FACTORS DETERMINING VARIETAL DIFFERENCES IN RACEME SIZE in BRASSICA JUNCEA.

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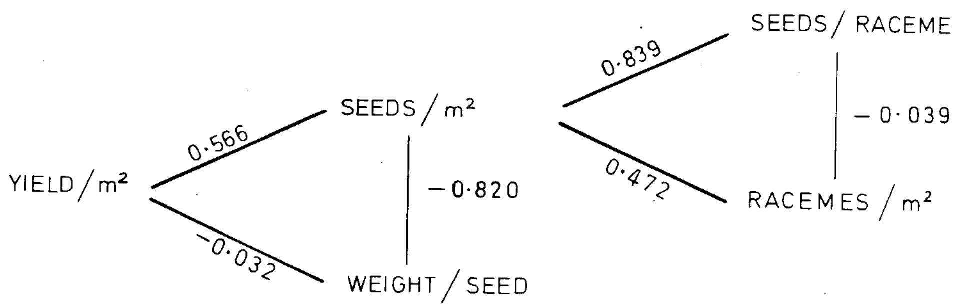
A. The factor that has been most closely associated with increased grain yield during the last thirty years of a brown mustard breeding programme has been the progressive enlargement of the racemes. Although there has been an increase in the number of seeds/pod, raceme enlargement has been mainly due to an increase in the number of pods/raceme. One effect of this trend has been to shift pods up the plant to more acropetal positions, where they develop in higher light intensities. Another related effect has been a gradual increase in harvest index.

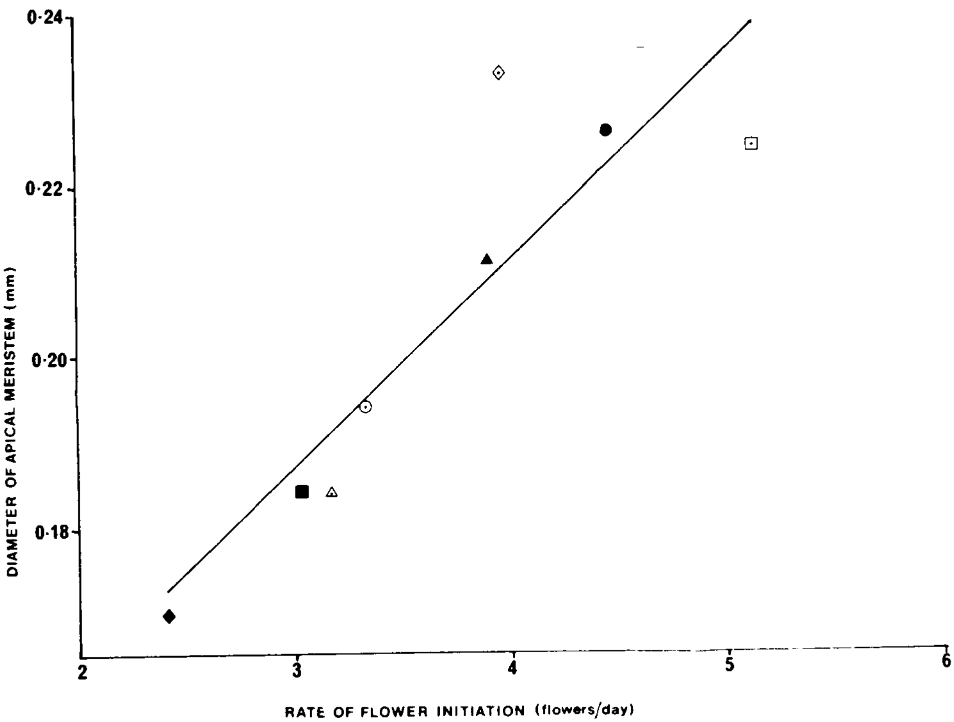
Figure A shows simple correlation coefficients between yield/m^2 and its components in an experiment with diverse genotypes in 1973.



B. Experiments conducted over the past ten years have investigated the factors determining raceme size in this crop. It has been found that varieties with larger apical meristems can initiate flower primordia at a faster rate than varieties with smaller meristems. This might indicate the existence of spatial constraints on the initiation of new primordia at the apex.

Figure B shows the relationship between the diameter of the terminal raceme and the rate of flower initiation in eight diverse genotypes in a 1978 experiment. ◇, J/868; ◆, J/869; ○, J/801; ●, J/803; □, J/870; ■, J/805; △, cv.Trowse; ▲, cv.Newton.

