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Natural Colorants from Safflower Florets in Response to Sowing Time and Plant Density

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Introduction

Recently, natural pigments have been drawn general attention due to restrictions on using synthetic pigments for food colorants. Dried petals of safflower contain edible pigments largely applied in the past as textile dye but that are being currently used as a natural food colorant. In this study, the effects of sowing time and plant density on florets and pigment production were examined in a cultivar of safflower cultivated under a typical Mediterranean environment.

Materials and Methods

Year of experiment: 2017

Experimental site: Eastern Sicily (10 m a.s.l., 37°25'N Lat, 15°30' E Long)

Cultivar: 'Catima'

Experimental design: split-plot with three replicates

Experimental factors: sowing time (I: February 24, II: March 28, III: April 26) and plant density (25 and 50 plants/m^2)

Seasonal volume of water: 460 (1st sowing), 490 (2nd sowing) and 700 m^3/ha (3rd sowing)

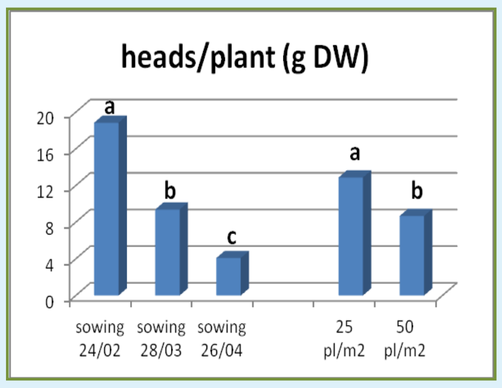
Measurements: number and weight of flower heads, florets fresh and dry weight at flowering

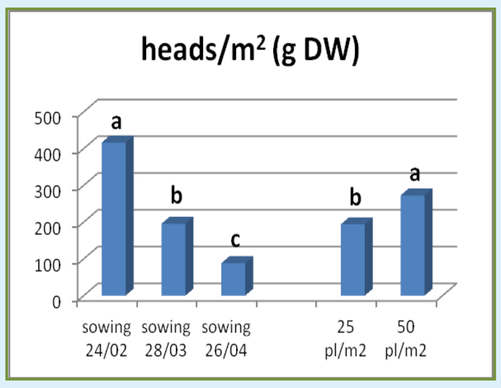
Calculation: number of total heads, fresh and dry weight of total heads and florets, incidence (%) of florets on total head weight

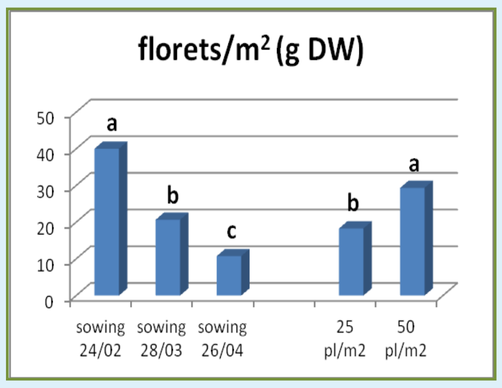
Pigments extraction and analysis: from air-dried florets in a Na_2CO_3 solution (1% w/v in water) and analysis in HPLC. *Safflomins* (yellow pigments) quantification at 410 nm; *carthamin* (red pigment) quantification at 520 nm

Results

The shift of sowing from February to April induced a progressive decrease in plant and crop productivity (Fig. 1). Minor spacing between rows decreased yield per plant, but the increased plant population overcompensated yield losses per plant at higher density, leading to significantly greater total production of heads per unit area.

