ELEVATED ACTIVITIES OF PHOSPHOENOLPYRUVATE CARBOXYLASE (PEPc) IN DEVELOPING WRINKLED (r/r) COMPARED WITH ROUND (R/R) PEA COTYLEDONS

Price, D. N. and J. B. Taffs Plymouth Polytechnic, Devon, U.K.

PEPc is thought to play an important role in the carbon economy of developing pea fruits. As part of a wider survey, the activity of this enzyme was compared in the developing seeds of round (R/R) and wrinkled (r/r) near-isogenic lines (kindly supplied by Dr. C. L. Ledley, JI Institute, U.K.). Plants were kept in a controlled environment (16h day, 17 C) and the extractable PEPc activity of the cotyledons measured by a coupled NADH oxidation spectrophotometric method (1). These activities, together with fresh and dry weight data, are presented in Pig. I).

Until 28 days after anthesis cotyledonary growth was similar in the two lines but from day 20-40 there was a greater fresh weight increase in the r/r line (Fig. la). Reference to dry weights shows this to be due to the increased water uptake associated with the wrinkled-seeded phenotype. The PEPc activity of the cotyledons of both lines increased dramatically with development, generally running ahead of overall weight increase (Fig. lb). Levels declined between day 30 and 35, but increased again by day 40. This pattern was confirmed with several repeats. From day 20 onwards PEPc activities were consistently higher in r/r than R/R cotyledons and this difference was maintained irrespective of the basis chosen for enzyme expression. From appropriate ancillary studies, we are sure that this discrepancy is not due to differences in the intrinsic kinetic properties of the enzymes in the two lines nor to differential effects of any interfering enzymes. Relative differences were not dependent on assay conditions and no evidence of higher levels of enzyme inhibitors in R/R cotyledons could be found. We therefore conclude that the difference in extractable PEPc activities is a real expression of the round vs. wrinkled phenotypes.

The relationship between these elevated PEPc activities and oilier expressions of the r gene is not clear, but could be related to the reported disturbances in carbohydrate metabolism (2). Because r/r cotyledons utilize less sugar for starch synthesis, they accumulate more and it is this sugar accumulation which is thought to be responsible for their greater water uptake during development. These higher sugar levels are also likely to support increased respiratory activity. Higher respiratory rates in developing plant tissues are often associated with elevated PEPc activity and this could provide the explanation for the increased activity observed in these r/r cotyledons.

1. Price, D. N. and C. L. Hedley. 1980. Ann. Bot. 45:283-294.
2. Kooistra, E. 1962. Euphytica 11:357-373.

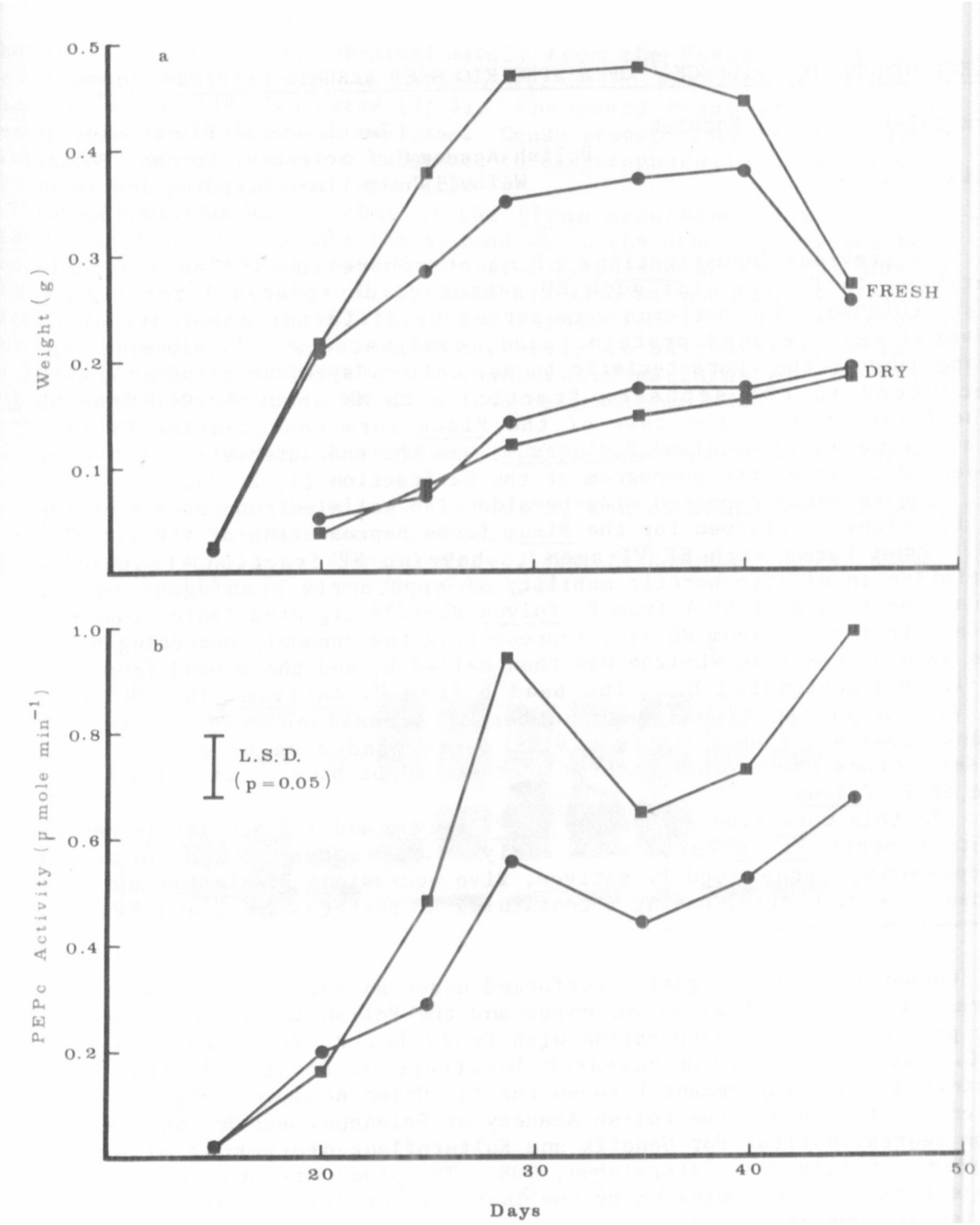

Fig. 1. Changes in (a) the fresh and dry weights and (b) the extractable PEPc activities (mk moles NADH oxidized min^{-1}) of developing R/R (•) and r/r (•) cotyledons.