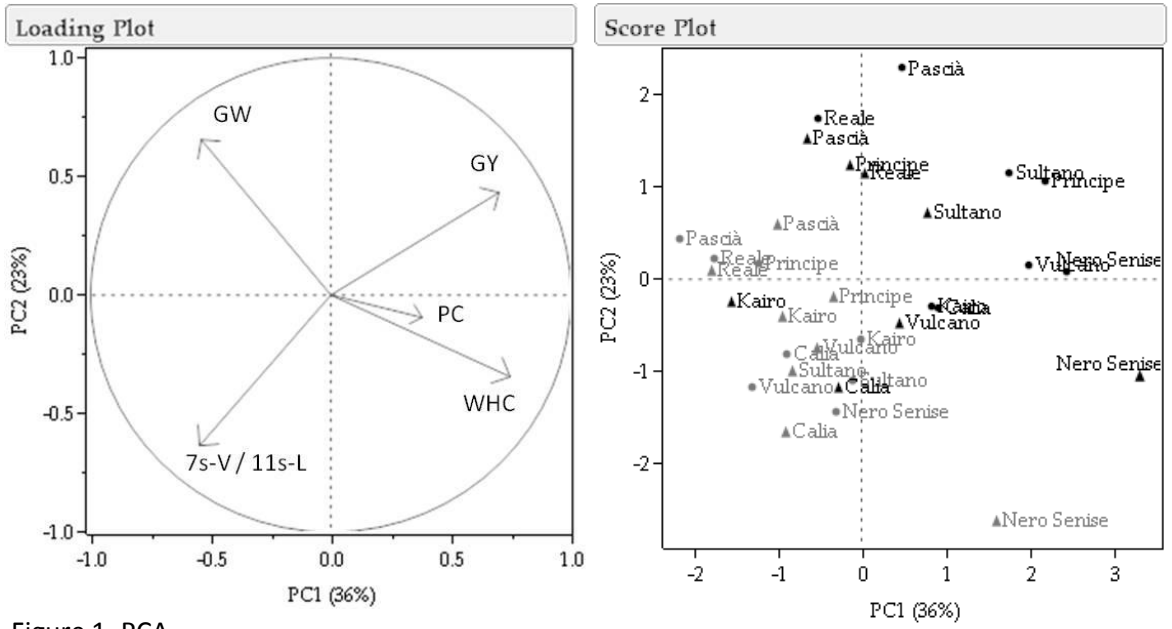

Figure 1. PCA