

its preparation. In return, the user reports research findings to TVA on a proprietary basis. TVA is a major fertilizer producer and conducts extensive research into fertilizer uses and effects.

Roots of plants were once considered the sole organ for uptake of nutrients and water. Experiments using radioactive isotopes proved the aboveground plant parts, such as flowers, fruit, foliage, and stems, could absorb and use nutrients from sprays. Now spray applications are widely used where root adsorption of fertilizer is limited or where precise control of nutrition is required. Tracer tests show they are often more effective than root applications. Bean and tomato plants are good examples.

Radioisotope techniques are providing a research tool in animal physiology previously unavailable for the study of nutrition and metabolism of trace minerals. This work has established that more effective—and less expensive—food supplies for farm animals, such as previously discarded high-cellulose materials, are now possible. Such discoveries are possible because scientists can measure extremely minute levels of radioactive isotopes.

Isotopes are also used to measure the moisture content of the soil, information important to determine irrigation needs and also to find out how heavy a crop a certain piece of land will support. A portable neutron soil moisture meter has been developed which can give virtually instantaneous readings. A pipe is driven five feet or more into the ground, and a radioactive neutron source and a detector are lowered into the pipe to the desired depth. The neutrons pass through the pipe into the soil. Only hydrogen atoms will markedly slow up this neutron movement. The slower the flow, the higher the water content of the soil because practically all hydrogen in the soil is contained in water in the soil. The neutron soil moisture meter is probably the most widely used nuclear energy device in water studies in agriculture.

Pest control

With the current concern with environmental problems, it is significant to note that nuclear techniques have been in use for some time to help counter pollution problems in agricultural areas. The pesticides farmers use to control diseases and insect pests are a boon to the production of food, fiber, and forage, but some pesticides are toxic and leave a long-lived residue.