Ceratonia siliqua L.: use of marginal lands for sustainable production

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Introduction

The use of marginal lands for sustainable production and agricultural adaptation to climate change represents one of the most challenging and promising alternatives. Local varieties seem to be the most adequate option to obtain a profitable output when low-input techniques are applied and is grown on nutrient poor soils and harsh climatic conditions (Sacristán *et al.*, 2021). Carob tree (*Ceratonia siliqua* L.) is widely distributed in the Mediterranean region and it is considered a rustic species, resistant to drought, calcareous soils and tolerant to salinity (Winer, 1980; Batlle & Tous, 1997; Gubbuk *et al.*, 2009). The main objective of this study was to investigate the adaptation of different varieties cultivated in marginal lands and severe weather.

Material and methods

- The 8 –year field trial was carried out on marginal land in the southeast of the Majorca under non-irrigated conditions (annual average temperature = 18.2 °C; annual precipitation = 425 mm) and without agronomic inputs.
- Nine traditional cultivars (Bajoca, Bauçana, Bugadera, D'en Pau, Des Mestre, Duraió, Lloseta, Mollar and Sa Llebre) and two open-pollinated cultivars (Granja and H-2-12 (E 13P)). Four selected individuals of each cultivar were studied.
- Parameters evaluated: yield (kg/ha), seed yield (%), seed production (kg/ha), pod length (cm) and pod weight (g) and incidence of *Pseudoidium ceratoniae*.

Results

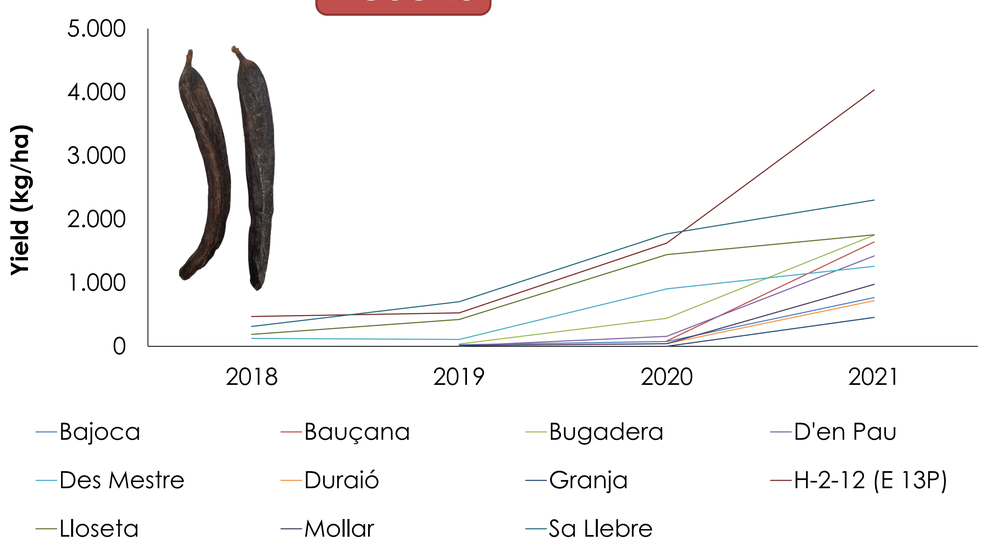

Figure 1. Annual evolution of yield in four consecutive growing seasons of the different varieties.

Table 1. Pod length and pod weight of the different varieties assayed.

