molybdenum deficiency[4] were clearly recognizable *only* in the nitrate and ammonium nitrate treatments. They were similar in both except for a somewhat darker colour of the green areas in the latter treatment. In the other treatments plants were practically symptomless and normal in appearance though smaller, except for occasional sporadic incidence of either dark brown marginal areas in old leaves (mainly with glutamic acid), or sudden wilting and withering without loss of chlorophyll in apical leaflets of mid-stem leaves (mainly with urea or nitrite). These symptoms were relatively slight in extent and were confined to plants given non-nitrate sources of nitrogen and no extra molybdenum.

The evidence presented here supports the conclusion that molybdenum is essential for tomato, irrespective of whether nitrogen is given as nitrate or in a number of other forms at different stages of reduction, but that relative requirements depend on the nitrogen source. Full details and results of work now in progress will be reported elsewhere.

E. J. Hewitt
C. C. McCready
Agricultural Research Council Unit of
Plant Nutrition (Micronutrients),
Long Ashton Research Station,
University of Bristol.
April 8.

[1] Agarwala, S. C., *Nature*, **169**, 1099 (1952).
[2] Hewitt, E. J., and Bolle-Jones, E. W., *J. Hort. Sci.*, **27**, 245 (1952).
[3] Agarwala, S. C., and Hewitt, E. J., Long Ashton Research Sta. Ann. Rep., 1952, 195 (1953).
[4] Hewitt, E. J., and Bolle-Jones, E. W., *J. Hort. Sci.*, **27**, 257 (1952).
[5] Hewitt, E. J., Agarwala, S. C., and Jones, E. W., *Nature*, **166**, 1119 (1950).

Copper Sulphate as an Aquatic Herbicide

During the course of an experiment in the use of copper sulphate against bilharzia snail hosts in the season 1951–52, it was noted that the water-weed vegetation appeared to be affected by the treatment.

Two canals, branching off the general Gezira irrigation system at the same point, were hand-weeded in July 1951 and treated with 30 parts per million of crystalline commercial copper sulphate for snail control. Three canvas bags containing copper sulphate crystals were then hung in the flowing water just below the head regulator of the first canal, and refilled as required. The second canal received no further treatment. It is estimated that throughout the watering season, all water entering the first canal was treated at an average rate of 1 part per million with copper sulphate. By March 1952, towards the end of the watering season, it was apparent that there were large differences in both weed and snail populations in the two canals under experiment, and a survey carried out at that time showed that though the second canal had a heavy population of both snails and pondweed species, neither weeds nor snails were to be found in the first, throughout the whole $9\frac{1}{2}$ km. of its length.

During the period April–July 1952 a certain regrowth of weed occurred, no doubt owing to the interrupted flow of water (for domestic purposes only) during this 'closed' period. In July 1952, with the resumption of watering for the new crop, the application point of the copper sulphate was removed 5 km. upstream so as to command a small branched system including the two canals of the previous year's experiment. This was all, except the 'second' canal referred to, treated again with 30 p.p.m. of copper sulphate, and then continuously with an amount afterwards estimated at 2 p.p.m. No weeding was carried out until March 1953, when an examination revealed that (1) no weeds grew nearer than 3 km. downstream of the point of application; (2) only patches of *Potamogeton nodosus* appeared able to grow within 10 km. of the point of application, though (3) at points below this some *Najas pectinata* and a little *Chara globularis* were found; (4) no bilharzia snails were found; (5) at no time were watering difficulties encountered on account of weed growth.

Further experiments are being carried out by the Sudan Ministry of Irrigation in order to ascertain if modifications of this method are practicable as a weed control treatment.

Hamid Sharif El Din
(Public Health Officer)
Ministry of Health, Sudan.
K. Wilson Jones
(Senior Economic Botanist)
Research Division,
Ministry of Agriculture,
Wad Medani, Sudan. April 3.

Culture of Insect Tissues

Goodchild[1] has recently described attempts to culture *in vitro* the tissues of *Rhodnius prolixus*, and suggested two possibilities that might enable the successful establishment of cultures. The two suggestions are (1) to replace glass surfaces by mica, or cover them with a film of wax, and (2) to enrich the culture medium with an extract of *R. prolixus* embryos. Similar suggestions were included in a series of experiments that I have recently performed. Cultures capable of growth and of yielding sub-cultures have not so far been established, and it appears that the problems of insect tissue culture are more complex than has hitherto been appreciated.

Attempts have been made to culture the following tissues: hæmocytes (from cetoniid larvæ), *Bombyx mori* L. pupæ, and from *Periplaneta americana* L. nymphs and adults; gonads from *B. mori* pupæ; embryonic cells from eggs of *Drosophila melanogaster* Meig. two hours old; imaginal disks (eye, leg, wing, antenna) of *D. melanogaster*; epidermal cells of cetoniid larvæ; fore and midgut of *P. americana*.

The following media were used: (1) *B. mori* pupal blood, (2) aqueous extracts of *Drosophila* pupal and adult tissues, (3) Trager's[2] medium, (4) adult and embryonic insect tissue extracts in various combinations with vitamins, glutathione, cystine, cholesterol, concentrations of free amino-acids approaching those of insect blood[3], fowl plasma and chick embryo extract, (5) fowl plasma and chick embryo extract.

The following techniques were used: hanging drops of fluid; hanging drops with solid clots of fowl plasma and other ingredients; perforated 'Cellophane' sheets covered by liquid medium on cover slips; cover slips containing a drop of agar on which were placed drops of liquid medium. All the cultures were incubated at 25° C.

The antibiotics chloromycetin and sodium sulphadiazine were used in some media. They did not appear to have any effect on the tissues.

Survival of various tissues up to a week was observed, but continued growth was not obtained. In certain tissues, notably *Bombyx* hæmocytes, a