Table 3. EXPERIMENT 2. TOTAL PHOSPHATE CONTENT OF BARLEY ROOTS AND TOPS AT VARYING LEVELS OF PHOSPHORUS-32

P^{32} μC./pot	500	25	4	0·5	0	L.S.D.
Total P (mgm.) roots (mean of 8 plots)	* 2·165	2·118	1·795	1·896	1·844	0·01 = 0·310
Total P (mgm.) tops (mean of 8 plots)	4·923	4·643	* 4·065	4·884	5·266	0·01 = 0·778

The interaction between phosphorus-31 and -32 was not significant

for dry weights, total phosphate, fertilizer phosphate uptake, and fertilizer phosphate uptake/soil phosphate uptake ratio. Moreover, at the second sampling there were no significant effects in any of these functions.

These experiments show that radiation effects on the growth and physiology of barley and tomato do occur at low radioactive dosages, lower than those accepted as 'safe' by some investigators. Thus for certain experiments this must be taken into account by adopting a statistical lay-out with two or three levels of phosphorus-32 and -31. The most striking feature of the experiments as a whole, however, is the smallness of the radiation effects, despite the fact that we have worked at concentrations of phosphorus-32 far greater than would normally be used in 'tracer' work, and at much higher specific activities (μC. phosphorus-32 per gm. phosphorus-31) than those adopted by other workers (see Table 4).

We have not made a detailed examination of the morphological and cytological changes which may well have occurred in the root tissues. We have considered only the criteria that would be used in plant nutrition studies in soil with phosphorus-32.

It would thus appear from our investigations that the overall effects of radiation are slight, and are in no way sufficient to preclude the use of phosphorus-32 in plant nutrition experiments in soil. [Sept. 27.

Note added in proof. In a further pot experiment with barley, completed after this article was submitted, no significant effects were observed in any of the functions discussed previously. The soil used was a sandy loam high in organic matter (*p*H 5·0), supplied with one level of sodium orthophosphate equivalent to 500 lb. of superphosphate per acre and with phosphorus-32 at the following rates: 0, 1, 5, 25, 125 and 400 μC. per pot.

Table 4. PHOSPHORUS-32 LEVELS USED IN FERTILIZER EXPERIMENTS

Workers	References	Microcuries P^{32} per gm. P^{31}	lb. phosphorus-31 per acre
Hendricks and Dean	*Proc. Soil Sci. Soc. Amer.*, **12**, 98 (1947)	980	—
Dean *et al.*	*Proc. Soil. Sci. Soc. Amer.*, **12**, 107 (1947)	230–1,150	100
Spinks and Barber	*Sci. Agric.*, **27**, 145 (1947)	150–1,000	6·7
Spinks and Barber	*Sci. Agric.*, **28**, 79 (1948)	54	6·7
Dion *et al.*	*Sci. Agric.*, **28**, 309 (1948)	33–1,600	6·7, 20·1 and 60
Dion *et al.*	*Nature*, **163**, 906 (1949)	26–260	5, 10 and 21
Hendricks and Dean	*Trans. Fourth Intern. Cong. Soil Sci.*, **1**, 221 (1950)	229	15
Russell, Martin and Adams	*Trans. Fourth Intern. Cong. Soil Sci.*, **2**, 138 (1950)	12–1,200	9 and 49
Long Ashton	1950	12–29,760	15 and 37

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EAST MALLING RESEARCH STATION

ANNUAL REPORTS FOR 1948 and 1949

THE thirty-sixth annual report, for 1948, of the East Malling Research Station of the Kent Incorporated Society for Promoting Experiments in Horticulture* includes an appreciation by T. N. Hoblyn of the retiring director, Sir Ronald Hatton. Sir Ronald made a fundamental contribution to the science of fruit-growing by classifying the wilder stocks upon which the gentler scions of commercial fruit varieties are grafted. This, more than any other single investigation, has made possible the development of modern standardized commercial fruit-growing. Sir Ronald was not the Station's first director, but was responsible for its period of most active development. He has been succeeded by Dr. F. R. Tubbs.