Variety	Pod length (cm)	Pod weight (g)
Bajoca	17.32 ± 0.314 ^{d,1}	19.99 ± 0.709 ^{cd}
Bauçana	14.76 ± 0.384 ^{a}	15.71 ± 0.869 ^{b}
Bugadera	17.37 ± 0.314 ^{cd}	18.15 ± 0.709 ^{bc}
D'en Pau	16.92 ± 0.314 ^{cd}	21.01 ± 0.709 ^{d}
Des Mestre	18.57 ± 0.384 ^{e}	23.60 ± 0.869 ^{e}
Duraió	16.03 ± 0.314 ^{c}	18.27 ± 0.709 ^{c}
Granja	14.16 ± 0.384 ^{a}	11.88 ± 0.869 ^{a}
H-2-12 (E 13P)	16.74 ± 0.384 ^{bcd}	11.39 ± 0.869 ^{a}
Lloseta	19.53 ± 0.314 ^{f}	27.40 ± 0.709 ^{f}
Mollar	16.28 ± 0.314 ^{bc}	17.85 ± 0.709 ^{bc}
Sa Llebre	16.34 ± 0.317 ^{bcd}	17.46 ± 0.716 ^{bc}
R^2	0.538	0.593
P (Varieties)	0.000	0.000
P (Cycle)	0.000	0.215
P (Varieties x Cycle)	0.000	0.000

[1] Mean ± standard error of 12 replicates. Different letters indicate significant differences between species or growing cycle.

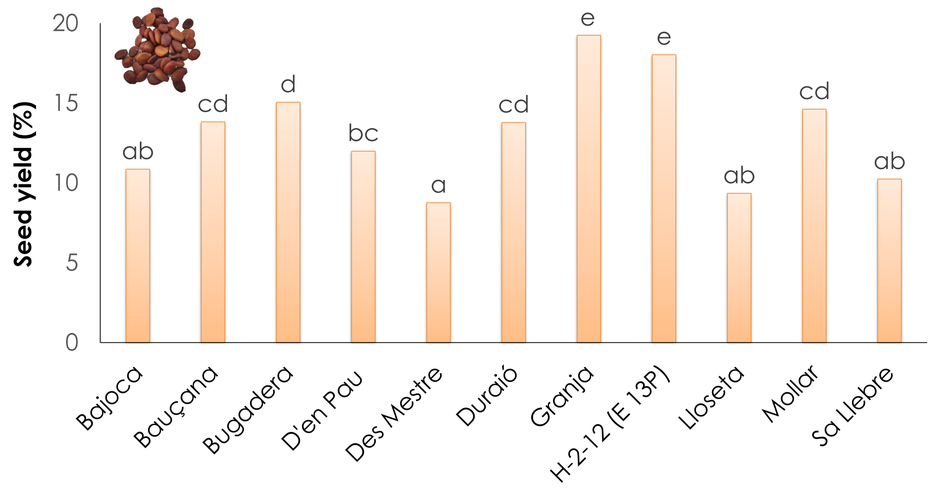

Figure 2. Seed yield of the different varieties studied. Different letters indicate significant differences between varieties.

- The hermaphroditic cultivars (H-2-12 (E 13P), Des Mestre, Lloseta and Sa Llebre) came into production in the fourth year, while the female varieties did so later (Figure 1).
- Across varieties, H-2-12 (E 13P) was the variety that performed best, with a cumulative production higher than 6,500 kg/ha, and Granja being the worst (Figure 1).
- Granja and H-2-12 (E 13P) were the varieties with the highest seed yield, while that Lloseta, Bajoca and Des Mestre varieties were the varieties that exhibited a lower yield seed (Figure 2).
- As for seed production, the H-2-12 (E 13P) cultivar remained the most productive, with a cumulative seed production of 447 kg seed/ha.
- Lloseta cultivar was the cultivars with the longest and weightiest pod.
- The incidence of *Pseudoidium ceratoniae* on leaves and fruit was virtually zero (< 5%) due to severe climatic conditions.

Conclusions

Hermaphroditic varieties come into production faster than the female varieties. Across varieties, H-2-12 (E 13P) is the most productive cultivar. Granja and H-2-12 (E 13P) are the varieties with the highest seed yield. As the seed production, H-2-12 (E 13P) cultivar is the most productive. There is no incidence of *Pseudoidium ceratoniae* on leaves and fruit. It is concluded then that the different varieties can be cultivated in marginal lands of the Mediterranean region with acceptable levels of productivity.

Acknowledgements

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