$Y = 0.116 + 0.0238\, X$; $r = 0.89$; S.E. = 0.0116.



C. The faster rates of flower initiation lead in turn to faster rates of flower opening and of pod setting.

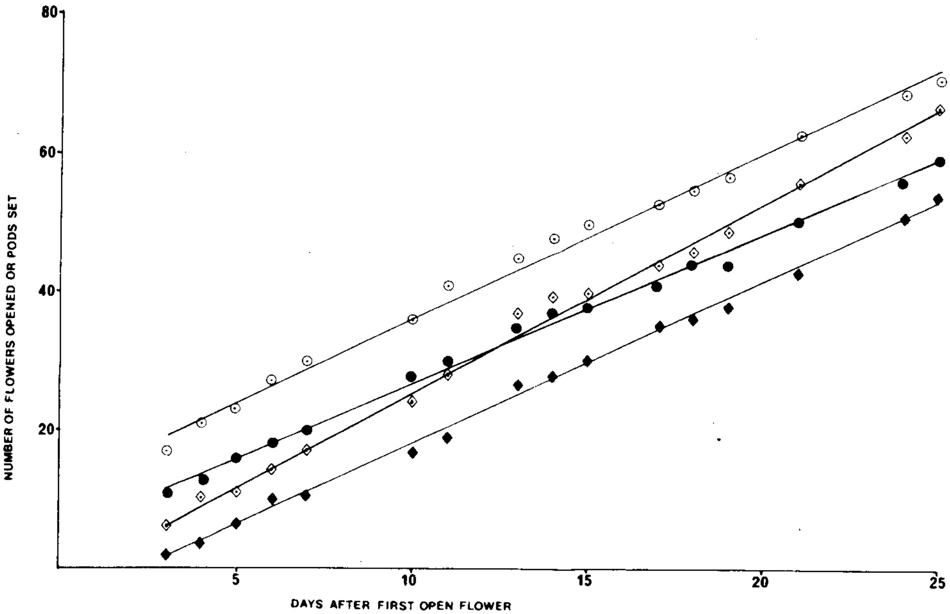
Figure C shows the numbers of flowers and pods set by terminal racemes in two varieties during the flowering period in 1981. The variety with the faster rate of pod setting opened a larger initial cluster of flowers than the slower variety. The number of open flowers in a cluster at this stage is probably a useful indicator of the subsequent rate of pod setting. Note that in both varieties, pod setting is a faster process than flower opening, so that the size of the open flower cluster decreases throughout the flowering period.

cv. Newton: ○, open flowers; $Y = 12.21 + 2.41X$; $r = 0.99$; S.E. = 1.419

◇, pods; $Y = -1.81 + 2.74X$; $r = 0.99$; S.E. = 1.388

cv. Trowse: ●, open flowers; $Y = 5.51 + 2.13X$; $r = 0.99$; S.E. = 1.068

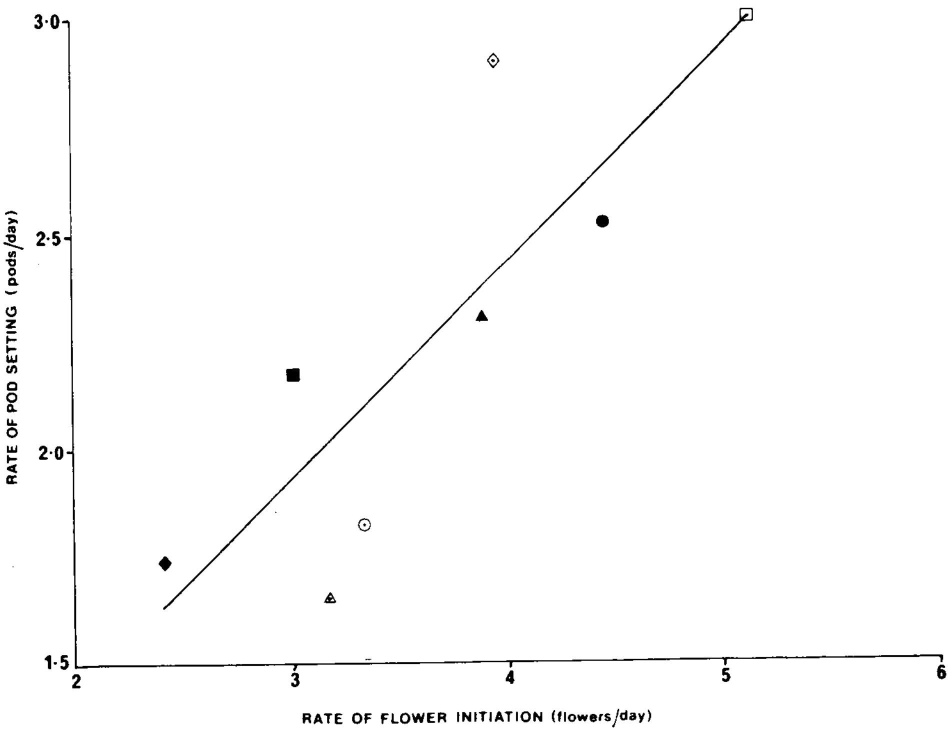
◆, pods; $Y = -5.02 + 2.32X$; $r = 0.99$; S.E. = 0.948



