Bioactive Compounds, Antioxidant Activity and Growth Behavior in Lettuce Cultivars Grown under Field and Greenhouse Conditions

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Lettuce – *Lactuca Sativa* L.

Popular leafy vegetable, widely consumed in salads

Huge morphological variability

Health benefits due to bioactive compounds

Several factors affect the concentration of bioactive compounds:

- Genotype
- Agro-climatic conditions
- Light radiation
- Postharvest handling

RECOMMENDED LETTUCE TYPES FOR EACH NUTRIENT

- Dietary fiber: Romaine
- Iron (Fe): Butterhead, Red Leaf and Baby Green Leaf
- Folate: Butterhead, Romaine and Red Leaf
- Vitamin C: Green Leaf and Baby Green Romaine
- β-carotene and lutein: Butterhead, Romaine and Leaf
- Phenolic compounds: Red Romaine and Red Leaf

* All lettuce types were low in sodium (Na).

Aim of work

- Study the interaction between genotype and environmental conditions regarding bioactive compounds content, antioxidant activity and growth behavior of twenty-two lettuce genotypes, cultivated under field and greenhouse conditions.

Materials and Methods

- Plant material: 22 green and red-pigmented lettuce cultivars

Table 1. Lettuce genotypes classified according to L'Union Internationale pour la protection des obtentions végétales (UPOV).

Type	Genotypes
Iceberg	83-25-317; Dessert storm; BL001; BL003; Road runner; Valley Green
Crisped head	Bacchus; Falbala; BL009; BL010; BL011; Lírice
Batavia	Rossia
Oak leaf	Grenadine
Latin	Crimor; Maravimor
Butterhead	Balerina; BL006; Lores
Romaine	BL012; BL013; BL014

Experimental Field

Greenhouse

- Field Temperature 2.5-19-7°C
- Greenhouse Temperature 4.5-23°C
- Sandy loamy soil

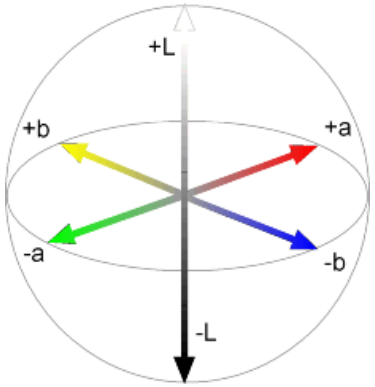
Biometric and analytical determinations

- *Biometric measurements*

Stem diameter

Plant Height

Fresh Weight



Color CIELab

$$C = \sqrt{a^2 + b^2} \qquad h° = \arctan\frac{b}{a}$$

- *Bioactive compounds*

- Phenolic compounds
- Carotenoid
- Chlorophylls
- Anthocyanin

- *Antioxidant activity by DPPH*

$$I\ (\%) = \left[\frac{A_B - (A_E - A_0)}{A_B} \Big/ \frac{A_B - A_{REF}}{A_B}\right]$$

Morphological parameters

Type cultivar	FIELD PRODUCTION Stem Diameter (cm)	Height plant (cm)	Fresh Weight plant (g)
Iceberg	1.67 ± 0.94[1] a[2]	32.67 ± 1.81 cd	465.45 ± 48.20 f
Crisped head	1.89 ± 0.68 ab	26.87 ± 4.65 ab	299.81 ± 89.57 cde
Batavia	3.27 ± 1.10 b	27.67 ± 1.53 abc	436.57 ± 78.95 ef
Oak leaf	2.57 ± 0.25 ab	30.00 ± 1.00 abcd	251.40 ± 15.81 abcde
Latin	2.28 ± 0.45 ab	31.83 ± 5.42 bcd	362.83 ± 42.36 def
Butterhead	1.61 ± 0.18 a	28.38 ± 5.74 abc	326.22 ± 94.90 de
Romaine	2.46 ± 0.24 ab	27.39 ± 3.53 ab	479.03 ± 58.93 f

