LESQUERELLA, A NEW SOURCE FOR HYDROXY FATTY ACIDS.

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INTRODUCTION

Species of *Lesquerella* (*Crucifereae*) originate from Southern and Eastern parts of the USA and Mexico. The genus is composed of annual, biennial and perennial herbs and some species can be cultivated in the dryer and temperate climates of Europe. Plants generally produce many stems which reach a height of 15 to 50 cm. In general the flowers are yellow and develop into capsules containing 10 to 25 small seeds (Roetheli et al, 1991). The thousand seed weight varies from 0,4 to 2,1 g (Mikolajczak et al, 1962). The seed oils of these species contain interesting hydroxy fatty acids, e.g. lesquerolic (*L.grandiflora*, *L.fendleri*), densipolic (*L.densipila*, *L.lescurii*), and auricolic acid (*L.auriculata*).

Lesquerolic acid is a possible feedstock for several industries such as oleochemical, lubricant, cosmetics and paint industries and can also be used in some applications as a replacement for ricinoleic acid derived from oil of the castor bean. Densipolic acid may be used as an additive in several products of the flavour and fragrances industry.

At CPRO-DLO, Wageningen, several *Lesquerella* spp. were evaluated for their agronomic potential under Northwest European conditions. Furthermore some accessions of four species were tested for the susceptibility to the beet cyst nematode, *Heterodera schachtii*.

After two years of evaluation *L.grandiflora* and *L.densipila* appear to be the most promising species for the production of lesquerolic and densipolic acid respectively.

MATERIALS AND METHODS

Experiment 1: *L.grandiflora* yield trial with three sowing times and three row distances

In 1993, one accession of *L.grandiflora* (910846) was sown in three replicates at three sowing times (March 30, April 26 and May 13) and with three row distances (12.5, 25 and 50 cm). Within the rows the number of seeds was the same (approximately 125 seeds per meter in each row). The size of each plot was 13.5 m^2. During development period emergence, soil

cover and crop height were measured. After harvest the total number of plants, seed yield, oil content and fatty acid content were determined.

Experiment 2: Evaluation of single plants of *L.grandiflora*, *L.densipila* and *L.auriculata*.

In 1993, an evaluation and selection experiment was carried out in one accession of *L.grandiflora*, number 910846 (380 plants), one accession of *L.densipila*, number 910819 (100 plants) and one accession of *L.auriculata*, number 910817 (100 plants). Plant spacing was 50 x 50 cm.

Several characteristics were evaluated, such as days until flowering, days until harvest, plant length and number of branches. Selection for earliness seems to be an important criterium. Therefore 200 early flowering single plants of *L.grandiflora* were selected and harvested. Yield and thousand seed weight of 60 best performing plants were measured.

All the plants of *L.densipila* and *L.auriculata* were harvested. Yield and thousand seed weight were measured on 30 best performing plants each.

Experiment 3: Susceptibility of *Lesquerella* spp. to the beet cyst nematode *Heterodera schachtii*.

Seedlings of six *Lesquerella* spp. and a rape seed cultivar were planted in small plastic tubes filled with silver sand according to the method of Toxopeus and Lubberts (1979). Per replicate six plants of each accession were tested with a total of eight replicates. After two weeks a suspension with 300 nematodes was inoculated into each tube. Four weeks after inoculation the evaluation took place. The silver sand was carefully washed out and the cysts on the roots were counted.

RESULTS

Experiment 1

Approximately 13% of the seeds sown on the first and third sowing date emerged (15-20 plants per meter row). Seeds sown on the second sowing date emerged for approximately 9% (10-12 plants per meter row). In glass house trials the emergence usually is over 40%. Table 1 shows the number of emerged plants and the total number of plants/m^2 in combination with the crop height.

Table 1: Crop height and number of plants at different sowing times and row distances on clay soil in 1993.

sowing time	row distance (cm)	emergence (plants/m^2)	crop height (cm)	total number of plants/m^2
March 30	12.5	132 (19.6)	42 (2.6)	82 (12.7)
	25	61 (12.3)	40 (2.2)	41 (6.7)
	50	41 (6.2)	35 (2.4)	28 (6.1)
April 26	12.5	83 (11.2)	40 (3.2)	58 (10.1)
	25	44 (10.1)	37 (3.3)	36 (6.6)
	50	24 (4.5)	30 (3.4)	22 (3.3)
May 14	12.5	128 (20.1)	41 (2.7)	91 (12.8)
	25	59 (10.6)	36 (4.9)	47 (7.7)
	25	36 (6.5)	33 (2.9)	28 (4.1)

(..) standard deviation

Sowing at a row distance of 12,5 cm results in the highest crop (over 40 cm). It provides also the fastest soil cover (figure 1). Compared to the plots with a row distance of 25 cm the 50% soil cover level is reached approximately one week earlier. Compared to 50 cm this is approximately three weeks earlier.

