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CHANGES IN SEED QUALITY AND SEED YIELD OF SPRING-SOWN OLEIFEROUS CROPS DURING THE RIPENING PROCESS

I. Ohlsson

The value of an oil seed crop is governed by the quality and quantity of the yield. The stage of maturity at which the best quality and the highest yield is to be expected is of fundamental interest when growing under field conditions in Sweden.

The present study was undertaken to investigate the extent to which changes in seed quality and seed yield occur during the ripening of seeds of spring rape, spring turnip rape and white mustard, and whether relationships could be established between the three species studied.

Materials and methods

The investigation was carried out from 1967 to 1969 at the Royal Agricultural College of Sweden, Uppsala. Spring rape (Brassica napus L. var. oleifera DC. f. annua), spring turnip rape (Brassica campestris L. ssp. oleifera Metzg. f. annua) and white mustard (Sinapis alba L.) were grown under normal field conditions.

Starting at about 70 % moisture content of the seeds, samples (plot size 4.5 m^2) were regularly harvested twice a week during a period of ten weeks. The plants were hand-cut and immediately dried in their entirety in a hot air drying plant (max. temp. 40° C) to ca. 15 % moisture content of the seeds and then threshed. From ca. 20 % moisture content of the seeds in the unharvested material and onwards the plants were threshed direct at harvesting without preceding drying. No harvest was carried out during or directly after rain.

The stage of ripeness corresponding to 20 % moisture content of the seeds is defined as combine ripeness and abbreviated to SkM. Data obtained at levels above 20 % moisture content of the seeds are reported in relation to moisture content of the seeds at harvest. Data from later stages of maturity are given in relation to the number of days after the 20 % moisture content was reached.

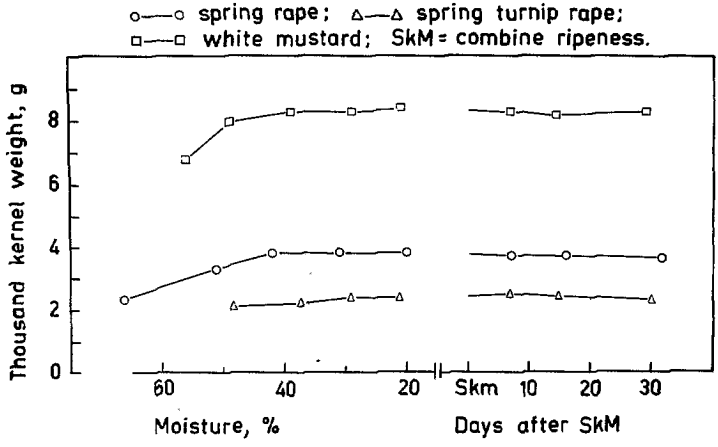
The yield was analysed for thousand kernel weight, germinating capacity, the contents of crude fat, free fatty acids, chlorophyll, crude protein and glucosinolates.

Results and discussion

As the general patterns of changes in quality and yield were very similar during the investigation period the averages of the three years are plotted in Figs. 1-8.

Thousend kernel weights of the seeds during the ripening process are shown in Fig. 1. In early stages of seed development a very low seed weight was

