Improvement of rapeseed meal quality through breeding for high protein content.

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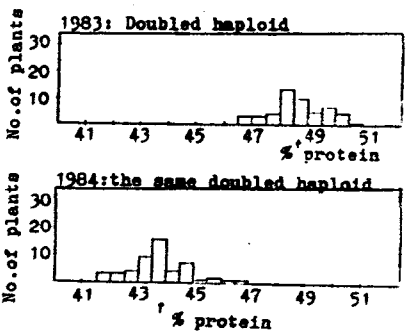
There is a wide range of variation in protein content of the breeding material of summer rape grown at Svalöf AB (38-55 % in defatted dry matter; NIR analysis of single plant seeds). The part of the variation caused by environment can be substantial.

The variance of single plants selected from a doubled spontaneous haploid (a homozygote) shows an example of the magnitude of the environmental variance on the single plant level.

In 1983 the protein content of the single plants selected from a spaced stand of this homozygote varied between 47-51 % (s^2 = 0,95), and in the following year, plants selected from the same homozygote varied between 42-47 % (s^2 = 1,18). The mean is indicated by the arrow.



The total phenotypic variance of 494 single plants selected from segregating populations grown under spacing 1983 was s^2 = 11,38. This variance is significantly higher than that of the homozygous plants grown in the same field in the same year ($P < 0,002$). Thus a certain amount of variation can be expected to be of genetic origin.

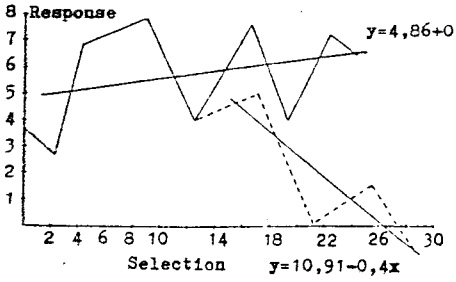
In order to estimate the magnitude of the heritability (h^2) of protein content, the regression (b) of progeny plot on mother plant has been calculated for some populations grown in different years. (r = correlation between mother and progeny, n = number of entries.)

The narrow sense h^2 can not be exactly estimated from the regression of offspring on mother, but falls between b and 2b.

There is a great variation in b and r, indicating that selection for high protein content may be efficient some years but not all years.

		n	b	r
Parent plant-observ.plot	1978	73	0,07	+0,09 NS
- " -	1979	82	0,04	+0,06 NS
- " -	1980	28	0,56	+0,56**
observ.plot-trial plots	1980	92	0,10	+0,25*
- " -	1981	134	0,50	+0,64***
parent plant-observ.plot	1984	118	0,33	+0,61***

Continuous selection for high protein content (% of defatted dry matter) has been performed for eight generations in a population of double low summer rape. Selection started in F_5. The cumulated response to selection (calculated as the difference between the generation means) was plotted against the cumulated selection differentials. _____ positive selection _ _ _ _ negative selection.



There is a response to selection but the generation means fluctuate markedly. The realized h^2 was low, 0,1.

To test for the presence of additive variance, selection was also practised in the opposite direction beginning in selection generation no. 4. The average response per generation was higher than of the positive selection, and the realized h^2 was as high as 0,4.

It is obvious that additive variance was still present in the population.

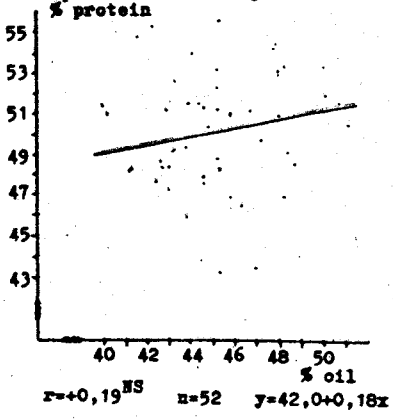
Continuous selection for high protein content /% in defatted dry matter/ in summer rape.
S=selection differential, R=response

		No of plants	Coeff. of variation	No of plants selected	S	R	Selected pop. x/
Cross A							
F3	1981	54	3,89	7	+2,8	+2,0	
F4	1982	80	3,87	11	+2,6	+0,2	+2,0
F5	1983	79	3,50	9	+2,7	+3,1	+2,2
F6	1984	70					+5,3
Cross B							
F4	1981	49	3,43	8	+2,2	-0,4	
F5	1982	77	5,76	8	+4,4	+1,5	-0,4
F6	1983	52	5,30	6	+3,8	+0,9	+1,1
F7	1984	70					+2,0

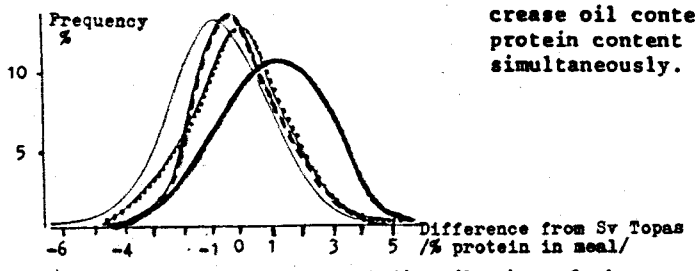
x/ Difference from the original population

Continuous selection for high protein content (% in defatted dry matter) in different crosses of summer rape. A good response was achieved without loss of variation.

The correlation between oil content in the seed and protein content in the meal of summer rape /Sv Karat x Orpal//1983/



It should be possible to increase oil content in the seed and protein content in the meal simultaneously.



The curves above show the range and distribution of the protein content of new breeding lines (single plant progenies) produced in different years.

- no previous selection for protein content
- one year of selection
- two years of selection
- three years of selection

A new summer rape variety, Sv Puma, has good yielding capacity and in addition has a higher oil content in the seed combined with a higher protein content in the meal.

Results from official trials, Sweden 1984-86.

	Sv Topas	WW Hann	Sv Puma
Seed yield,kg/ha	2394	2441	2374
Oil content, % in dry seed	47.2	46.6	47.8
Protein content, % in dry meal	42.3	40.5	43.9
Crude fat yield,kg/ha	965	968	977
Protein yield,kg/ha	462	452	471

For more details: see Bengtsson, L. Improvement of rapeseed meal quality through breeding for high protein content. Svalöv 1985.
ISBN-91-576-2249-3.