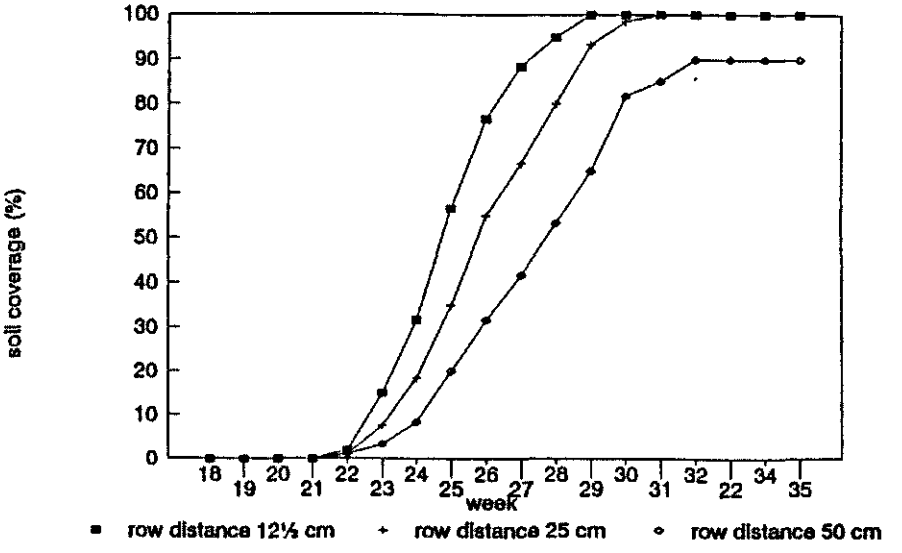

Figure 1: Percentage soil cover of *L.grandiflora* on clay soil in 1993.

The highest seed yields were obtained by early sowing (March 30) at a row distance of 12.5 cm (figure 2). Due to the poor seed retention only half of the produced seeds was harvested

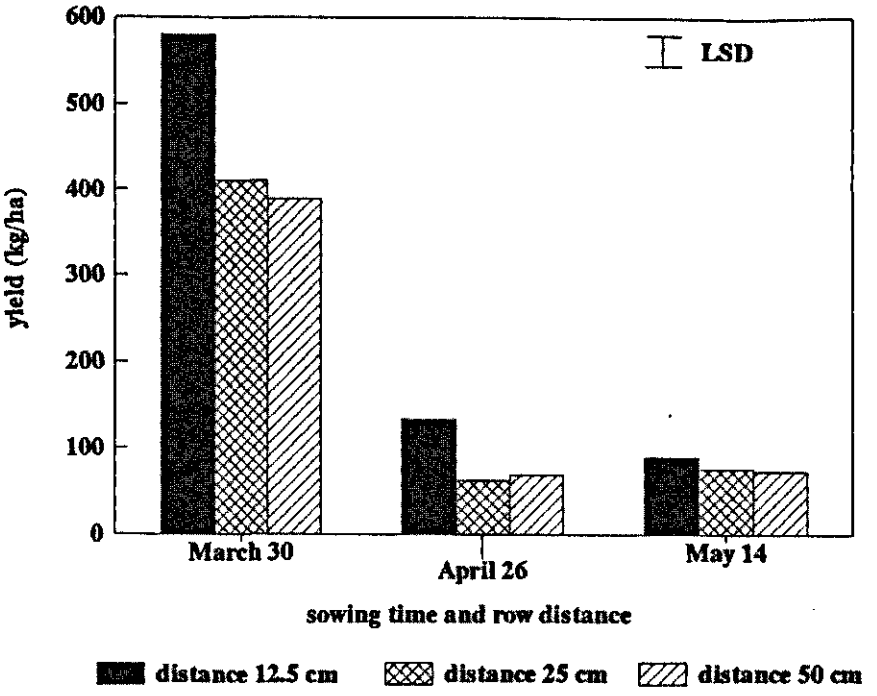

Figure 2: Yield of *L.grandiflora* on clay soil at different sowing times and row distances in 1993 (mean of three replicates).

