STAND DENSITY EXPERIMENTS WITH *ERUCA SATIVA*

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INTRODUCTION

A joint research programme on rapeseed/mustard improvement and oil and protein utilization between India and Sweden has been running since 1979. Within the sector dealing with cultivation technique, field experiments with *Eruca sativa* Miller concerning sowing time, fertilization and plant distribution in the field have been carried out in both countries. Earlier Swedish results concerning sowing time/ /nitrogen fertilizer are presented by Kjellström & Ohlsson (1986).

The general purpose of the Swedish investigations was to find out the principal reaction of the Indian seed materiel when grown in Sweden with a cultivation technique somewhat different from the one used in India.

Eruca sativa (taramira) is a drought-tolerant minor oil crop grown in South Asia mainly on marginal lands with low inputs of fertilizer and irrigation. The oil obtained from the seeds is used for burning purposes, the oil cake serves as cattle feed and the leaves can be used as salad or as green fodder for cattle.

At the SKN College of Agriculture, Jobner, Rajasthan, three inter-row spacings (30, 45 and 60 cm) and six intra-row spacings (no thinning, 10, 15, 20, 25 and 30 cm) were compared over a period of four years. No thinning treatment consisted of all the surviving plants from 6 kg seeds per hectare. Planting with narrow inter-row spacing of 30 cm yielded significantly more than 45 and 60 cm spacings. Among the intra-row spacings compared, 15 cm was found to be the best. Mean yields obtained were between 1000 and 1200 kg/ha on the light textured soils of Jobner following a fertilization of 30 kg N/ha and 20 kg P_2O_5/ha (Jangir *et al.*, 1986).

MATERIAL AND METHODS

The experiments were conducted at the Swedish University of Agricultural Sciences, Uppsala (59^0 N and 17^0 E) on a clay loam with high levels of phosphorus and potassium. The amount of nitrogen fertilizer applied was 60 kg/ha.

In experiment 1, a split-plot design with two replications, two row spacings on main plots (12 and 48 cm) and three seed rates on sub plots (1, 2 and 4 million seeds/ha) were compared for two years, 1982 and 1983. Plot size was approximately 15 m^2. Cultivars used were T-27 and RTM-1. The seed rate, expressed in number of germinative seeds per hectare, was calculated according to the experimental plan and adjusted with regard to the germinability and the thousand-seed-weight of the cultivar. Effects of row spacing are discussed on the basis of an average of all seed rates, whereas effects of seed rate concern an average of both row spacings.

In a more penetrating experiment (experiment 2) in 1986 with cultivar T-27, two inter-row spacings (24 and 36 cm) and three intra-row spacings (5, 15 and 25 cm) were compared. The plant stand was thinned manually about two weeks after emergence to obtain the desired spacing between plants within rows. From each of the treatments 10 plants were examined and described. Number of seeds per pod was determined in 5 pods from each plant.

RESULTS AND DISCUSSION

Experiment 1

The seed rates used were calculated in such a way that they could give rise to approximately 1, 2 or 4 million plants per hectare.

At the 12 cm row spacing, 0.9, 1.9 and 4.1 million plants were obtained respectively, on average. Due to poor growing conditions, only the two lower seed rates are accounted for at the 48 cm spacing, with 1.1 and 2.0 million plants per hectare obtained, respectively.

Table 1 shows that the narrow row spacing yielded about 30 per cent more than the wider spacing. The best seed quality was obtained when the plants were distributed more uniformly per unit area. Crude fat content was higher and chlorophyll content lower following sowing with 12 cm spacing compared with 48 cm spacing.

Table 1. Effect of row spacing

Yield and quality factors	Row spacing, cm 48	12
Seed yield, kg/ha	781	1038
rel. value	100	133
Crude fat content, %	36.0	36.7
Chlorophyll content, ppm	15	9
Crude protein content, % of fatfree dry matter	46.6	46.4
Glucosinolate content, micromol/g fatfree dry matter	154	149
Erucic acid content, %	48.1	48.5

There were only small differences between the different seed rates compared (Table 2). In investigations with *Brassica* crops in Sweden (Ohlsson, 1976) a wider spacing between plants generally delayed maturity of the stand, leading to increased moisture and chlorophyll contents in the seeds at harvest. There is a slight tendency for similar effects also in this experiment with *Eruca*.