Fig. 1: Thousand kernel weight during the ripening process

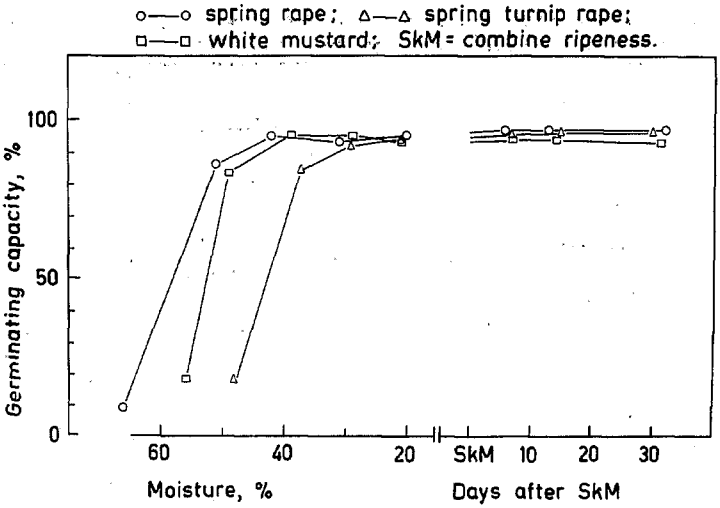


found. However, the maximum in spring rape and white mustard was reached already at a moisture content of 40 %. For the spring turnip rape small differences were found during maturation and the maximum thousand kernel weight was not reached until 30 %. Apparently is this due to vigorous and uneven development, which vertainly might have affected the uniformity of ripening and consequently might have resulted in the storage being completed at a later stage in comparison with spring rape and white mustard. Furthermore, this difference between spring rape and white mustard on the one hand and spring turnip rape on the other, as regards the stage of development when storage is completed, is marked by changes found in the other properties studied (e.g. Figs. 2 and 5). Further ripening down to one month after SkM was not found to influence the thousand kernel weight of any of the species studied.

Germinating capacity (Fig. 2) exceeding 95 % was reached at harvest times later than 40 (spring rape and white mustard) and 30 % moisture content (spring turnip rape). In earlier stages of the ripening process very low values were attained. For example, spring rape harvested at 66 % moisture content showed only 9 % germinating capacity.

The content of crude fat in spring rape and white mustard increased during the ripening period down to 40-50 % moisture content in the seed, showed

Fig. 2: Germinating capacity during the ripening process



a tendency to decrease during the following period down to SkM and remained relatively constant for a month after SkM (Fig. 3). In all three years the highest values of crude fat content in the seeds of spring turnip rape were found at ca. 50 % moisture content.

Changes in the content of free fatty acids during maturation are given in Fig. 4. At an early stage of ripening, before ca. 50 % moisture content, high values were found in seeds of spring rape and white mustard. After this stage of maturity the oil of all species contained less than 0.5 % free fatty acids and very small differences between different harvest times were obtained.

The curves representing chlorophyll content in the seeds at different stages of maturity show at ca. 40 (spring rape and white mustard) and at ca. 30 % moisture content (spring turnip rape) a marked stabilization at a low level. In comparison with the rapid decrease at earlier stages of the ripening process, the chlorophyll content of all species shows a considerably slower rate of decrease from these stages onwards.

The crude protein content of the seeds (Fig. 6) showed the lowest values when harvested earlier than at 50 (spring rape and white mustard) and at 30 % moisture content (spring turnip rape). Later harvest times gave almost the same content of crude protein.

The glucosinolate content in seeds of white mustard (Fig. 7) remained relatively uniform during the ripening process except for harvest times earlier than at 50 % moisture content, when low values were obtained. A low content of glucosinolates was also found in spring rape and spring turnip

