BREEDING OF HIGH OLEIC ACID SPRING TURNIP RAPE IN FINLAND

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ABSTRACT

The breeding program for high oleic spring turnip rape started from one individual with 69 % oleic acid of the total fatty acids in the seed oil. The high oleic plant was found from a multiplication of the breeding line Jo 4072 in 1992. By the end of 1994 five selfed generations have been produced. The fatty acid profile of the high oleic breeding material is at present: 85-90 % oleic acid, 1-3 % linoleic acid, 3-6 % linolenic acid, 0 % erucic acid. The amount of saturated fatty acids totals 3-5 %. RAPD markers linked to a major gene accounting for the increase in the oleic acid content have been found by DNA analysis.

INTRODUCTION

The main oilseed crop in Finland is spring turnip rape, Brassica rapa subsp. oleifera. To be successful, cultivars should have rapid life cycles and high yielding capacity together with a desired seed quality.

Different breeding projects for spring turnip rape aim at cultivars with modified fatty acid compositions to meet the needs of industry. Oleic acid content in the present spring turnip cultivars is below 60 %. Higher oleic acid content would allow the oil to be used even more widely because of increased thermostability.

EXPERIMENTAL

One individual with high oleic acid content was found in 1992 when single plants had been selected at random from a field multiplication of the breeding line Jo 4072 originating from a cross between Sv 3232 and Jo 3104. The fatty acid composition of each individual with a low glucosinolate content (gluco tape test) was analysed by gas chromatography of the fatty acid methylesters from 10 bulked seeds with a modified method of Thies (1968).

The breeding program for high oleic spring turnip rape started from the high oleic individual in 1992. The material originates from 61 seeds of the high oleic individual analysed by half seed technique. Of these, 22 plants had an oleic acid content over 70 %. The

breeding has been recurrent selection consisting of cycles of analysing a new generation by half seed technique, selfing plants at the greenhouse, determining fatty acids from bulked seed samples of selfed plants and selecting best individuals with highest oleic acid content.

Presently (December 1994) the sixth selfed generation of high oleic plants is growing in the greenhouse. The plants show good vigor and normal features of spring turnip rape. The fatty acid profile of the high oleic breeding material is at present: 85-90 % oleic acid, 1-3 % linoleic acid, 3-6 % linolenic acid, 0 % erucic acid. The amount of saturated fatty acids totals 3-5 %. The oleic acid content in different generations are presented in Tables 1 and 2.

TABLE 1. The fatty acid composition of the breeding line Jo 4072 and the high oleic individual.

Fatty acid	18:1	18:2	18:3	22:1	C:0
Jo 4072	59.8	21.6	10.4	0.5	5.3
high oleic individual	69.2	13.4	10.2	0.0	4.8

TABLE 2. The oleic acid content (% of total fatty acids) in the first, third and fourth selfed generations.

Fatty acid method,	Mean of 18:1	standard deviation	maximum of 18.1	minimum of 18:1
half seed technique F1, 61 seeds	67.4	5.9	75.0	48.4
half seed technique F3, selected 310	81.4	8.2	92.0	70.0
bulked sample F3, 302	74.9	7.0	90.0	51.6
half seed technique F4, selected 310	82.7	8.2	92.0	70.0
bulked sample F4, highest 50	88.1	1.1	90.2	85.6

In addition, outbreeding was started from the second generation by crossing inbred individuals with lines and cultivars of spring turnip rape. As a result, in summer 1994 two lines were multiplied in the field as 20 m^2 plots. The seed oil of these lines contains approximately 67 % oleic acid.

One high oleic individual was crossed with one individual from the breeding line Jo4002 (average oleic acid content 55 %) to create a F2 population for linkage mapping. By using bulked segregant analysis (Michelmore et al. 1991), 5 RAPD markers associated with the oleic acid content were found. All these markers mapped to the same chromosomal region with linkage analysis (MAPMAKER/QTL, Lander et al. 1987) (Tanhuanpää et al., in preparation).

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