Table 2. Effect of seed rate

Yield and quality factors	Seed rate, million seeds per hectare 1	2	4
12 CM ROW SPACING			
Seed yield, kg/ha	966	946	1002
rel. value	100	98	104
Crude fat content, %	36.7	36.9	36.8
Seed moisture content at harvest, %	13	10	11
Chlorophyll content, ppm	11	9	8
48 CM ROW SPACING			
Seed yield, kg/ha	728	745	
rel. value	100	102	
Crude fat content, %	36.1	36.3	-
Seed moisture content at harvest, %	10	11	-
Chlorophyll content, ppm	16	15	-

Experiment 2

In this experiment, plant stand density expressed in number of plants per m^2, ranged from 111 to 833. Results are shown in Table 3 and Figures 1 and 2.

In a stand with few plants per unit area, individual plants showed good growth with profused branching, and a large number of pods per plant and seeds per pod. Yield per plant was high but yield per area was low.

With increasing stand density (within the range studied) the number of pods and yield per plant decreased, but at the same time the total seed yield of the stand increased. Also, a lesser proportion of the yield per plant came from pods on secondary branches. Increasing stand density from 111 to 833 plants per m^2 increased seed yield per hectare by 50 per cent.

Table 3. Effect of stand density

Yield and yield components	Plant stand density ($/m^2$) and inter- & intra-row spacing)					
	111 (36x25)	167 (24x25)	185 (36x15)	278 (24x15)	556 (36x5)	833 (24x5)
Number of branches						
primary*	8.2	7.2	6.4	6.6	4.3	4.4
secondary*	24.0	13.2	10.7	11.7	5.1	4.6
Number of pods on						
prim. branches	89	62	65	61	39	28
sec. branches	81	37	30	25	12	11
Number of seeds/pod						
pods on prim. br.	26	26	23	23	22	20
pods on sec. br.	25	25	23	22	19	19
Seed yield						
prim. br./plant, g	4.53	3.05	3.37	3.00	1.79	1.20
sec. br./plant, g	3.24	1.51	1.39	0.82	0.39	0.35
per plant, g	7.77	4.56	4.76	3.82	2.18	1.55
per hectare, kg	863	760	882	1062	1211	1292
rel. value	100	88	102	123	140	150

* See figure 3.

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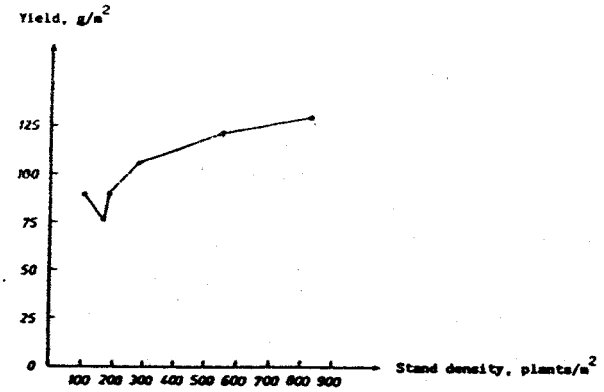

Fig. 1. Effect of stand density on yield per m^2.

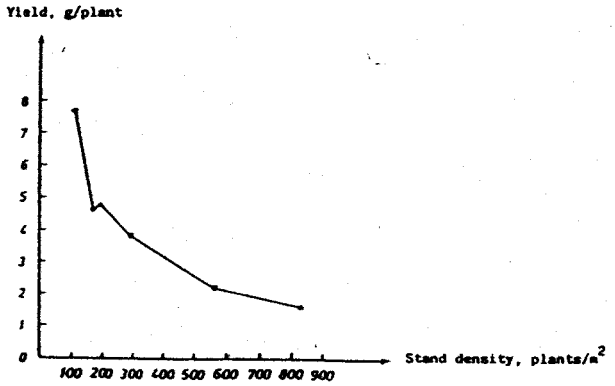

Fig. 2. Effect of stand density on yield per plant.

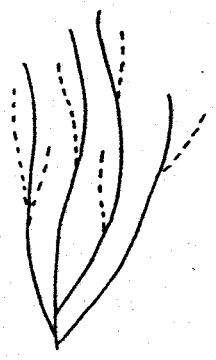

Fig. 3. A plant with primary (———) and secodary (– – –) branches. A branch is defined as having at least on pod.