D. Figure D of the relationship between the rate of flower initiation and the subsequent rate of pod setting on terminal racemes in 1978 shows that varieties with faster rates of flower initiation also set their pods faster.

◇, J/868; ◆, J/869; ○, J/801; ●, J/803; □, J/870; ■, J/805; △, cv.Trowse; ▲, cv. Newton.

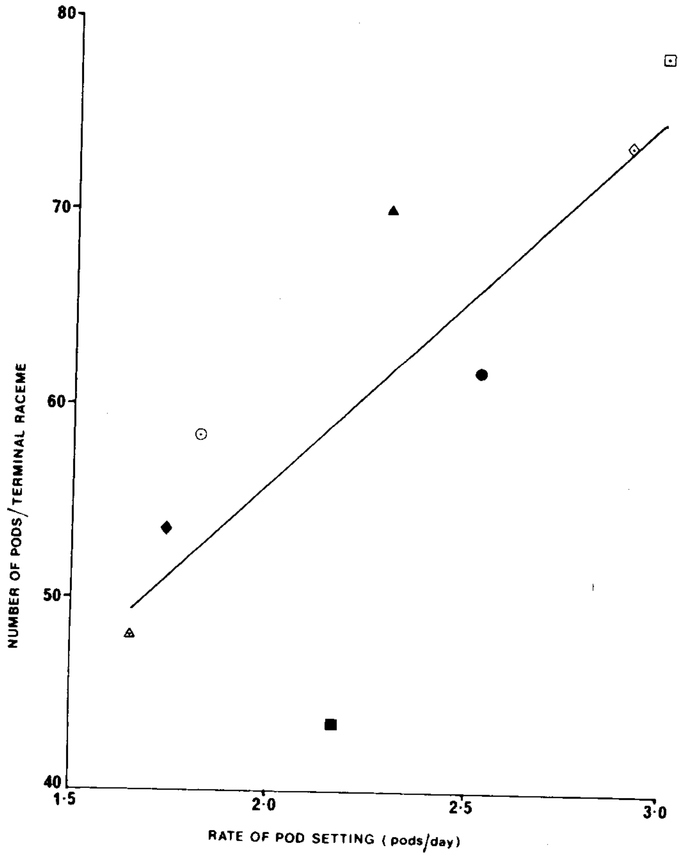
$Y = 0.416 + 0.503X$; $r = 0.84$; S.E. = 0.301



E. There were small differences between the varieties in their duration of fertile pod setting, but Figure E shows that the rate of pod setting was the major determinant of pod numbers/raceme. Presumably the faster varieties were able to set a greater number of pods/raceme during the limited period available during flowering before pod setting was switched off by phytohormonal and/or nutritive changes within the plant. One such change that has been identified is the onset of oil accumulation in seeds developing within the oldest pods on the plant, an event which normally occurs a few days before the last fertile pods are set.

◇, J/868; ◆, J/869; ○, J/801; ●, J803; □, J/870; ■, J/805; △, cv.Trowse ; ▲, cv. Newton.

Y = 17.87 + 19.00X; r = 0.80; S.E. = 8.040



F. In most varieties, raceme enlargement has resulted in a similar relative increase in the number of pods/raceme on all classes of branch from terminals to tertiaries. The absolute difference between varieties is greater on larger plants and on higher order racemes. For this reason, the terminal raceme is the best indicator for raceme size and it has been used as the basis of a very successful selection system for identifying high yielding lines in breeding programmes.

Figure F shows a comparison of the curves fitted to pods/raceme for variety G (cv. Stoke) with those of variety B (cv. Trowse) over a range of plant size in 1971. 93 data points/curve.