Biological and productive responses of different oilseed rape (*Brassica napus* L. var. oleifera DC.) varieties to the southern Italy environmental conditions.

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ABSTRACT

The biological and productive response of annual and biennial rapeseed cultivars was studied over eight consecutive seasons in two localities of southern Italy. The biological cycle showed a rather wide variation in relation to sowing dates and cultivars. The annual varieties concluded the cycle much earlier than the biennial ones due to a shorter time to flowering. This allowed the annual varieties to carry out the phase from flowering to maturity, positively related to the seed yield, in a more favourable period than the biennial forms do. On average, the annual varieties were the most yielding. The productive behaviour of the cultivars showed, however, in each trial, wide variations in relation to rainfall during the growing season.

Key words: rapeseed – cultivars – crop cycle – grain yield - rainfall

INTRODUCTION

The realisation of the prospect to spread canola in southern Italy is based on the knowledge of the biological and productive response of the crop to the environmental conditions present in these areas of cultivation. This assumes greater emphasis with reference to the biological diversity of the two existing forms: *biennis* and *annua*, and, among these, of a high number of varieties with different earliness (Myers et al., 1982).
This paper aims to provide, on the basis of the results of pluriannual experiences, a contribution towards the understanding of the variability of the biological and agronomic behaviour of a number of varieties of canola with different *habitus* in two areas of Calabria.

MATERIALS AND METHODS

The trials, sixteen in total, were conducted over eight growing seasons from 1988/89 to 1995/96, in two different localities in Calabria: Rocca di Neto (39°05'N, 18°08'E, 40 m a.s.l.) and San Marco Argentano (39°33'N, 16°07'E, 232 m a.s.l.). In all trials, a randomized-block design with four replicates was adopted. The sowings were carried out, irrespective of the year, in a period between the end of October and the middle of January.
In this paper six varieties common to all the trials will be taken into consideration: Santana, Ceres, Cobra and Tapidor, winter; Drakkar and Activ, spring: all belonging to the 00 group.
In addition to grain yield, dates were recorded, in accordance with the standards proposed by CETIOM, for: emergence (A), start of flowering (F1), physiological maturity (G5).
The relationship between rainfall and yield was described using asymptotic monomolecular functions ($y=a+b_{*}(1-e^{-c*X})$) (Allen, 1976).

RESULTS AND DISCUSSION

On average for years and localities, mean monthly temperatures decreased from November to February, from 12.4 $\pm$ 1.4 ($\pm$s.d.) to 8.0 $\pm$ 1.2 °C, then increased until June (20.9 $\pm$ 1.0). During winter, absolute minimum temperatures below 0° C were frequently recorded. Absolute maximum temperatures often reached values in excess of 30° C at the end of grain filling phase of the later varieties. The quantity of rainfall relating to the November-June period was, by year, 176, 104, 737, 258, 824, 693, 304 and 952 mm at Rocca di Neto and 499, 272, 1142, 297, 515, 849, 554 and 505 mm at S. Marco Argentano.

Figure 1 shows, irrespective of varieties, the variations in the duration of the biological cycle and a number of its phases in an order, which, regardless of year, takes account of the sowing date; the same variations are shown, for each variety, irrespective of years and locality.

