Glucose is the dominating sugar in the monohexosides (cerebrosides), while galactose and glucose occur in about equal amounts in the other neutral glycolipids.

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## Hereditary Variation in Content of Isothiocyanates and Thiooxazolidones in Seeds of Rape and Turnip Rape

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The use of rapeseed meal in animal nutrition is limited mainly due to its content of glucosides, which in the presence of water are split up and form isothiocyanates and thiooxazolidones. Rather much work has been performed to find the maximum permitted dosage of such meals to various animal species [1]. As rapeseed meal is available in large quantities in several countries considerable effort has been made, *e.g.* in Canada and Sweden, to apply some industrial detoxification process to the meal and thus increase its nutritional value. Even if it is relatively easy to remove the toxic substances industrially [2], it is at present not economically possible as the price for processed rapeseed meal would be to high. If toasting — dry heating — should be efficient in decreasing the toxicity of the meal such high temperatures must be used (130°C for 24 h or 150°C for 5 h [2]) that protein denaturation most probably occurs. Therefore we started this investigation with the object to find out if the hereditary variation in content of these substances are great enough to form a basis for decreasing their content through plant breeding.

The seed samples investigated were taken from the field trials of the Oil Crop Division at the Swedish Seed Association, except for Duro which was received from the General Seed Company, Svalöv. Thus all samples represent carefully handled seed, grown in Sweden under normal conditions.

The determination of isothiocyanates (I) and thiooxazolidones (II) were made essentially according to Wetter [3,4]. All tabulated figures are based upon defatted, dry meal and represent the mean of two analyses. The detailed procedure used in this investigation will be described in a forthcoming, more comprehensive report.

The results thus obtained with rape and turnip rape are shown in Table 1.

Varietal differences in content of these substances in the summerforms of rape and turnip rape have earlier been investigated by Wetter and Craig [5] using seeds grown in different locations in Canada.

Kreula and Kiesvaara [6] investigated the variation in thiooxazolidone content as well in winter as in summer types of rape and turnip rape most probably grown in Finland. Delaveau [7], using a method not quite comparable to the one used in this investigation, has studied varietal differences in content of isothiocyanates in rape and turnip rape, most likely grown in France.

Compared with the figures of Wetter and Craig our results show much greater varietal deviations and lower mean values for both I and II in summer rape. We have found varieties of summer turnip rape with more I and less II than they found. Their findings that the quotient I/II is about 1 in rape and 3.5 in turnip rape can not be of general validity and are most probably due to the rather close relation of the varieties used by them. We have found variations between 0.7 and 1.4 in I/II for summer rape, 2.9 and about 40 in summer turnip rape. The variation reported for the winter types is considerable. It should also be noted that the amount of II is approximately twice as high in winter rape as in summer rape.

The mean value and the variation in content of II in all four groups investigated are not very different from those reported by Kreula and Kiesvaara.

The great variation in content of thiooxazolidone, from 7.9 mg/g for Matador

*Table 1.*

| Species and varieties | Isothiocyanates mg/g I | Thiooxazolidones mg/g II | I + II | I/II |
|---|---|---|---|---|
| *Brassica napus*, wintertype, 59—255 Matador | 5.3 | 7.9 | 13.2 | 0.7 |
| — » — , 59—271 Dippes | 4.0 | 7.8 | 11.8 | 0.5 |
| — » — , 59—259 from Hungary | 3.6 | 7.2 | 10.8 | 0.5 |
| Mean | 4.3 | 7.6 | 11.9 | 0.6 |
| *Brassica napus*, summertype, 61—751 Regina II | 3.4 | 3.2 | 6.6 | 1.1 |
| — » — , 61—753 from Canada | 3.0 | 4.4 | 7.4 | 0.7 |
| — » — , 61—755 » | 3.1 | 2.5 | 5.6 | 1.2 |
| — » — , 61—756 » | 2.5 | 1.8 | 4.3 | 1.4 |
| Mean | 3.0 | 3.0 | 6.0 | 1.1 |
| *Brassica campestris*, wintertype, Duro (1959) | 7.7 | 0.5 | 8.2 | 5.4 |
| — » — , 59-276 from Poland | 8.1 | 1.3 | 9.4 | 6.2 |
| — » — , 61-680 from Austria | 9.2 | 0.3 | 9.5 | 30.7 |
| Mean | 8.3 | 0.7 | 9.0 | 17.4 |
| *Brassica campestris*, summertype, 61-880 Bele | 5.3 | 1.8 | 7.1 | 2.9 |
| — » — , 61-304 Sv-strain | 8.9 | 0.8 | 9.7 | 11.1 |
| — » — , 61-307 » | 7.0 | 0.7 | 7.7 | 10.0 |
| — » — , 61-879 » | 7.4 | 0.2 | 7.6 | 37.0 |
| Mean | 7.2 | 0.9 | 8.0 | 15.2 |

winter rape to 1.8 for Bele summer turnip rape (or even 0.2 for some non commercial varieties) seems to offer at least a partial explanation why different batches of commercial rapeseed meal (which can contain both rape and turnip rape) in feeding trials have shown great variation in toxicity.

As rape *(Brassica napus)* can be synthesized from kale *(Brassica oleracea)* and turnip rape *(Brassica campestris)* it would be interesting to investigate varietal differences in content of II in kale seed as the genes for high content of II could originate from the kale parent. Work along these lines will be reported in the above mentioned forthcoming report.

The variations found seem to be sufficient for further selection towards lower content of isothiocyanates and thiooxazolidones in rape and turnip rape.

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