

## NEWS

### THE GROWTH OF THE POTATO; TENTH EASTER SCHOOL IN AGRICULTURAL SCIENCE, UNIVERSITY OF NOTTINGHAM

The Tenth Easter School was held at the University of Nottingham School of Agriculture on 8–11 April 1963, it being a symposium on the above topic. An attempt was made to summarize our present understanding of the physiology of the plant and to relate this to agronomic management, seeking explanations for current practices and suggesting possible modifications to meet new requirements and to improve yield and quality. Twenty-three papers were read by invited contributors and stimulating active discussion among the 170 members of the School, who came from 9 countries and represented interests ranging from biochemistry to production and processing.

In the first session under the chairmanship of Mrs. N. McDERMOTT, F. L. MILTHORPE (Nottingham) outlined the general growth pattern of the potato and its relationship to the growing season, pointing out that analysis in terms of net assimilation rate and leaf area was inadequate and that more detailed consideration of growth interrelationships was necessary. A brief description of tuber and bud development was given. W. G. BURTON (Ditton Laboratory) then took up the story of dormancy describing its general features and the influences arising from variety, season, cultivation practices, infection, and storage conditions. Little was known of the biochemical and physiological mechanisms of dormancy.

In the session on sprout growth, with Dr. A. R. WILSON as chairman, B. EMILSSON and H. LINDBLOM (Nynäshamn) provided a comprehensive review of our knowledge of the changes in carbohydrate metabolism, respiration, ascorbic acid metabolism, nitrogen metabolism, growth regulators, and gas exchange during sprouting. They concluded that possibly growth inhibitors, interacting with gibberellins, provide the central control; during the period in which inhibitors dominate, phosphorylation is uncoupled from electron-transfer systems and the amylases rendered inactive. Growth inhibitors were also invoked by P. GOODWIN (Nottingham) to explain apical dominance; the inhibitor was possibly produced from auxin (arising from the stem tip) and a precursor (produced in leaves) and was continually destroyed. The influence of apical dominance in determining the pattern of sprout growth was discussed. O. FISCHNICH and H. KRUG (Braunschweig-Völkenrode) described

the different growth patterns of plants grown under constant conditions and in the field from sprouts of varying length at planting. R. D. TOOSEY (Seale-Hayne) developed the same theme in a comprehensive review; generally, it was agreed that larger sprouts at planting led to earlier development, tuber initiation and maturity but yields at maturity were lower than from unsprouted seed – if there was unlimited season for growth.

Stolon growth and tuber initiation were discussed by A. BOOTH (Sheffield), J. W. SLATER (Nottingham) and P. MADEC (Landerneau) with Prof. O. V. S. HEATH as chairman. BOOTH described the diageotropic growth of stolons and the role of growth substances therein, and suggested that tuber initiation, the first evidence of which was an increase in the radial dimensions of stolon cells, arises from the assimilation of an inhibitor of cell elongation. SLATER reviewed the evidence relating to the stimuli influencing tuber initiation and pointed out that both substrates and growth substances are likely to be involved, although the nature of the changes remained unknown. MADEC presented evidence showing that sap from induced plants but not non-induced plants caused cuttings to form tubers; he favoured growth substances as “initiators” of tubers and substrates as being required for *subsequent* growth.

With Professor E. G. HALLSWORTH in the Chair, J. EDELMAN (London) showed that the translocated sucrose was converted to starch via uridine diphosphate glucose, being deposited around the vascular ring, with little movement to the interior. The formation of amylose, amylopectin and starch grains were discussed. Starch

breakdown probably resulted from the activity of phosphorylase and the debranching R-enzyme. G. NORTON (Nottingham) showed that the Embden-Meyerhof pathway and tricarboxylic acid cycle and possibly the pentose phosphate pathway operated in potato tubers. T. SWAIN and colleagues (Cambridge) discussed the biochemical aspects of quality, particularly after-cooking blackening, enzymic browning, flavour and the role of low boiling volatiles therein, and texture.

Professor A. H. BUNTING guided the discussion on environmental aspects of growth. I. F. LONG and H. L. PENMAN (Rothamsted) described the detailed structure of the environment of a potato crop analysing the temperature, humidity and wind profiles and the energy balance and "stomatal conductivity". H. L. PENMAN (Rothamsted) showed that the yield of potatoes was very closely related to the accumulated potential transpiration throughout the growing season during all times when the soil-water deficit was less than 1 inch (With greater deficits it was assumed that transpiration and growth ceased). The accumulated potential transpiration so adjusted appeared to a most promising climatic index. K. B. A. BODLAENDER (Wageningen) pointed out that high temperatures were favourable for stem growth but unfavourable for leaf expansion and tuber production; high radiation had opposite effects. Varietal differences were also considered and responses to photoperiod discussed; generally, late varieties have a longer critical daylength than early varieties. R. W. RADLEY (Nottingham) described changes in growth of four varieties as influenced by planting date and by early frosts; the size of the plant at tuber initiation generally determines later performance. H. KRUG (Braunschweig-Völkenrode) described how applications of (2-chloroethyl)-trimethylammonium chloride and gibberellic acid allowed "normal" plants to be grown in glasshouses during the winter.

With Dr. J. C. HOLMES in the chair, D. J. WATSON (Rothamsted) outlined the general features of crop nutrition, showing that nitrogen, phosphorus and potassium had little effect on the net assimilation rate but increased leaf production. The general changes with growth and influences

arising from internal distribution, the concept of "internal starvation" and the influence of competition were discussed. R. HOLLIDAY (Leeds) discussed the influence of fertilizers on yield and quality of potatoes, the economic rates of application, and the value of farmyard manure.

In the concluding session, Mr. H. JACKSON guided the discussion to relevant aspects of agronomy. P. BREMNER (Nottingham) reviewed the influence of seed size and spacing showing the remarkable stability of this crop in relation to density; detailed analysis suggested that light was relatively unimportant and nutrients a significant factor in competition. P. T. G. TWISS (Ditton) surveyed the problem of quality in relation to time and method of haulm distribution, method of harvesting, the "curing" and holding periods of storage, and subsequent unloading. He quoted data showing the alarming proportion of mechanical damage experienced during harvesting, grading and loading into store. H. W. HOWARD discussed the significance of breeding in improving quality and yield. During the last 30 years in England and Wales the average yield had increased by only 22% compared with 34% in wheat; 64% of the acreage in the U.K. was of varieties evolved more than 50 years ago. Very little basic material was available for breeding for yield but *Solanum andigena* offered some hope. Improved quality and characters for different needs would be the main aims of future breeding. J. D. IVINS (Nottingham) reviewed the agronomic treatments which had little influence on yield (e.g. cultivation) and those promoting yield, especially late application of nitrogen and irrigation. He suggested in future that after deep ploughing in autumn and 1-2 cultivations in spring, tubers would be planted on the "flat" with moderate N, P and K. Weed control would be by spraying, further nitrogen applied during "bulking", crops earthed-up to prevent greening and attention given to irrigation and to blight control.

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