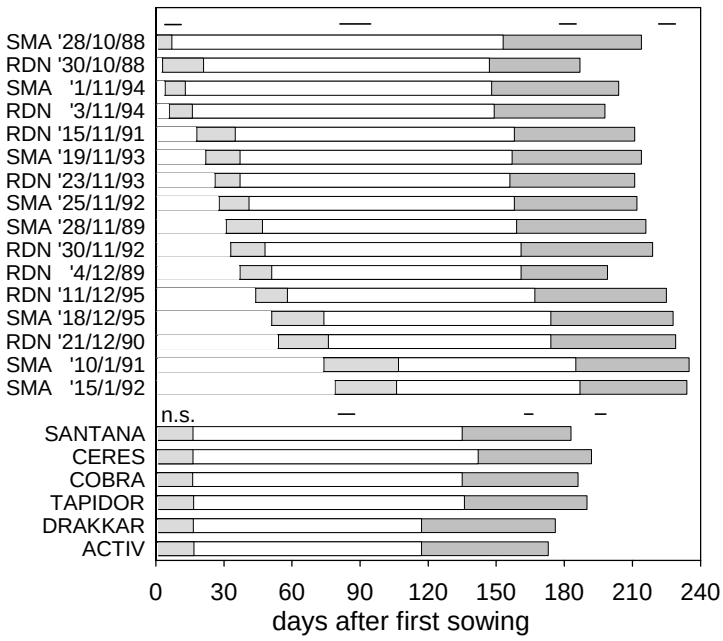

Fig. 1. Duration of the biological cycle and of its main phases (S-A, A-F1, F1-G5), irrespective of variety (top), locality and years (bottom). The segments indicate lsd at p=0.05 for each phase and for the whole cycle.

The duration of the biological cycle, independently of the cultivar, experienced a progressive and significant reduction as the sowing date was delayed. This reduction was most evident in years with lower rainfall and higher temperatures. In particular, in Rocca di Neto in 1989/90, the winter cultivars Santana, Ceres and Tapidor did not reach flowering. The duration from sowing to emergence, which varied between 7 and 33 days, was found to be inversely associated with temperature which progressively reduced with the delaying in sowing.

The duration of the biological cycle also showed wide variations among cultivars. The two spring varieties ended their cycle with a large and significant anticipation compared to winter varieties; among these, the first to reach maturation phase to a significant level were Santana and Cobra; the last were Ceres and Tapidor. However, the latter variety was one of the first winter varieties to flower. Earliness of flowering was often found to be associated with a wider flowering-maturation phase, whose duration revealed a positive and significant association with grain yield (Fig. 2).

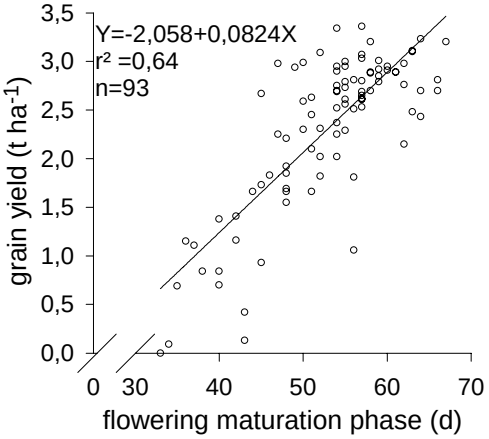

Fig. 2. Relationship between duration of the flowering-maturation phase and grain yield.

On average, grain yield was 2.22 t ha^{-1}. With reference to the main effects, the yield at S.Marco Argentano was significantly higher than at Rocca di Neto (2.63 e 1.99 t ha^{-1}, respectively). The two spring varieties guaranteed a yield (2.52 tha^{-1}, on average) statistically higher than that of the four winter varieties (2.08 t ha^{-1}, on average). Of these, Tapidor and Santana were the most and least productive respectively (data not shown). However, in each trial this classification revealed differing variations as shown in Table 1 which details the grain yield provided by the six cultivars in the two environments and in the eight years of trials. In particular, in the trials in which the highest average yields were recorded following higher rainfall, the winter varieties, with the exception of Santana, tended to reach productive levels statistically similar to those of the spring varieties. The latter, on the other hand, often guaranteed significantly higher yields than the winter varieties in the years with less rainfall.

Table 1. Grain yield provided by the six varieties in the two localities during eight years of trials. The lsd at p = 0.05 of the VxLxY interaction is 0.44.