	GREENHOUSE PRODUCTION Stem diameter (cm²)	Height plant (cm)	Fresh Weight plant (g)
Iceberg	1.85 ± 0.99 ab	29.22 ± 2.67 bc	209.48 ± 75.97 bc
Crisped head	1.87 ±0.59 ab	34.31± 20.71 ab	96.11 ± 39.53 a
Batavia	1.50 ± 0.30 ab	22.62 ± 2.09 abcd	16.,09 ± 61.19 abcd
Oak leaf	2.60 ± 0.10 ab	22.62 ± 3.07 ab	39.35 ± 6.11 ab
Latin	2.58 ± 0.94 ab	31.07 ± 1.79 abcd	140.21 ± 4.90 ab
Butterhead	1.43 ± 0.67 a	36.94 ± 4.40 d	179.79 ± 58.89 ab
Romaine	2.82 ± 0.39 b	22.53 ± 3.16 a	111.68 ± 22.62 ab

[1]Mean ± SD. [2]Values in the same column marked by different letters differ statistically ($p<0.05$).

Lettuce cultivated under field production reached higher fresh plant weight than types cultivated in greenhouse

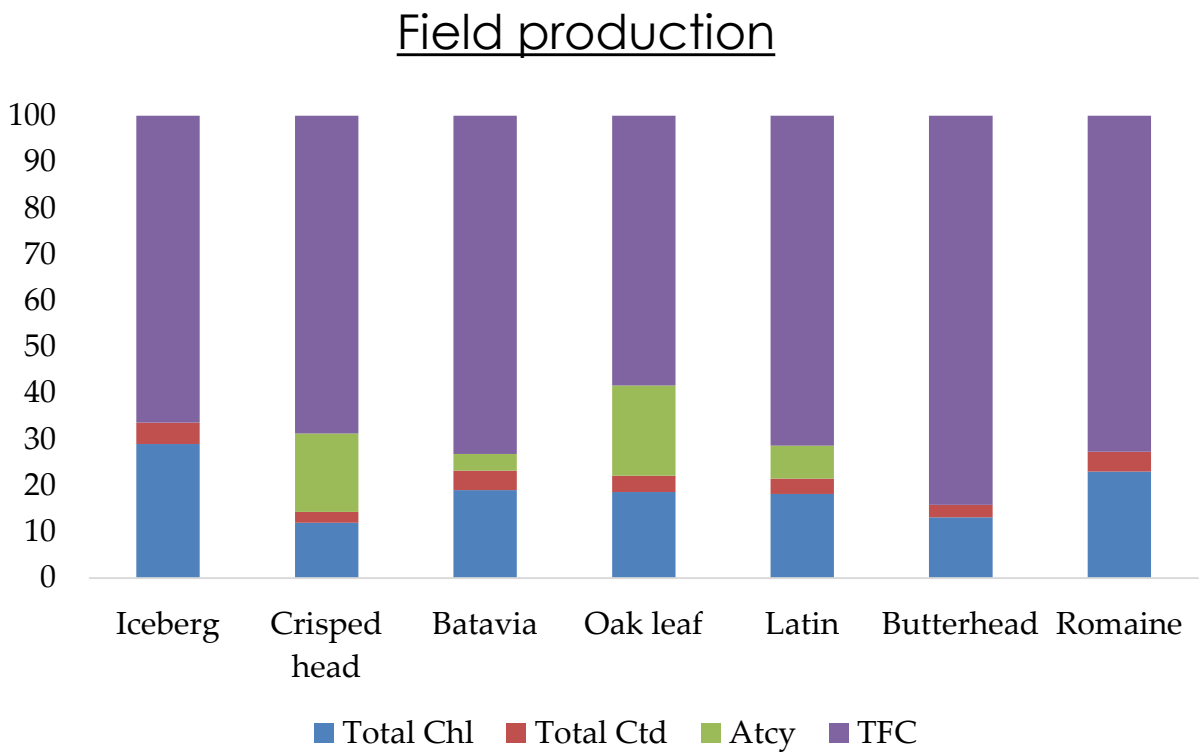
Color

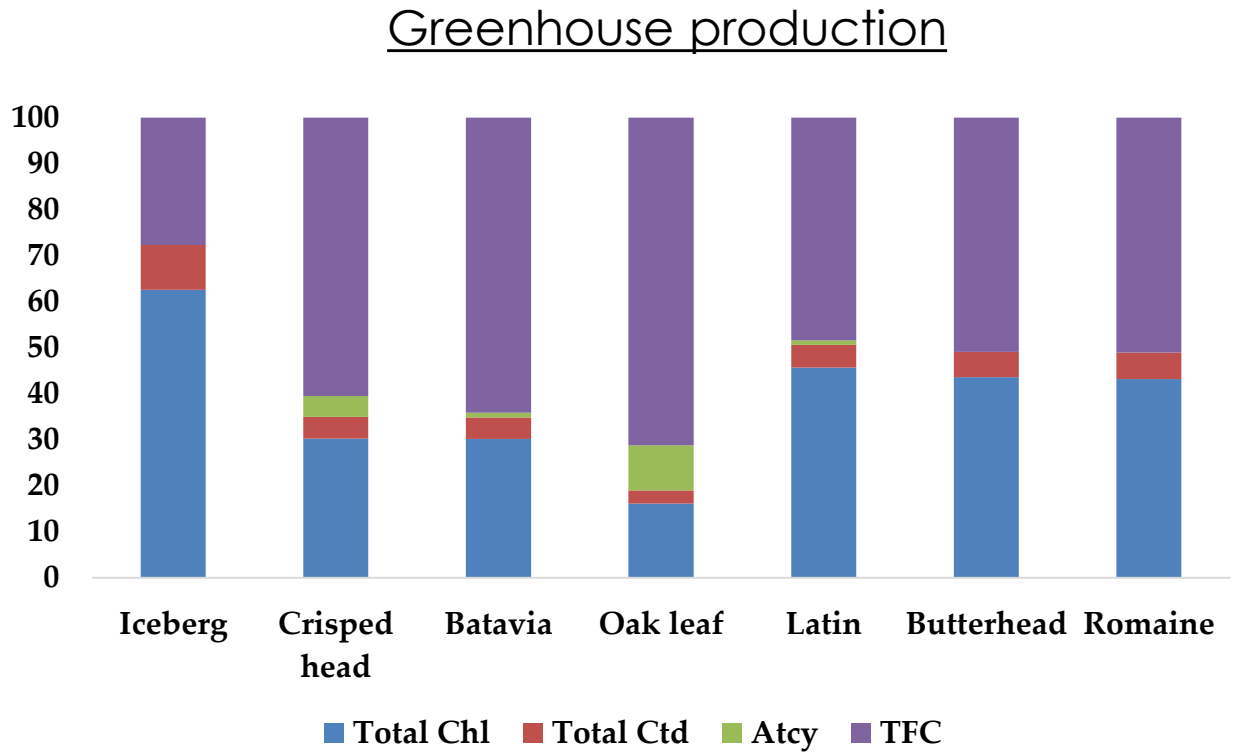
greenhouse