The report includes the usual sections describing the experimental farm, reviewing the research work, and a new section of bulletins for fruit-growers. Fifteen research papers form the main part. H. M. Tydeman describes two new varieties. Tydeman's Late Orange is an apple somewhat more vigorous and later than Cox's Orange Pippin, which is one of its parents. To judge by the coloured frontispiece, the variety is indeed attractive. Amos Black is a promising variety of blackcurrant, heavy yielding, late in flowering to escape spring frosts, and firm in the skin to travel without damage. Mr. Tydeman also reports on fifteen quince stocks for pears. They are all, in general, less vigorous than Malling *A*, *B* and *C*, and, though trees from the more dwarfing stocks were more productive for their size, the total yield of fruit was less than when the more vigorous *A*, *B* and *C* stocks were used. A. P. Preston shows that bees often have difficulty in reaching the nectary of Bramley's Seedling apple flowers because of the close bunch of stamens. This is a character which might be avoided when breeding new varieties of apple. The same author also describes the production of a primary branch framework on apple trees. Notching above a bud to ensure its development into a branch leader is a successful practice to this end.

R. J. Garner and E. S. J. Hatcher describe a large-scale experiment on the relation between water-table and vegetative propagation. An interesting incidental result is the discovery of fructifications of the fungus *Stereum purpureum* on cuttings of marianna plum

* East Malling Research Station. Annual Report, 1948. Pp. 162+20 plates. 10*s*. Supplementary Annual Report, General Develpment. and Activities, 1948. Pp. 30. (East Malling: East Malling Research Station, 1949.)

one year after planting. Circumstantial evidence strongly suggests that the cuttings were invaded by the fungus while still alive. M. C. Vyvyan, C. West and H. W. B. Barlow found that a fortnight's delay in picking greatly improved the quality of Cox's Orange Pippin apples after three months in store. The delay, however, resulted in a heavy drop of fruit which could, nevertheless, be controlled by spraying with alpha-naphthalene-acetic acid (10 p.p.m.) about a month before picking. This had no effect upon the quality of the fruits. Hardwood cuttings of the plum rootstock Myrobalan *B* were found by E. S. J. Hatcher and R. J. Garner to root best when taken between mid-October and early February. The earlier planting, however, had more vigour of growth.

The grey mould fungus *Botrytis cinerea* probably causes more widespread parasitism than is generally realized. It is now noted by M. H. Moore as the probable cause of cankers and rotting in apple and other hosts. A. M. Massee notes some rather unusual cases of damage by insects; they include *Apion* spp. feeding on apple foliage, cockchafer larvæ on the roots of hops, weevils attacking strawberry roots and earwigs feeding upon fruits of peach. Predators of the fruit tree red spider mite have been studied by Elsie Collyer. One of them, the black-kneed capsid, *Blepharidopterus angulatus*, was of practical importance in Essex. Some workers have found that nitrophenol emulsions are less toxic to insect eggs when alkaline than when acid. R. G. Davies and J. K. Eaton found this to be so, but with 2 : 4-dinitro-6-methylphenol (DNC) and related substances the effect would not be significant in practice between *p*H 4 and 8; it was only seen at *p*H 10.

The thirty-seventh annual report of the Station, for 1949, covers only the first nine months of the year, but is larger than usual*. The research section of the report contains twenty-four papers, including the text of the second Amos Memorial Lecture, "The Soil and the Fruit Tree", by B. S. Furneaux. Preliminary laboratory and field experiments by W. S. Rogers and Irena Modlibowska have shown that continuous sprinkling of fruit tree blossoms with water during spring frosts can protect them from frost damage at air temperatures round about −2·2° C. (28° F.). Sprinkling also cooled the soil by 1–2° C. at 4 in. depth without harmful effect. R. J. Garner condenses, in a short paper, the results of fifteen years of work on framework-grafted Laxton's Superb on thirteen-year-old trees of Newton Wonder. This method of renovating trees gave thicker trunks, more spreading branches and heavier crops than did top grafting. N. H. Grubb describes two new raspberry varieties, Malling Jewel and Malling Exploit. The latter is stated to have superior dessert quality to the other Malling varieties. Hop stems layered prior to propagation by cuttings are shown by Dorothy J. Wilson to develop a large amount of phloem and a store of starch; buds begin to develop when light is excluded.