Season	1988/89		1989/90		1990/91		1991/92		1992/93		1993/94		1994/95		1995/96	
Location	RDN	SMA	RDN	SMA	RDN	SMA	RDN	SMA	RDN	SMA	RDN	SMA	RDN	SMA	RDN	SMA
Santana	0.84	2.15	0.00	1.06	2.02	2.25	1.20	0.84	1.82	1.83	2.21	2.45	1.38	1.66	2.30	1.55
Ceres	0.69	3.03	0.00	1.66	2.99	2.67	1.77	1.16	2.69	2.57	2.52	3.09	1.66	2.63	3.07	2.31
Cobra	1.15	2.89	0.09	1.81	2.61	2.98	1.81	1.41	2.80	2.61	2.73	2.81	1.69	2.79	2.69	2.29
Tapidor	0.70	2.95	0.00	2.02	2.80	2.94	2.14	1.85	2.99	2.78	3.01	3.11	2.10	2.65	2.76	2.59
Drakkar	0.93	2.70	0.13	2.43	3.00	3.36	2.18	2.25	3.20	3.13	2.98	3.23	2.51	2.81	2.89	3.10
Activ	1.73	2.70	0.42	2.48	2.88	2.61	2.47	2.37	2.91	2.69	2.56	2.62	2.70	2.85	2.89	2.75

The existence of relationships between the rainfall recorded during each trial and grain yield (Fig. 3) has therefore been confirmed. The monomolecular curves, whose r^2 values were all higher than 0.89, show the progression in the increase in yield with the increase in rainfall: these increases were initially steady; negligible over a certain threshold whose values, ranging, according to the cultivar, between 350 and 450 mm, agree with those quoted by Weiss (1983) and Copani and Cosentino (1989). In agreement with these authors it can be stated that in most cases the mean rainfall of Calabria should not constitute a major limiting factor in the productive potential of the crop.

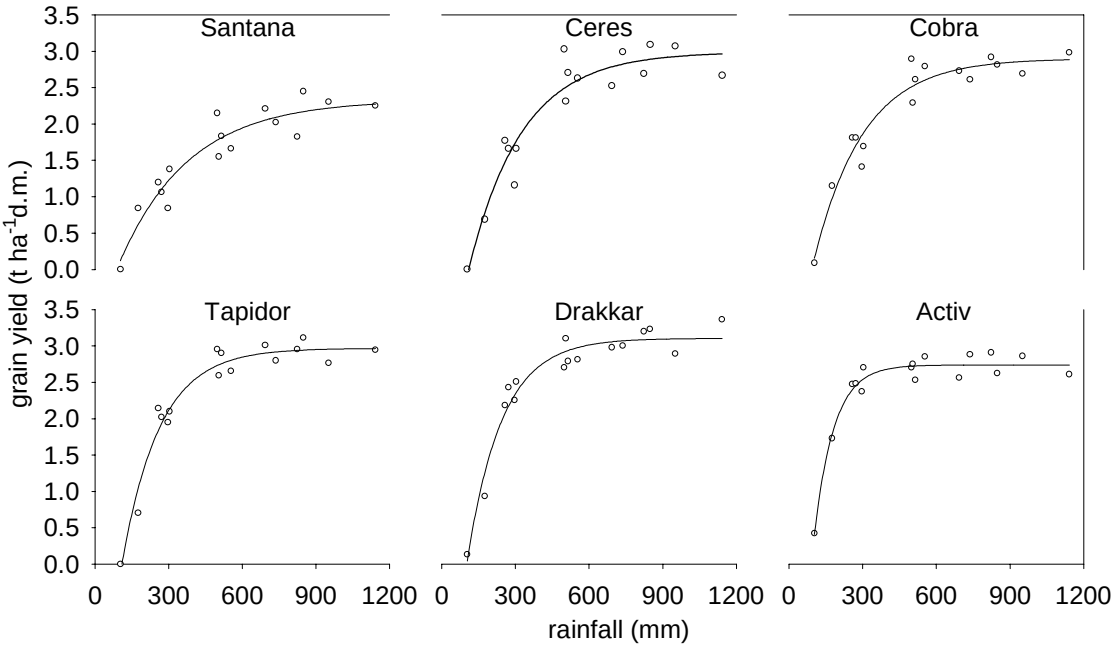

Fig. 3. Relationships between amount of rainfall and grain yield.

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