Table 2: Oil content and fatty acid content of *L.grandiflora* at three sowing times in 1993.

sowing time	oil content (%)	fatty acid content (C20:1OH) (%)
March 30	30.6	53.7
April 26	17.0	38.2
May 14	13.4	29.4

Harvested seed from the plots sown on March 30 shows the highest oil and lesquerolic acid content, 30.6 and 53,7% respectively. This agrees with results presented in the literature (Mikolajczak et al, 1962).

Experiment 2

Within *L.grandiflora*, *L.densipila* and *L.auriculata* a large variation for several characters was shown (table 3). For *L.grandiflora* variation for earliness is present. Variation for yield and thousand seed weight exists in all species investigated.

Table 3: Single plant variation for several agronomical traits within accessions of different *Lesquerella* spp..

	L.grandiflora			*L.densipila*			*L.auriculata*		
	RANGE	MEAN	N	RANGE	MEAN	N	RANGE	MEAN	N
# days until flowering	55-86	65	380	45-91	68	100	45-75	54	100
# days until maturity	129-156	140	200	111-125	115	100	111-116	113	100
plant length (cm)	30-80	55.5	200	25-38	31	100	17-31	22	100
# branches	4-17	9.5	200	-	-	-	-	-	-
yield (g)	1.6-20.2	4.8	60	1.7-5.9	3.5	30	2.8-18.9	5.6	30
1000 seed weight (g)	0.34-0.79	0.49	60	0.40-0.79	0.54	30	0.36-0.74	0.54	30

Experiment 3

Within the genus *Lesquerella* a large variation in susceptibility for the beet cyst nematode was shown (figure 3).
Preliminary results indicate that accessions of *L.grandiflora* have a low level of susceptibility for the beet cyst nematode. Accessions of *L.densipila* and *L.auriculata* were very susceptible.

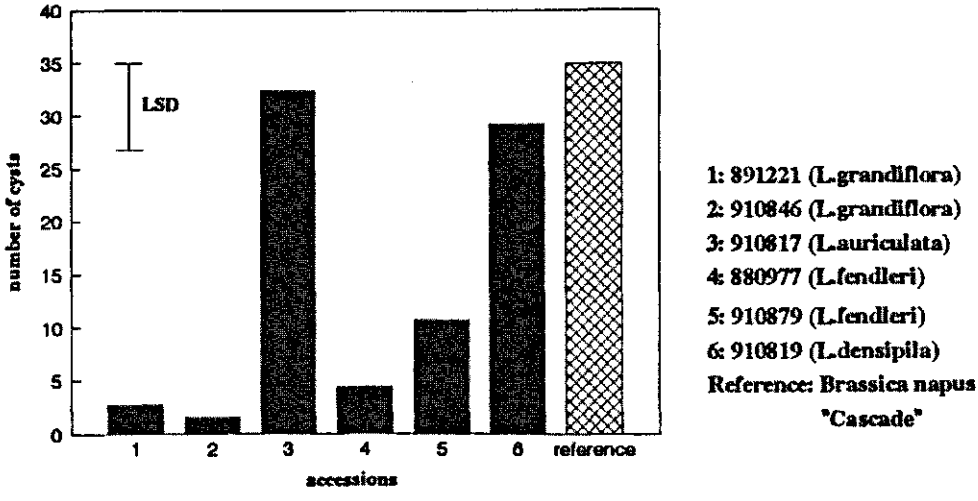

Figure 3: The number of cysts of the beet cyst nematode *Heterodera schachtii* on roots of different *Lesquerella* spp.

CONCLUSIONS AND DISCUSSION

The results of sowing time and row distance were obtained from one trial in 1993. It is important to repeat this experiment in another year, to determine year effects. It seems preferable to sow *L.grandiflora* in a narrow row distance (12.5 cm). The obtained yield was higher and the soil cover was faster, decreasing the weed problem. Early sowing seems preferable.

Selection within accessions for several favourable characteristics is of great importance for further crop improvement. First investigations show that variation is available in the present limited gene pool. Yield and plant habit can be substantially improved.

The low level of susceptibility of several *Lesquerella* spp. for the beet cyst nematode could be of importance for present crop rotation in the Netherlands were beets are included. Further breeding research, including field experiments, should be directed towards a decrease of susceptibility.

REFERENCE

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