

## AGRONOMIC MANAGEMENT OF THE NEW 'HYBRID-LINE' COMPOSITE VARIETIES.

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### ABSTRACT

During the cropping season 1993-94, the new 'hybrid-line' composite SYNERGY was tested in field experiments on a large scale. The results underlined its productivity, its ability to produce a great number of pods. No major lack of fecundation was detected, but plant competition between male fertile and male sterile plants had to be taken into account. Possible adaptations of cropping techniques will be discussed here.

### INTRODUCTION

One of the major events in 1994 was the registration on the French catalogue of the first 'hybrid-line' composite named SYNERGY (INRA/SERASEM). This was the first registration of a winter oilseed rape variety belonging to the hybrid type. This material is an association of 80 % of male sterile F1 hybrid plants made using the OGU-INRA cytoplasmic male sterility, and 20 % of male fertile plants from a classical line which provide pollen to the association. Several questions were raised by this type of association:

Does the hybrid vigour expression imply a risk of low survival rate of pollinators at flowering ? What are the risks of a bad fecundation linked to a lack of pollen or to unfavourable climatic conditions at flowering ? Does the hybrid vigour induce changes in the management of nitrogen fertilization or growth regulator applications ? With its specific field experiments, isolated fields, and its variety field test network, CETIOM tried to answer such questions in the cropping year 1993-94 and will continue in the present season.

### EXPERIMENTAL

In 1993-94, the variety field test network was made up of 46 improved field trials conducted in a randomized complete block design. Autumn vigour and lodge were noted on a 1-9 scale. At harvest, grain yield, oil content (RMN), protein content in harvested dry matter (infra red analyzer), glucosinolate compounds, and thousand seed weights were determined. The percentage of fertile plants at flowering was determined on the basis of 60 plants per replication in 2 adjacent rows. Specific experiments on nitrogen fertilization were carried out with different levels of spring fertilization. The soil mineral nitrogen content was followed from the beginning. The plant N dry matter accumulation was followed and determined by the Kjeldhal method on samples collected from 1 square meter per replication. In isolated fields, the percentage of male fertile plants was checked on the basis of almost 2 visits. The number of pods was checked, and the number of seeds per pod calculated from the grain yield, the number of pods and the thousand seed weight.

As expected, Synergy productivity was higher than that of other good and well-known varieties ( see Table 1). Sources of grain yield benefits were attributed to heterosis and to male sterility.

Table 1 - Grain yield (ton per hectare) per area for the LHC SYNERGY compared to classical varieties. Data in brackets represent the grain yield expressed relatively to the control (Eurol + Falcon) / 2.

	Number of trials	SYNERGY	GOELAND	FALCON	EUROL	BRISTOL
SOUTH	7	5.05 (117.1)	4.42 (104.9)	4.37 (101.1)	4.23 (98.9)	4.50 (104.8)
WEST-ATLANTIC	11	4.23 (122.6)	3.99 (114.7)	3.52 (101.7)	3.40 (98.3)	3.99 (115.2)
CENTER	8	3.65 (118.3)	3.56 (119.3)	3.20 (103.5)	2.99 (96.5)	3.40 (109.7)
CENTER-EAST	10	4.40 (122.7)	4.16 (115.3)	3.70 (101.3)	3.60 (98.7)	4.05 (111.9)
NORTH/NORTH-EAST	10	4.08 (121.5)	3.95 (116.9)	3.63 (106.9)	3.19 (93.1)	3.68 (108.1)

The quality parameters (oil, glucosinolates and proteins) were as good as the controls.

Synergy was less sensitive to lodging than many classical varieties. This means that there was no reason to modify the way to appreciate if spring regulator would be necessary or not. The usual procedure takes into account lodging sensitivity, plant density, and nitrogen nutrition.