Bioactive compounds

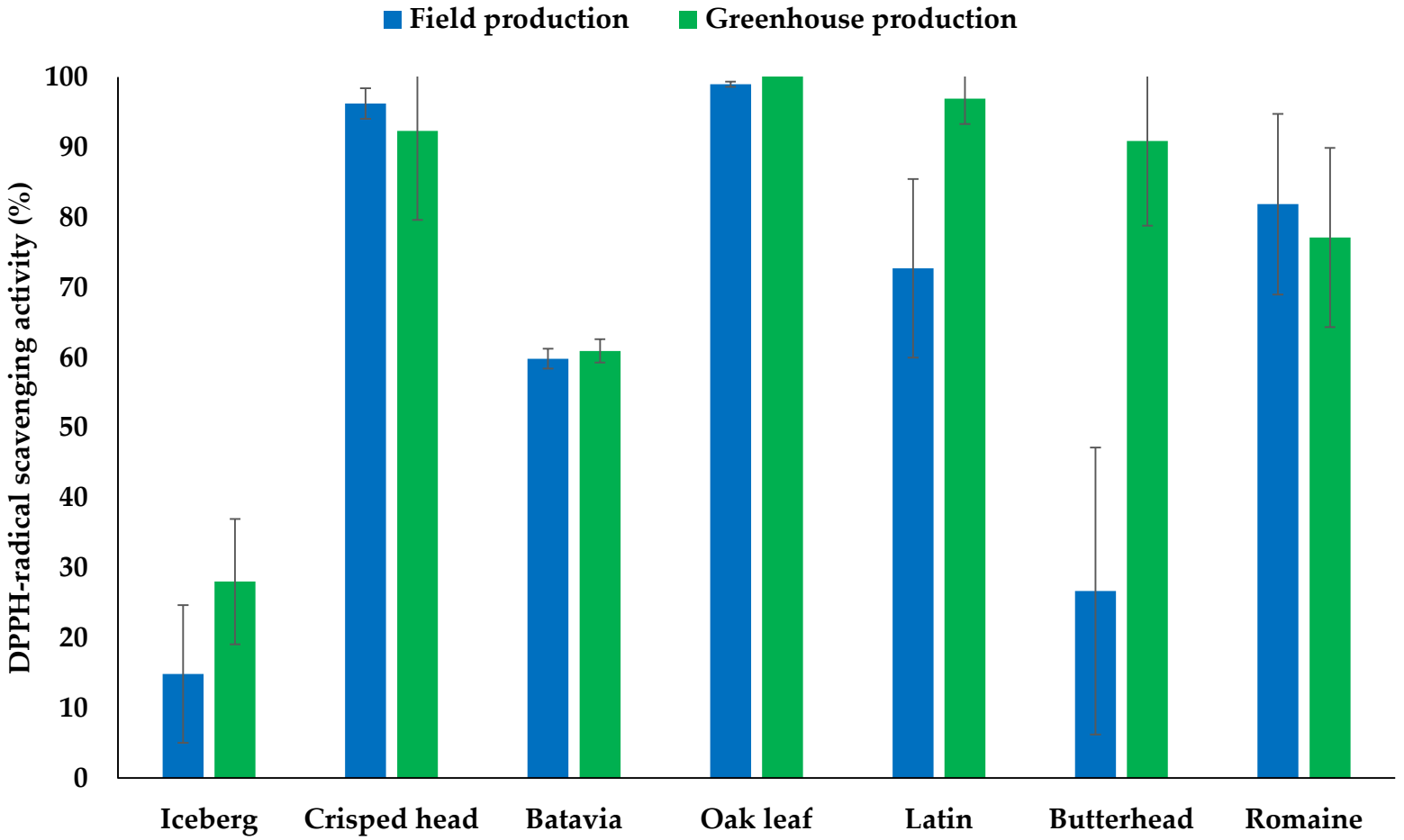
In field production, lettuce accumulated high levels of phenolic compounds and anthocyanins, while in greenhouse production lettuce accumulated high levels of chlorophylls and carotenoids

Relative composition of total chlorophylls (Chl), carotenoids (Total Ctd), anthocyanins (Atcy) and total phenolic compounds (TFC) of 7 types of lettuces



