Winter oilseed rape Ogu-INRA restored hybrids : results of field evaluations in France and determination of optimal plant densities

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ABSTRACT

Two hybridation systems are actually available at the commercial step to produce restored hybrids. Heterosis effects are expected on grain yields to reach around 20% more. Nevertheless, results from variety testing networks are showing closer results with the best lines, and market shares of restored hybrids are growing slowly. Several reasons could be pointed out to explain such a situation. Among them some suggest that cropping techniques have to be adapted to new varietal types. One of these, is that we should try to get more benefits through lower plant densities. This paper aims to present results from CETIOM variety testing networks of the recent past years and from specific trials, to test the hypothesis of a relationship between plant density and heterosis expression in field trials. Ogu-INRA restored hybrids results looks better for lower plant densities which avoid lodge and promote a higher number of pods.

Key Words : Oilseed rape, Hybrids, Heterosis, Plant Density

INTRODUCTION

Since early nineties, the arrival of first hybrid materials contributed to diversify the varietal offer. Nevertheless mixed hybrids and varietal association could be considered as transitory varietal types, and restored hybrids are slowly developing their market shares. Two hybridation systems are actually available at the commercial step: one from NPZ-Lembke (Germany) and the Ogura hybridation system from INRA (France). Heterosis effects on grain yields are expected to reach around 20% more. Nevertheless, results from variety testing networks are showing closer results with the best lines (Pinochet et Bertrand 2000). Several reasons could be pointed out to explain such a situation for each hybridation system. Among them some suggest that cropping techniques have to be adapted to new varietal types. One of these, is that we should try to get more benefits through lower plant densities. This paper aims to analyse results from CETIOM national variety testing networks of the recent past years and from specific experimentations done in collaboration with private seeds companies, and try to test the hypothesis of a link between plant density and heterosis expression in field trials for Ogu-INRA Hybrids.

MATERIALS AND METHODS

The national post registration winter oilseed rape variety testing network is carried out each year by CETIOM and its usual local partners to evaluate the recently registered genotypes. Experiments were carried out from 50 to 80 different sites each year. Trials were generally done with 4 replications in randomised bloc designs. Plot sizes could be different among sites. A special attention is paid to avoid neighbouring effects, with elementary plots large enough or including border rows. Environments and technical practices could be different among sites. Plant densities were measured during winter on each plot throwing randomly six times a 0.25 m2 circle in which plant numbers were recorded. Each trial has been validate according to national agronomic and statistical procedures. Grain yield results were expressed as a ratio between a given variety and the average value of each trial. National average scores are arithmetic mean values of the ratios. In 1999-2000, specific trials were carried out in collaboration with Syngenta Seeds and with Euralis Semences to test hypothesis done on the effect of plant density, sowing date on the productivity of Ogu-INRA Restored hybrids compared to reference lines. These experiments were carried out in split plot designs in several locations under the control of the CETIOM or the seeds company. Methodologies used in both cases were similar to those applied for CETIOM national post registration network.

RESULTS

Grain yield results from CETIOM post registration network are showing good results for new restored hybrids compared to classical lines. Especially high results were registered in some sites with Ogu INRA Hybrids, especially for Extra and CCWH001. Results with Elite were very Heterogeneous, mainly due to its high sensitivity to lodge. Good results were reached with MSL hybrids but closer with to the best lines.

Table n°1 : Grain yield results of restored hybrids for different areas of France expressed as an average ratio between the restored hybrid and all the lines present in each trial. Scores are average values of 15-30 different sites. Results from CETIOM Post registration network.

				Regions	
Years	**Genotypes**	**Hybridization System**	***South***	***West Atlantic***	***Center and North East***
1997-98-99	Pronto	MSL	104	107	103
1998	CCWH001	Ogu INRA	121	111	110
1999	Elite	Ogu INRA	101	103	98
2000	Extra	Ogu INRA	109	105	111
2001	Extra	Ogu INRA	112	99	104
2002	Banjo	MSL	98	103	105
	Talent	MSL	101	101	101

During 1997-98 cropping season the restored Ogu INRA hybrid CCWH001 and its two parental lines were present in the trials of the CETIOM post registration network. For low plant densities, the heterosis estimation from the results seems to reach the expected level of 20% (see Figure n°1). When plant density increases the ratio decreases, especially over 50 plants/m2. Some of these results may be explained by higher lodge scores for the restored hybrid compared to its parents. Similar results were registered in 1998-99 and in 1999-2000 with the ogu INRA restored hybrids. Nevertheless during the following experimental year, with Extra in 2000-01, no clear relationship was found between plant densities at the end of winter and the relative grain yield results of restored hybrids compared to the lines present in CETIOM national post registration network.

Figure n°1 : CETIOM post registration network 1997-98. The Ogu-INRA restored hybrid was compared to its 2 parental lines in different sites.