According to CETIOM recommendations, spring nitrogen fertilization has to be determined on the basis of shoot growth and nitrogen accumulation during autumn and winter from the field expected grain yield and the soil potential nitrogen mineralisation in the spring. Autumn and winter vigour were much more important for Synergy. Consequently, the nitrogen accumulation in plant dry matter was also higher in most observed situations. This could be due to the plant hybrid vigour expression on the root system, which induced a better soil exploitation. Nevertheless, the expected productivity was also higher with a parallel increase in nitrogen needs. Then spring nitrogen fertilization will not be significantly modified, because the expected yield and increase in nitrogen needs will be balanced by a better utilisation of available nitrogen.

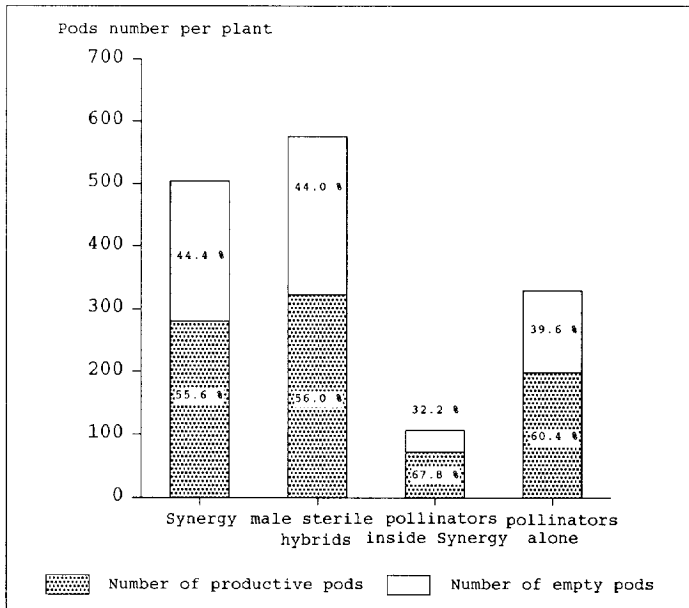
The theoretical percentage of male fertile plants was 20%. A large variability of this parameter was observed at flowering: from 3.8 to 26.3 %. In the northern trials, where plants were poorly developed (low shoot dry matter), the observed values were roughly around the theoretical value, varying between 15 and 25 %. On the other hand, trials conducted in the southern half of France, where growth conditions were more favorable, showed a greater variability from 3.8 to 25.0 %. For these locations, the percentage on male fertile plants seemed to be linked to the plant density. As plant density increased, the percentage of male fertile plants decreased. Two trials comparing different plant densities led to the same conclusion, with the lowest percentage for the highest plant density (Table 2).

Table 2 - Percentages of male fertile plants for different plant densities in Nancy and St Florent field trials.

Trial	Plant density (plts/m <sup>2</sup> )	fertile plants (%)
Saint-Florent	31	11.0
	44	9.1
Nancy	25	22.8
	45	22.5
	65	17.5

In field trials where SYNERGY was compared to its pollinator cropped alone as a classical line, results showed a much lower number of pods per plant on male fertile plants coming from the association than on the fertile plants cropped alone (see figure 1). An individual plant competition for growth between hybrid and non-hybrid plants may be involved in both cases.

Figure 1 - En Crambade field research center: number of pods per plants : comparison of LCH SYNERGY, male sterile hybrids and male fertile plants of the association, and pollinators alone at the same plant density.



Data collected in isolated fields showed no relation between the percentage of male fertile plants in the association and the number of seed per pod or the grain yield. This means that we observed no situations with a bad fecundation, even if sometimes we could record a high thousand seed weight and always a very high number of pods. This underlines the plasticity of the plant and its ability to overcome lacks of fertility and to avoid drastic yield decreases.

The LCH- material is very new and there is a lack of knowledge about the way to crop it. Our results are only preliminary results which will have to be improved on a larger scale over several years. Nevertheless, it seems already better to crop this type of hybrids at lower plant densities to promote a pollinator survival and avoid a lack of pollen. On this particular point, 1995 will be highly interesting with strong plant vigour in most locations.