EFFECT OF SEED SOURCE ON SOWING QUALITY AND YIELD OF CANOLA

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ABSTRACT

Germination and emergence characteristics and yield of seed of four canola cultivars from five different sources were evaluated. Laboratory germination characteristics under optimal conditions did not reflect field germination and emergence, whereas germination under cold conditions (4°C) and from depth (4cm) did. Differences in field germination and emergence were not related to original seed quality (oil, protein, glucosinolates, oleic acid) or size. Poor germination and emergence from seed from one source resulted in a marginally significant yield reduction.

INTRODUCTION

In Australia, the majority of canola (*Brassica napus*) is sown in late autumn or early winter, thus seed is often germinating and emerging under cold conditions. Under such conditions, variable emergence and seedling vigour can sometimes lead to poor establishment, despite using certified seed with a high germination percentage.

This study sought to evaluate whether germination percentage of seed from different sources was a reliable guide to field emergence and seedling vigour. It further aimed to see whether the quality of the original sowing seed was related to germination and emergence characteristics and whether differences between seed lots in germination and emergence characteristics had an effect on grain yield.

EXPERIMENTAL

Seed of four cultivars (Barossa, Dunkeld, Oscar, Rainbow) was sourced from five 1992 advanced variety trials in different regions of Victoria. The sources, which were chosen on the basis of geographic divergence and differences in seed quality, were: 1 (Carranballac), 2 (Charlton), 3 (Rutherglen), 4 (Winchelsea) and 5 (Wycheproof).

Yield trials of the 20 lines (4 cultivars x 5 sources) were sown in 1993 at Horsham (Victoria), Mundalla (South Australia) and Wagga Wagga (New South Wales). At the Horsham site, plots were rated for emergence and seedling vigour, both on a 0 (nil) - 5

(very good) scale. Harvested seed was evaluated for quality (oil and protein content, glucosinolates, fatty acids). Oil contents and protein contents (whole seed) were measured at 6% moisture, while glucosinolates were expressed as total glucosinolates per gram of oil-free, air-dried meal. Thousand-seed weights were also measured.

Additionally, the following laboratory tests were carried out on the original sowing seed, using 3 x 50-seed replicates: germination % (% of seed germinated after 7 days on filter paper in an incubator at 20°C); germination rate (proportion of the total germination % germinated in the first 24 hours); low temperature germination % (% of seed germinated after 35 days at 4°C in sand, from a depth of 1 cm) and germination % from depth (% of seed which germinated after 35 days in the glasshouse [20° ± 5°C] in sand, from a depth of 4.0 cm).

RESULTS

There were major differences in the quality of the original sowing seed from the different sources, particularly in relation to oil and protein contents (Table 1).

TABLE 1. Weight and quality of original sowing seed (all cultivars combined) from different sources

Source	1	2	3	4	5
1000-seed wt.(g)	3.58	3.32	3.40	3.98	3.42
Oil %	46.3	48.7	43.1	38.5	47.1
Protein %	15.3	14.6	18.0	22.3	15.4
Oleic acid %	61.2	61.9	57.8	56.9	61.7
Glucosinolates	10.2	8.1	9.8	9.1	10.2

The seed line from source 5 had a lower germination percentage than all other lines (Table 2). This seed from source 5 also had the lowest germination from cold temperature and depth, plus the poorest emergence and vigour (Table 2). While seed from sources 1-4 had the same germination under optimal conditions, it differed in germination from depth and cold temperature, plus emergence and vigour (Table 2).

There were no consistent significant correlations between the quality of the original sowing seed and its germination and emergence characteristics, using the individual cultivar data (results not presented). Germination percentage and germination rate under optimal conditions were not significantly correlated with field emergence and seedling vigour, whereas germination from depth and cold temperature were ($r^2 > 0.88$).

Poor germination and emergence from seed from source 5 resulted in a marginally significant ($P = 0.057$) yield reduction. For each cultivar, there were no differences in the end-product quality of the harvested seed from the different sources.

TABLE 2. Laboratory and field germination and emergence characteristics and mean grain yield of seed (all cultivars combined) from different sources

Source	1	2	3	4	5
Germination %	99	99	100	100	85
Low temp. germ. %	35	32	38	37	15
Depth germ. %	27	22	31	30	18
Germination rate	32	78	51	81	52
Emergence rating	3.5	3.0	4.0	4.3	2.5
Seedling vigour	3.3	3.3	3.9	4.3	2.5
Yield (t/ha)	2.92	2.89	2.91	2.95	2.66

DISCUSSION

It is evident from this study that laboratory germination of seed under optimal conditions cannot be used to predict performance under sub-optimal conditions, such as low temperature germination or field germination and emergence. Different seed lines, all with greater than 90% germination, had variable field germination and emergence. In Canada, Barber *et al.* (1991) found that germination percentage was a reasonable indicator of stand establishment for Westar (*Brassica napus*), but not for Tobin (*B. rapa*). As in the present study, Nykiforuk and Johns (1994) found that lines with similar germination under high temperatures will not necessarily perform the same at sub-optimal temperatures.

In this study, seed source 5, which had the lowest germination and emergence, had a marginally significant yield reduction. Apart from this source however, differences in emergence and vigour did not result in any yield differences. In Canada, Barber *et al.* (1991) found yield differences between seed lots, but stand establishment was not a good predictor of the differences.

Attempts to relate differences in seed performance to those seed quality characteristics important for end-use were unsuccessful. The work of Nykiforuk and Johns (1994) suggested that measurement of the activity of enzymes involved in mobilisation of storage lipids and proteins may be more successful.

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