Estimation of oilseed rape seed losses before and during harvest in France in various conditions.

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Introduction

Seed losses before and during harvest are detrimental to grain yield, but can also produce volunteers and subsequent grain quality management difficulties in case of different segmented productions, e.g. High Erucic Acid Rapessed or GM vs. non-GM.
CETIOM carried out field trials between 2002 and 2010 on this general subject. These trials aimed at answering different questions: the first years were devoted to the estimation of seed losses in different contexts, separating those prior to harvest, under the cutter bar and behind the combine harvester. After analyzing the results, we tested different factors. We present here a synthesis of all these investigations.

Material and Methods

We carried out 13 field trials in different French regions (table 1). Seed losses before harvest and under the cutter bar were recovered in dishes covering at least 1 m² in total. Seed losses behind the combine were recovered with plastic tarpaulins.

Table 1: list of all field trials carried out between 2002 and 2010.

Year	Place (department)	Modalities				Losses measurement		
		Variety	Cutter bar	Maturity	Other	Before harvest	Under cutter bar	Behind combine
2002	St Apollinaire (21)	4	1	2		X	X	X
2002	Martincourt (54)	2	1	1		X	X	X
2002	En Crambade (31)	4	1	3		X	X	X
2003	St Apollinaire (21)	2	1	2		X	X	X
2003	Martincourt (54)	2	1	2		X	X	X
2003	En Crambade (31)	2	1	3		X	X	X
2004	Brognon (21)	1	2	1			X	X
2005	Brognon (21)	1	2	1	3		X	X
2006	Quétigny (21)	8		1		X		
2007	Chaignay (21)	1	5	1			X	X
2008	Marsannay le Bois (21)	1	5	1			X	X
2008	Etaules (21)	1	3	2			X	
2010	Estrées-Mons (80)	1	1	2	2	X	X	

Different factors of variation of losses were tested depending on the trial objective: variety, cutter bar (classical, or advanced, i.e. special model for oilseed rape), maturity measured by harvested grain moisture, other (fertilization or growth regulator). For most trials, seed losses measurements were repeated 3 times by modalities, without randomization (repetitions along one strip). The average values by modalities for each trial were pooled to perform analysis on a multi-year and multi-site dataset.
An additional survey was conducted on harvesting practices in 2009. 20 farmers near Dijon were asked about their harvest practices and seed losses were assessed with various methods, less reliable than that used for trials. These last results were analysed as a specific dataset.

Results and discussion

Estimation of total losses

The average total losses were 2.4 q/ha (7.8% of the potential yield), occurring mainly under the cutter bar, but with losses behind the combine possibly high, and losses before harvest still uncommon. This general figure hid a considerable variability (figure 1).

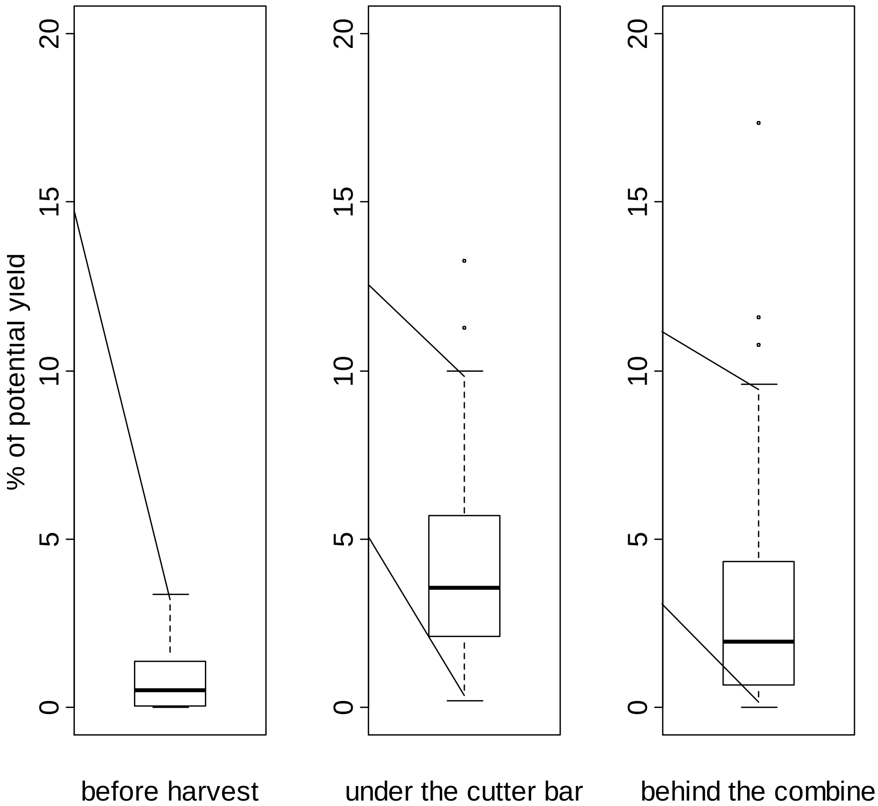

Figure 1: seed losses measured on the 13 field trials.

Before harvest

The losses before harvest were moderate. The highest were obtained after storms. It was not possible to discriminate the impact of different varieties in a specific trial on that subject in 2006, due to low losses.

