Effect of Post-Harvest Cultivation on Persistence of Oilseed Rape Seeds

C. PEKRUN and P.J.W. LUTMAN

IACR-Rothamsted, Harpenden, Herts, AL5 2JQ, UK
E-mail : pekrunc@bbsrc.ac.uk

Unlike the seeds of other crops, oilseed rape seeds have a high potential to persist in the soil. Burial experiments by Schlink (1994) demonstrated that they can persist for at least 5 years. As a consequence, severe volunteer problems can occur in the years following a rape crop. This has been a problem in the past but may become more important in the future with the introduction of cultivars with a range of different oil types and also to genetically manipulated rape. In laboratory and field experiments we are investigating the role of soil cultivation, particularly post-harvest cultivation, on the onset and release of dormancy. From previous laboratory studies (Pekrun, 1994) and complementary recent research we have concluded that:

- seeds of oilseed rape can only become dormant when hydrated but prevented from germination by water stress or oxygen deficiency,
- induction of dormancy can occur in the dark and is prevented by light,
- the proportion of seeds developing dormancy is a function of the time they are exposed to sub-optimal soil conditions in the dark,
- the closer seeds are lying to the soil surface, the less likely they are to persist.

Two field experiments, one on a flinty silty clay loam, one on a sand, mainly confirmed these hypotheses. Both fields had been fallow the preceding year. At the end of July 1995 rapeseeds were broadcast on the plots at a density equivalent to harvesting losses of 500 kg/ha. After that five different types of post-harvest cultivation were done:

a) Ploughing immediately after harvest (Plough)
b) Three stubble cultivations in weekly intervals followed by ploughing (3 St. + Pl.)
c) Delayed ploughing 4 weeks after harvest (delay Pl.)
d) Non inversion tillage 4 weeks after harvest (delay NI)
e) Control: no cultivation (Zero-till.)

The seedbank was assessed in the following spring and in July by taking soil samples and counting viable seeds in the soil. Seed counts showed that post-harvest cultivation, particularly time of post-harvest cultivation, had a marked effect on the seedbank (Table 1). Maximal persistence was present in plots that had been cultivated immediately after the start of the experiment (Plough, 3 St. + Pl.). Much less persistence was found in plots that had been cultivated 4 weeks later (delay Pl., delay NI). No, or very little, persistence was found in non-cultivated plots (Zero-till.). The results also reflected an effect of burial depth. Hardly any seeds were found in the upper layer (0 - 10 cm), the majority of seeds persisted below 10 cm (not shown). The effect of the treatments tested was the same on both sites but the level of persistence differed, being much greater on the sandy soil than on the heavy soil. This probably reflects the effect of differing water hold capacities and its related effect on the proportion of seeds developing dormancy.

Table 1. *Seedbank (log of % seeds in 0 - 30 cm) assessed between middle of February 1996 to the middle of April 1996 at Rothamsted (flinty silty clay loam) and Woburn (sand). Mean of 4 replicates. Means of original values, in parentheses*

(a) Rothamsted

	Plough	3 St. + pl.	delay pl.	delay NI	Zero-till.
Apex	2.351 (12.7)	2.314 (12.5)	1.251 (3.2)	- 0.002 (0.8)	- 0.693 (0)
Bristol	2.695 (14.8)	2.144 (9.9)	1.231 (3.4)	0.629 (1.5)	- 0.500 (0.2)
Envol	2.124 (8.6)	1.949 (7.0)	0.308 (1.1)	- 0.485 (0.2)	- 0.693 (0)

standard error of means 0.2715 (same level of cultivation 0.2532) (d.f. 30)

(b) Woburn

	Plough	3 St. + pl.	delay pl.	delay NI	Zero-till.
Apex	3.378 (38.2)	2.937 (25.5)	1.270 (3.7)	0.109 (0.7)	- 0.693 (0)
Bristol	3.443 (43.4)	3.024 (23.4)	1.721 (5.1)	- 0.392 (0.3)	- 0.693 (0)
Envol	3.836 (62.7)	3.000 (20.6)	1.237 (3.2)	- 0.485 (0.2)	- 0.278 (0.3)

standard error of means 0.3203 (same level of cultivation 0.2740) (d.f. 30)

As the effects of cultivation were similar at the two sites and results of the field experiments clearly reflected laboratory findings, the authors are optimistic that a similar effect will be observed in many dry years. However, the summer 1995 was exceptionally warm and dry and thus results may be different in a wet year. Further field tests sponsored by HGCA and MAFF are under way and are also planned for 1997/98.

Pekrun C. 1994. Untersuchungen zur sekundären Dormanz bei Raps (*Brassica napus* L.). *PhD-Thesis University of Göttingen, Germany.* 120 pp.

Schlink S. 1994. Ökologie der Keimung und Dormanz von Körnerraps (*Brassica napus* L.) und ihre Bedeutung für eine Überdauerung der Samen im Boden. *PhD-Thesis University of Göttingen, Germany,* 194 pp.