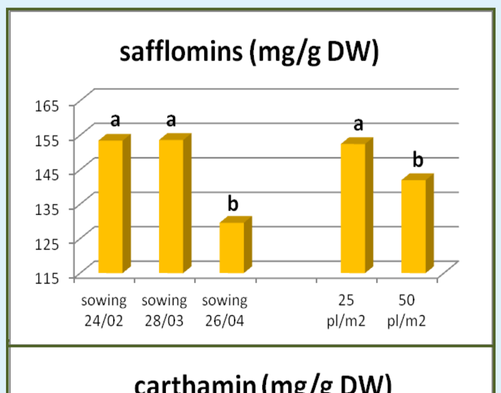


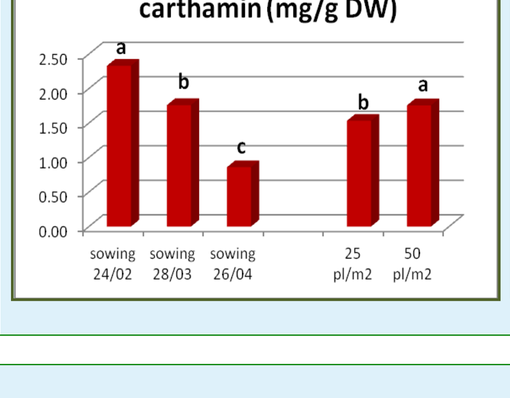




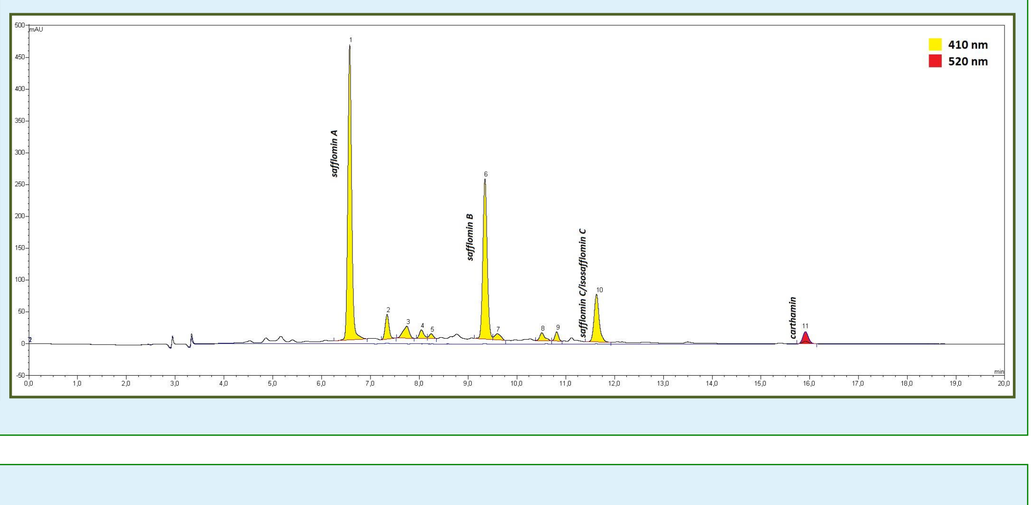
Sowing time	Plant density (plants/m^2)	Florets on head weight (% DW)	
		I harvest	II harvest
I (24/02)	25	8.15	9.78
	50	7.90	11.66
II (28/03)	25	8.89	10.91
	50	9.58	12.46
III (26/04)	25	9.13	-
	50	9.56	-

Florets contribution to total head weight increased with the shift of sowing time. However, according to heads yield, florets yield was the greatest in the earliest sowing. Greater incidence of florets on total head weight was overall measured at higher plant density, resulting in greater florets yield at 50 plants/m^2.





Both safflomins and carthamin pigments were the lowest in florets from the last sowing. High plant density had negative impact on the content of safflomins but positive impact on that of carthamin, irrespective of sowing time (*sowing time* x *plant density*, ns).



Conclusions

Early sowing in late February in safflower had positive effects on florets production and pigments content. High plant density increased heads and florets yield, while having negative (safflomins) or positive (carthamin) effects on pigments.
The addition of pigment extracts from safflower may represent an added value to food products (e.g. ice-cream).