Under the cutter bar

Grain moisture and the type of cutter bar were the two main factors influencing seed losses under the cutter bar. The modelling of losses based on these variables bar showed significative effects, but generated a high residual variability (table 1).

Table 1: Analysis of covariance on losses under the cutter bar expressed as % of the potential yield; adj r²=0.33.

	Estimated coefficient	P-value
Intercept	8.5	$<10^{-5}$
Advanced cutter bar	-2.8	2.10^{-3}
Grain moisture	-0.5	10^{-2}

The increasing of losses with grain desiccation is probably the consequence of low mechanical siliquae resistance caused by drying. The use of a special cutter bar for oilseed rape reduced the losses about 60% considering all trials. But the manufacturers propose different models of this kind of equipment. The results obtained in Dijon 2008 on this topic showed the efficiency of an advanced cutter bar was proportional to its depth (figure 2). Seed losses were higher at the middle of the cutter bar when classical, while smoother when advanced. Another advantage of this equipment is to allow faster harvest than with conventional equipment.

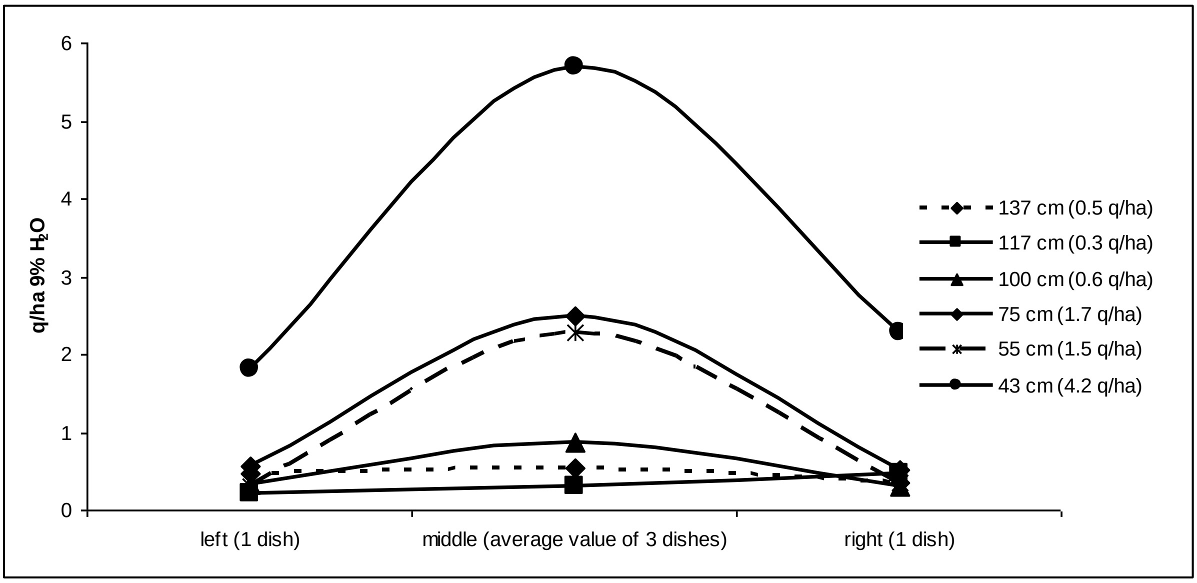

Figure 2: seed losses at different locations under the cutter bar, for different depths of cutter bar. Total losses are indicated between brackets. Marsannay trial in 2008.

Behind the combine

Variability of losses behind the combine was more difficult to explain. We observed highest losses for early harvests involving non-threshed green siliquae, with grain moisture above 10%. The combined effects of machine settings and threshing equipment could play a role, but were not described in detail.

The 2010 trial and the 2009 survey suggested that an early harvest could increase losses behind the combine, due to the conjunction of dry grain and moist straw, which involves grain threshing difficulties. But this conclusion has to be confirmed, due to less reliable methods for seed loss recovering.

Discussion

Many variables influencing seed losses are difficult to control under experimental conditions. For example, the degree of ripeness cannot be simply described by a harvesting date or average harvested grain moisture. Our observations showed that it should be splitted into three variables each having a specific effect: mechanical siliquae resistance, straw humidity and volume; grain ripeness homogeneity. Furthermore, harvest practices are extremely diverse and difficult to describe precisely. The 2009 field survey showed the diversity of these practices: machine settings were highly variable and the manufacturers offered diversified equipments.

Despite this variability, our results suggested possible improvements. Our work made farmers more aware of an important technical and economic issue, and gave strong arguments for the promotion of advanced cutter bars. Now, the results put into question the main indicator for starting the harvest, which is grain moisture, and the usual strategy of early oilseed rape harvest before wheat. Should the farmer wait in order to facilitate the harvest and reduce losses behind the combine, or hasten the harvest to avoid losses under the cutter bar? The “green straw / mature grain” scenario involving losses behind the combine seems to us more frequent since new hybrid varieties are tolerant to phoma stem canker. Our works suggest the farmer using an advanced cutter bar would have interest in waiting for straw desiccation in order to avoid losses behind combine.