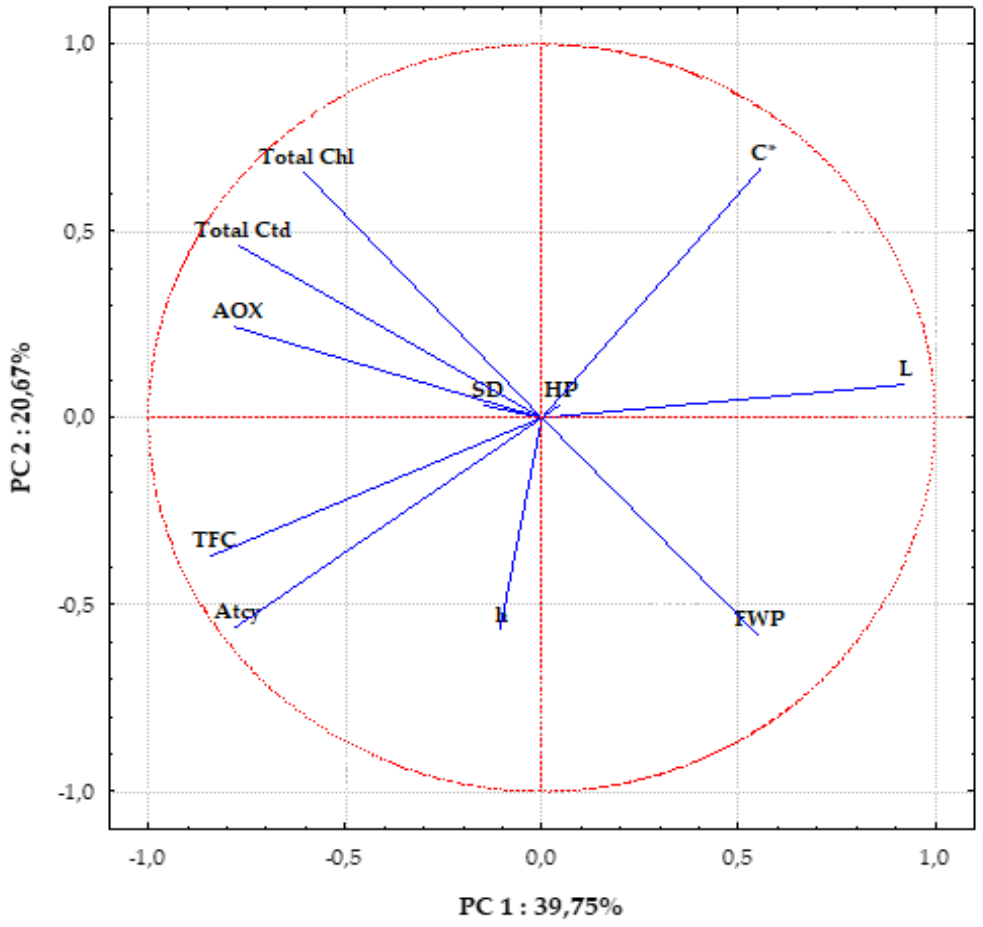


Antioxidant activity

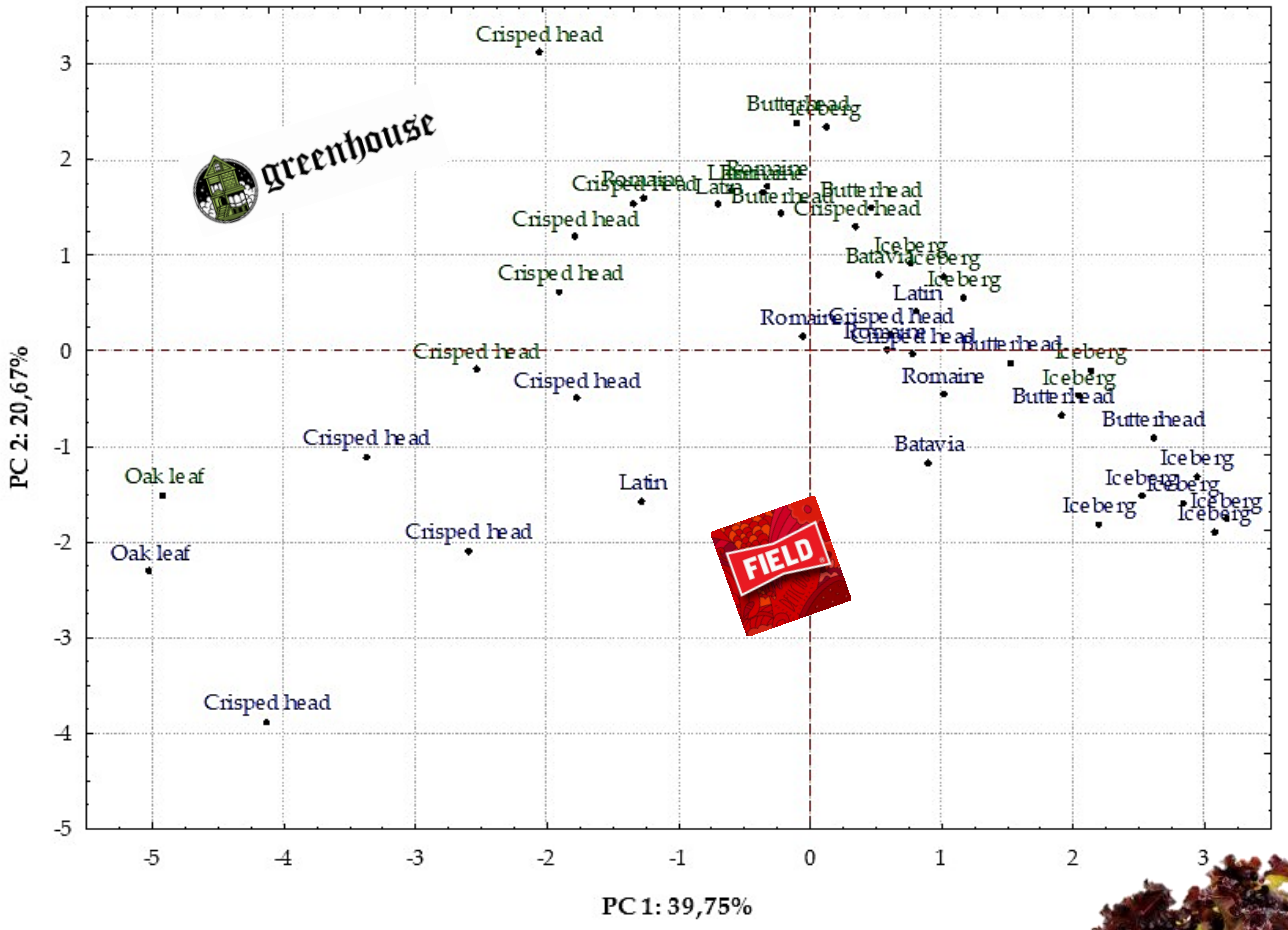


Antioxidant activity expressed as DPPH-radical scavenging activity (%) of 7 types of lettuces in two cropping systems: field and greenhouse production

Principal component analysis of lettuce types in field and greenhouse production, (a): Quality of representation (cos^2) correlation circle of variables to PC 1 and PC 2; (b): PCA biplot of lettuce genotypes to PC 1 and PC 2. SD: stem diameter. HP: height plant. FWP: fresh weight plant. L: lightness. C*: chroma. h°: hue angle Total Chl: Chlorophylls. Total Ctd: total carotenoids. Atcy: total anthocyanins. TFC: total phenolic compounds.



(a)



(b)

Conclusion

- The present study provides evidence that there is great variability for bioactive compounds content, antioxidant activity and growth behavior among lettuce genotypes from different morphological types produced under field and greenhouse systems.
- It is crucial to known the best agronomic methods and cultivars to maximize the contents of bioactive compounds with health-promoting properties.

THANK YOU
FOR YOUR
ATTENTION