In the section on statistics, S. C. Pearce and J. Taylor recommend that experimental trees should be 'calibrated' by growth before an experiment is performed with them. 'Strip' and 'tile' lay-outs for this method of assessing individual potentialities are described. Studies of the organic constituents of fruit plants revealed the presence of phloridzin, glyoxal and sorbital in a methyl alcohol extract of apple shoots (J. K. Eaton). Chromatographic examination confirmed the presence of sorbitol and phloridzin, with numerous fractions of carbohydrates, acids and other substances (A. E. Bradfield and A. E. Flood). Methods of analysis provide important contributions to research equipment; F. H. Vanstone and H. J. Philcox describe a method of building materials into a 'Cellophane' tube for flame spectrographic analysis, and A. C. Mason gives full methods for tissue analyses of small samples for seven elements; Anne V. Delap has a new interveinal injection needle.

P. C. R. Webb, studying the canker-producing bacteria, *Pseudomonas mors-prunorum* and *Ps. prunicola*, finds that bud infection of the fruiting spurs of sweet cherry is common, and frequently gives rise to cankers. Viable bacteria were isolated from surfaces which had received 6–9–100 Bordeaux spray three weeks previously. I. W. Prentice reports successful graft transmission of the disease known as rubbery wood of the apple variety Lord Lambourne. He interprets the results as supporting the view that rubbery wood is caused by a virus. A review of insect pests during the year by A. M. Massee includes special reference to the pear sawfly, a new pest of cultivated pears in Great Britain. Full details of the life-history of the strawberry aphis, *Pentatrichopus fragæfolii*, are given by G. H. L. Dicker, with the results of experiments on its control with, *inter alia*, 'Parathion' and *bis* (*bis*-dimethylamino)-phosphonous anhydride. The same author also describes the shallot aphid, *Myzus ascalonicus*, which has caused damage on strawberry, and the control of the apple capsid by spraying early in March with DDT dissolved in tar oil. Catherine A. Blair has investigated the life-history of the fruit tree red spider mite. Control of apple sawfly can be achieved, according to R. G. Davies and J. K. Eaton, by sprays of gamma-benzene hexachloride, 'Parathion', and the chlorinated hydrocarbon, 'Chlordane'. These substances give a superior control to that of a petal-fall spray of nicotine.

A useful series of bulletins for fruit-growers is included in the report. These deal with results which are now incorporated into modern practice, or incipiently so; it is in no invidious sense that they are not reviewed here.

* East Malling Research Station. Annual Report, 1st January 1949 to 30th September 1949. Pp. 187+21 plates. (East Malling: East Malling Research Station, 1950.)

SCIENCE MASTERS' ASSOCIATION

JUBILEE MEETING

NEARLY a thousand members of the Science Masters' Association, which comprises the bulk of the teachers of science in the public and grammar schools of Great Britain, together with many from the universities, the modern secondary schools and from schools overseas, met in London during the first week of January for the jubilee meeting of the Association.

Morning lectures were given in the Royal College of Science, and the evening lectures in the Huxley Buildings of the Imperial College of Science and Technology, while the afternoons were devoted to visits to research laboratories, Ministry of Supply institutions and commercial works, or alternatively members had the opportunity of seeing some of the latest teaching films in science. Publishers and manufacturers showed books and apparatus useful in the laboratory, while most valuable of all was the