DEVELOPMENT OF HIGH ERUCIC, LOW GLUCOSINOLATE *SINAPIS ALBA*

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ABSTRACT

A cross was made between high erucic (>55%), high glucosinolate *Sinapis alba* and normal erucic, low glucosinolate *Sinapis alba*. Open pollinated F_2 seed was planted in the field for single plant harvest. Over 1000 single plants were analysed for glucosinolate content and the 13 plants with total glucosinolate content less than 10 µmoles/gram were selected for half-seed fatty acid analysis. From these plants 39 seeds were found with an erucic acid content greater 54%. Further selections have been made in succeeding generations and the success of these is discussed.

INTRODUCTION

Low glucosinolate, high erucic acid (>50%) *Brassica napus* is grown commercially in Canada as a source of erucic acid for the industrial market. However, *B. napus* has limited potential in the dryer areas of southern Saskatchewan and Alberta. *Sinapis alba* (L) has been successfully grown as a condiment crop on the Canadian prairies, especially Saskatchewan and Alberta under dryland conditions. It has superior heat and drought tolerance in comparison to *B. napus* and is therefore well adapted for production in these areas. *S. alba* is also highly shatter resistant and has a large bright yellow seed. Further advantages include tolerance to blackleg and flea beetle attack. Because of the existence of a high erucic acid line (Sabre), a low glucosinolate line developed in Poland (Krzymanski et al., 1991) and a high oil content (36-38% oil) line developed in Sweden (Olsson, 1974), we have decided to develop a high oil content, high erucic acid and low glucosinolate cultivar suitable for the Canadian prairies. This paper describes the first step towards this goal, a cross between the high erucic acid line and the low glucosinolate line.

EXPERIMENTAL

Materials and Methods

The glucosinolate content of seed meal was determined by the gas chromatographic method of Thies (1980), except that the glucosinolates were extracted with 65% methanol, the trimethylsilylation was carried out according to the method of Landerouin et al. (1987) and the gas chromatography of the trimethylsilyl derivatives was on a J & W DB-1 (1 µm by 0.32 mm by 15 m) fused silica capillary column

(Sosulski et al. 1984) at 280 ° using hydrogen as the carrier gas. The seed meal was prepared by the method of Raney et al. (1987). The fatty acid composition of half seeds was determined by the method of Thies (1971), except that gas chromatography of the methyl esters was performed with a Supelcowax 10 (0.5 µm by 0.32 mm by 15 m) fused silica capillary column at 210 ° using hydrogen as the carrier gas.

The low glucosinolate parental line (92-6669) used was from a single plant selection for zero hydroxybenzyl glucosinolate content and lowest total alkenyl glucosinolate content from the low glucosinolate line obtained from Dr. Krzymanski in 1991 (Krzymanski et al., 1991). The high erucic acid line parental line (Sabre) contained >52% erucic in its seed oil. The cross was made between 18 plants of 92-6669 and 10 plants of Sabre in 1992. Open-pollinated F_2 seed was produced and grown in a plant pulling block in 1993. 1120 plants F_2 plants were harvested and screened for glucosnolate content by TES-tape. 49 were considered to be low which were analysed by gas chromatography. Of these 13 were found to have a hydroxybenzyl glucosinolate content less than 1 µmole/g and < 10 µmoles/g of total alkenyl glucosinolate. Another 17 had a hydroxybenzyl glucosinolate content < 1 µmole/g, but their alkenyl glucosinolate content was too high. 24 F_3 half seeds were analysed from each of these 13 plants and a total of 39 half seeds were selected having an erucic acid content ≥ 54%. Another 41 seeds had an erucic acid content >50%. F_4 open-pollinated and selfed seed was produced on 36 of these F_3 plants. The open-pollinated seed was analysed for glucosinolate content and 10 F_3 plants with the lowest glucosinolate content were selected for further half seed analysis. 26 of the 36 F_3 plants contained ≤0.2 µmoles/g hydroxybenzyl glucosinolate. Analysed 12 seeds from each of these 10 plants from which 22 half-seeds with a erucic acid content ≥54% were selected for crossing with the Svalof high oil line (Olsson, 1974) and for producing open-pollinated seed for 1994 field trial. Of all 120 F_4 half seed analysed only 12 seeds had an erucic acid content <50%. Tables 1 and 2 summarize the glucosinolate and fatty composition data for the parents used in the cross and their progeny.

Discussion

We have been able to successfully combine the low glucosinolate trait of parent 92-6669 with the high erucic acid trait of parent Sabre (Table 1 and 2). The material is being grown in 1994 field trials for conformation of this. If the oil content of this material can be increased to near *B. napus* levels, then we may have an industrial oil crop for the southern Canadian prairies.

Table 1. Glucosinate content (µmole/g meal ± SD) of parental lines and progeny

Generation (plants)	Hydroxy-butenyl	Total Alkenyl	Hydroxy benzyl	Total Indolyl
92-6669	27.7	28.0	0.0	7.7
Sabre	4.2	4.2	224.4	2.0
F_1 bulk	8.1	8.2	116.9	4.0
F_2 selected	6.8±2.5	7.0±2.5	0.2±0.3	8.1±1.9
F_3 selected	4.4±2.1	4.6±2.2	0.0±0.1	5.6±1.9

Table 2. Fatty acid composition (% of total ± SD) of parental lines and progeny

Generation (seed)	16:0	18:0	18:1	18:2	18:3	20:1	22:1
92-6669	2.7	1.1	32.8	9.5	11.8	12.0	28.8
Sabre	2.9	0.9	15.4	10.3	9.6	6.3	52.5
F_3 mean	2.9±0.3	0.7±0.1	20.7±6.7	8.2±1.6	13.1±1.7	10.8±2.5	42.1±9.8
F_3 selected seed	2.6±0.2	0.6±0.1	13.0±1.1	7.4±1.4	12.4±1.6	6.3±1.2	56.1±1.7
F_4 mean	2.2±0.2	0.5±0.1	12.4±3.9	9.6±2.5	14.6±3.2	4.1±2.1	54.7±4.1
F_4 selected seed	2.2±0.2	0.4±0.1	10.6±1.6	9.1±2.4	14.8±2.4	2.3±1.1	58.7±2.0

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