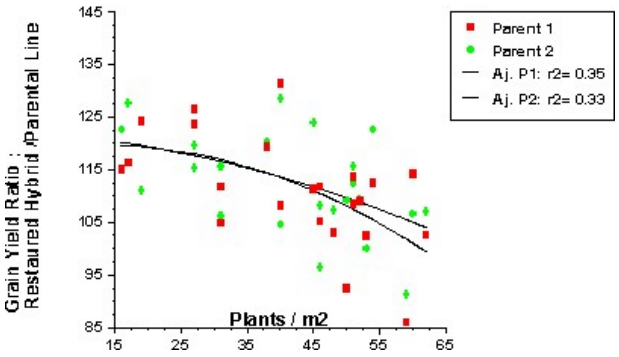
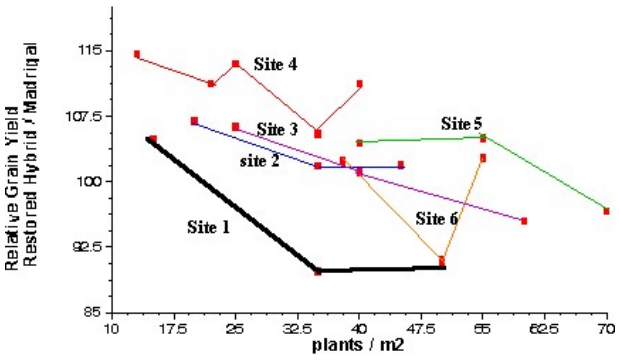


Figure n°2 : Results from 6 different trials carried out in collaboration with Syngenta Seeds with RNX3802 as an Ogu INRA restored Hybrid and Madrigal as the reference line.



During 1999-2000 cropping season, specific trials were carried out to test the hypothesis of the plant density effects on the grain yield performances of restored hybrids compared with reference lines. This work was done in collaboration with Syngenta Seeds and Euralis Semences using their Ogu INRA restored hybrids and reference lines. On 6 different locations carried out with Syngenta Seeds, comparing RH RNX3802 to the reference line Madrigal, the hypothesis seems to be accepted. In several sites the ratio was higher for the lower plant densities.
During the same experimental year, in 1999-2000, 4 trails in split splot design where carried out in collaboration of Euralis semences , with two different sowing dates. In the four sites results were similar. RPC702 (Elvis) performed always better than Navajo. Relative grain yields were always higher for low plant densities (around 15 plants/m2) than for classical plant densities (around 50plants /m2). For early sowings , higher grain yields were registered with low densities . On the opposite side better results were reached for classical plant densities for late sowings.

Table n°3 : Average results from 4 different trials carried out in collaboration with Euralis Semences with RPC702 (Elvis) as an Ogu INRA restored Hybrid and Navajo as the reference line. Two sowing dates were used in each trials.

	Early sowing	**20th. august**	**Late sowing**	**10th September**
	Line Navajo	**RH RPC702**	**Line Navajo**	**RH RPC702**
15 plants / m2	3.5 t/Ha	3.7 t/Ha (107)	2.7 t/Ha	3.3 t/Ha (122)
50 plants / m2	3.4 t/Ha	3.5 t/Ha (103)	3.1 t/Ha	3.4 t/Ha (109)

DISCUSSION

Restored hybrids, especially Ogu-INRA restored hybrids seems to performed particulary well in our trials and were able to reach the expected level of heterosis for the grain yield. Nevertheless sometimes results were not so high for hybrids compared to lines. For Ogu-INRA restored hybrids this could be due to higher lodging sensitivity on the hybrid. Elite or CCWH001 were classified as sensitive. In 1997-98 experiments, lodge on the hybrid was higher than on the parental lines in several locations where plant densities were higher than 45 plants /m2. For MSL Hybrids the difficulty to breed a secure female has probably, for a first stage, limited the choice of parental lines to optimise the grain yield heterosis.
We got contradictory results for the effect of plant density on the relative grain yield performances of hybrids compared to lines. In 1997-98, 1998-99, higher ratio were found for the lower plant densities. More or less similar result was found in 1999-2000 with Extra. On the opposite side, this was not true for the following year in 2000-01 with Extra. Nevertheless sub-groupings of trials which have received or not a growth regulator (result not shown), indicate higher grain yield ratio for hybrids when growth regulator was applied. This suggests that probably lodge is a key factor to focus on. A posteriori analysis of trials networks are always difficult , with the aggregation of different sources of variation and no clear isolation of a studied factor. This is the reason why specific experiments done with the seeds companies were needed to test our hypothesis. Generally, in these specific trials, better results for hybrids were registered at the lowest plant densities. There was no evidence of differential responses of Hybrids and lines to the low density for the branching ability (number of ramifications).Differences may be due mainly to pods number per m2.

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