THE SEED PROTEIN PRODUCTION OF HIGH-YIELDING PISUM GENOTYPES

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Three groups of high-yielding mutants and recombinants of our Pisum collection were investigated with regard to seed production, seed size, and protein content of the seed flour. From these data, the seed protein production per plant was computed and compared with the control value of the variety 'Dippes gelbe Viktoria' which was used for our radiation-genetic experiments (Fig. 1).

The first group contained mutants and recombinants showing apical stem fasciation which results in a strong increase of the number of flowers and pods per plant. Therefore, the number of seeds per plant is essentially higher than the control value of the mother variety. The various genotypes were tested in different years, some of them over a period of 7 to 13 generations with 4-6 replications per year. The mean number of seeds per plant for each generation is given in the upper half of the figure. Unfortunately, most of these genotypes contain the mutant gene sg responsible for reduced seed size derived from the fasciated mutant 489C. Their high seed production did not lead to an equally high production of seed proteins. On the contrary, the 1978 values of 5 genotypes of this group were only roughly equal to or even lower than the control value of the initial line. The seed production of recombinant R 668A, for instance, varied between 172 and 227% of the control values considering 7 generations. In 1978, the protein content of its seed flour was similar to that of the initial line, but the seed size was essentially smaller (thousand seed weight of the mother variety 283.4 g of R 668A: 147.9 g). This reduced the seed protein production per plant to about 94% of Dippes gelbe Viktoria. Recombinant R 849 and mutant 1206E, on the other hand, had a lower seed production than R 668A, but their seed size was only insignificantly reduced. The protein production per plant of these two genotypes was about 60% higher than that of the mother variety.

The genotypes of the second group exhibited a dichotomous stem bifurcation in the upper part of the shoot (gene bif-1). Recombinant R 177 also contained gene sg for small seeds and therefore showed no increased protein production in spite of its high seed production. The increased protein production of the genetically very complicated recombinant R 20D, on the other hand, is again the result of the combination of a very high number of seeds per plant and nearly normal seed size. The protein content of the seed meal was about equal to the control; the protein production per plant, however, was 80% higher in 1978.

The three genotypes of the last group have a normal shoot structure. Recombinant R 933 is of particular interest. It originated from the cross of mutant 3137 (late, tall, very high seed production, but small seeds) x 1001 (increased seed size). The seed production of this recombinant type was found to be very high-; the seed size was nearly normal. In 1978, the protein content of the seed flour was slightly increased. The favorable combination of these properties led to an extraordinarily high protein

production per plant, exceeding the control value by about 140%.

Most of the genotypes with improved protein production are not suited for field cultivation because of their tallness. The recombinants R 224 and RM 1010, however, are not inferior to their mother variety with regard to plant height and flowering time. In 1978, their protein production was 20-30% higher than that of the initial line. The protein quality, i.e. amino acid composition, was not influenced by the mutant genes. These recombinants will be tested more intensively in the future.

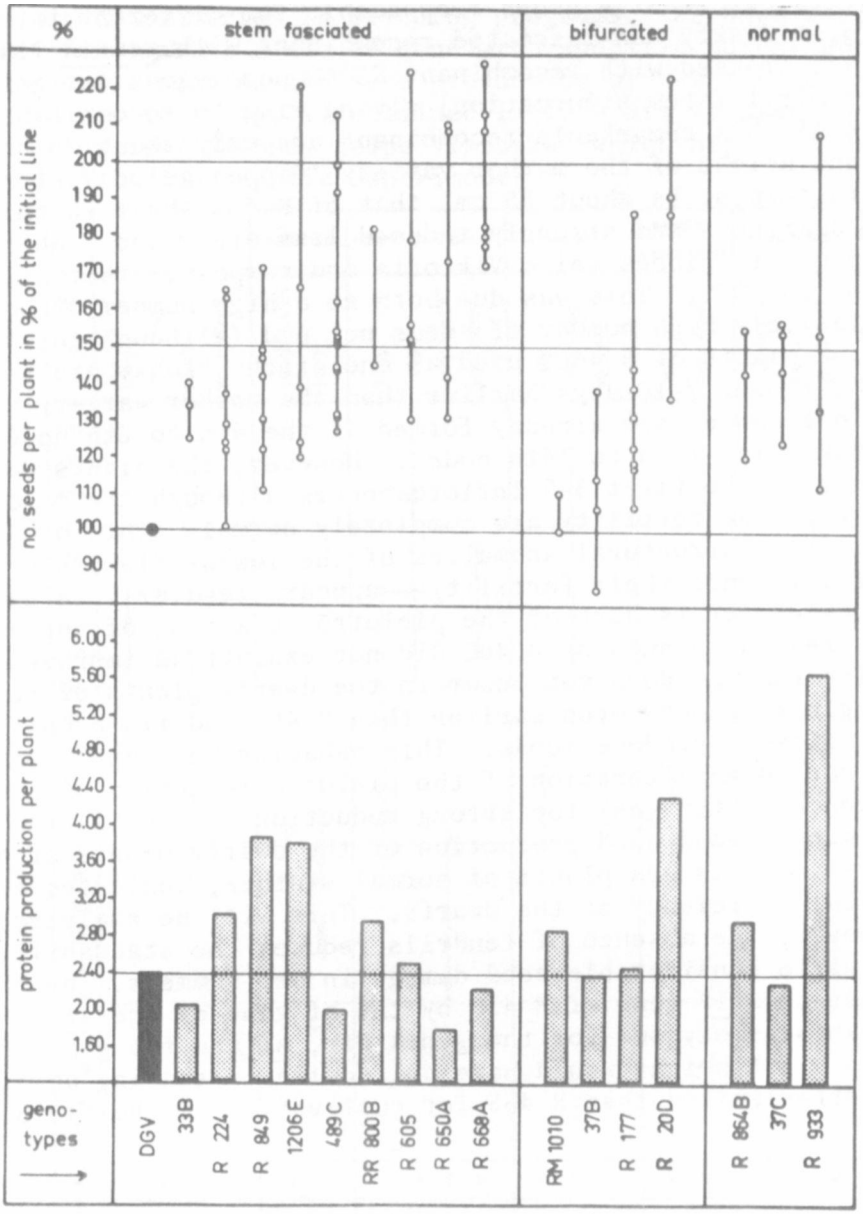

Fig. 1. Upper part: Seed production of 16 pea mutants and recombinants as related to that of the mother variety Dippes gelbe Viktoria in successive generations. Each dot represents the mean value for the character number of seeds per plant for one generation. Lower part: Mean values for the protein production per plant of the same genotypes determined in 1978.