Fig. 3: Content of crude fat during the ripening process

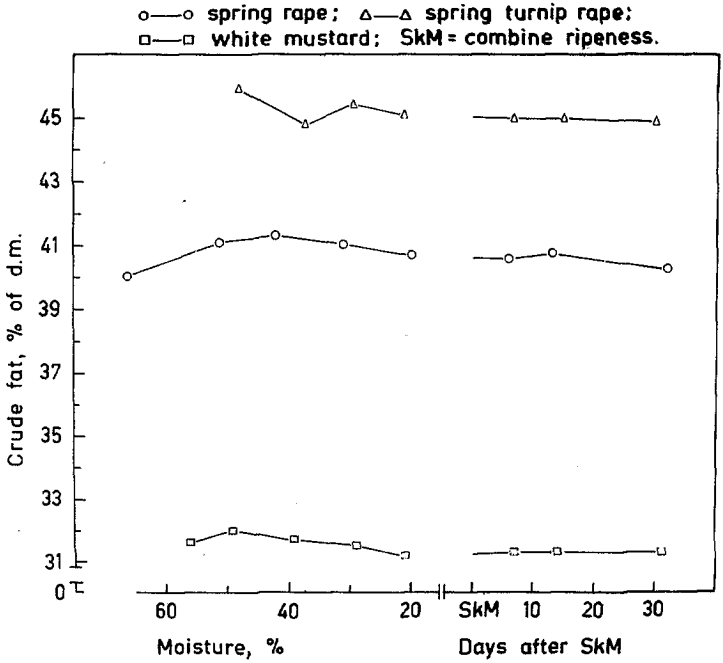


Fig. 4: Content of free fatty acids during the ripening process

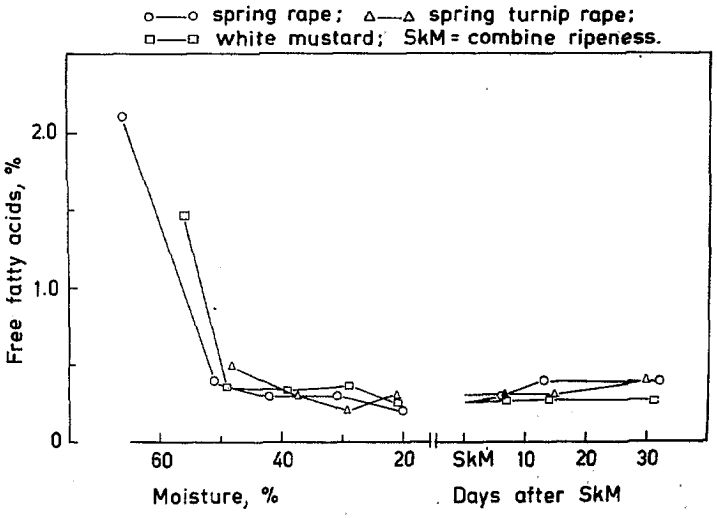


Fig. 5: Chlorophyll content during the ripening process

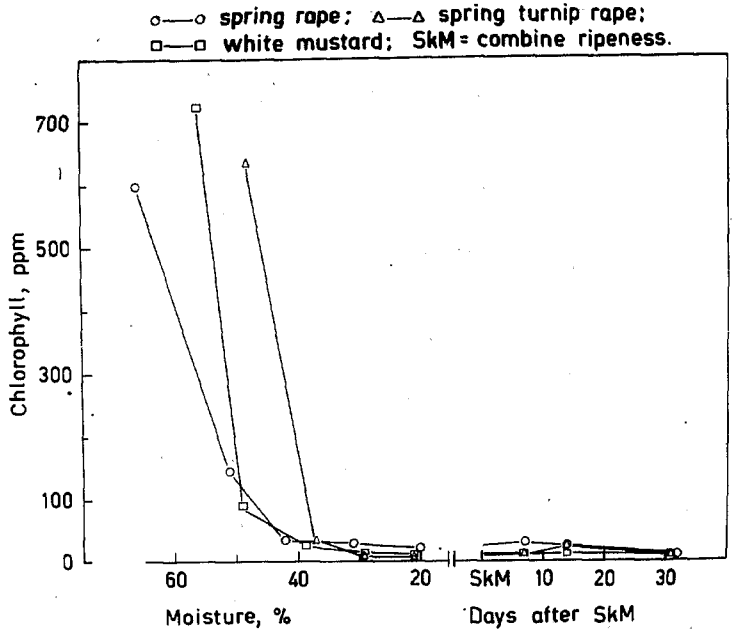


Fig. 6: Content of crude protein during the ripening process

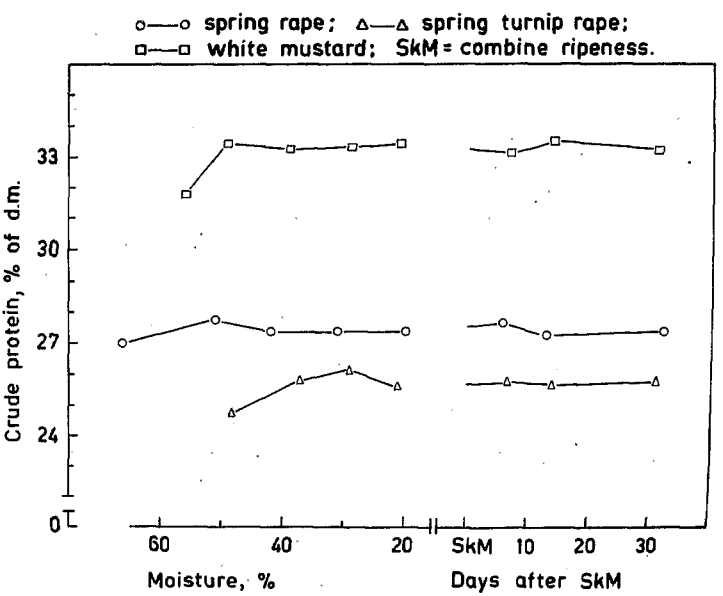


Fig. 7: Content of glucosinolates during the ripening process

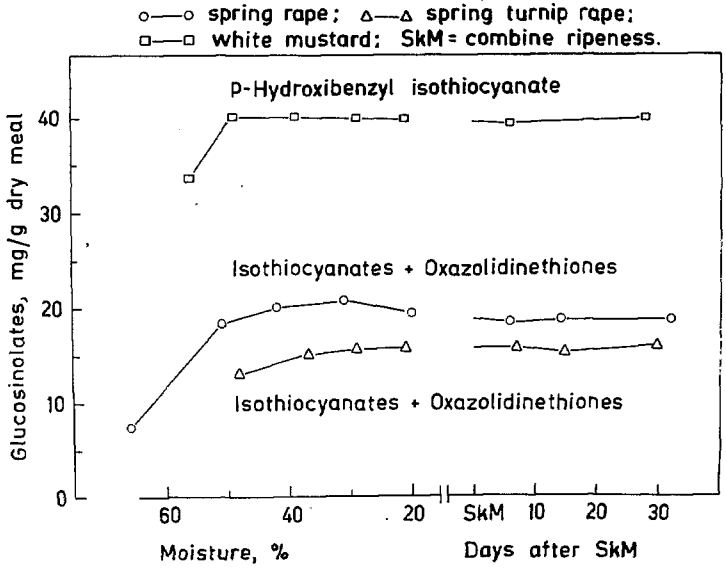
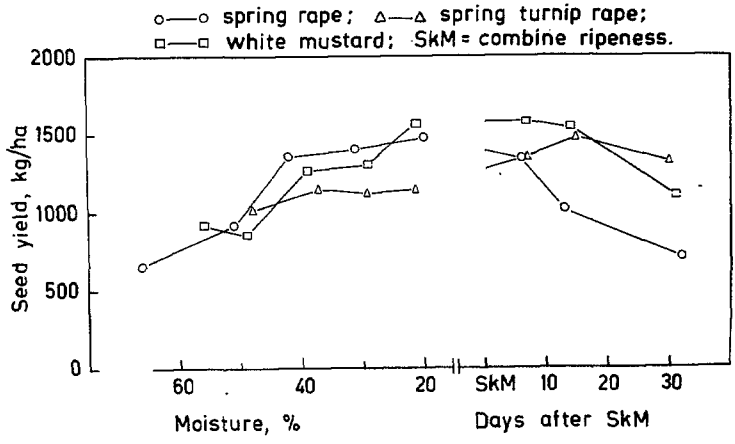


Fig. 8: Seed yield during the ripening process



rape at early stages of the ripening process, before reaching a 40 and a 30 % moisture content, respectively.

The yield of all species increased during the ripening process down to ca. 40 % moisture content. From this stage of maturity down to SkM the yield of spring rape and spring turnip rape remained relatively constant. A marked increase of seed yield by white mustard down to SkM was obtained in one year but could not be confirmed in the two other years, when the same yield was obtained at 40 % as at SkM. According to Fig. 8 the yield of spring turnip rape increased during the week after SkM. However, this unmotivated increase was only obtained in one of three years. The spring turnip rape in the other two years gave almost the same yield during the period from 40 % moisture content down to one month after SkM.

As a general conclusion of the results obtained concerning seed quality and seed yield during the ripening process the following can be stated:

During the ripening process a considerable stabilization in the properties of the seeds was found at a stage of ripeness characterized by 40 % moistu-