Spectrum

Growing celery with the help of the sludge.

Cadmium in sewerage sludge

The Bolivar sewerage plant is one of four serving Adelaide. In the final stage of treatment, the plant produces a sludge that is left to dry out in lagoons.

This sludge, rich in organic matter, is sold to a fertilizer company that sterilizes it with heat before incorporating it into several of the firm's organic fertilizers.

In this way, the sludge finds its way into the market gardens surrounding Adelaide, principally the areas near Two Wells and Virginia to the north.

Unfortunately, the Bolivar works serves mainly industrial suburbs, and so amounts of heavy metals inevitably end up in the sewage.

One of the concerns of Mr Paul de Vries of the CSIRO Division of Soils has been to check that the concentration of toxic heavy metals in vegetables fertilized with the sludge doesn't pose a risk to human health. Various workers overseas have warned of this possible danger, but the only way to ascertain the risk in any situation is to grow plants and analyse their heavy metal content.

Harvesting sewerage sludge from the drying lagoons at Bolivar, S.A.

The most dangerous element is cadmium, because plants can absorb it in high concentrations without showing any sign of toxicity. Zinc, nickel, and copper become toxic to plants long before they reach a level hazardous to humans.

Cadmium certainly showed up in Mr de Vries' samples of Bolivar sludge (at 32 p.p.m.), but to see whether the metal migrated into plants, he grew experimental batches of a number of vegetables, both in open fields and in greenhouses. Plants were fertilized with various amounts of sludge, and harvested specimens were analysed by atomic absorption spectroscopy.

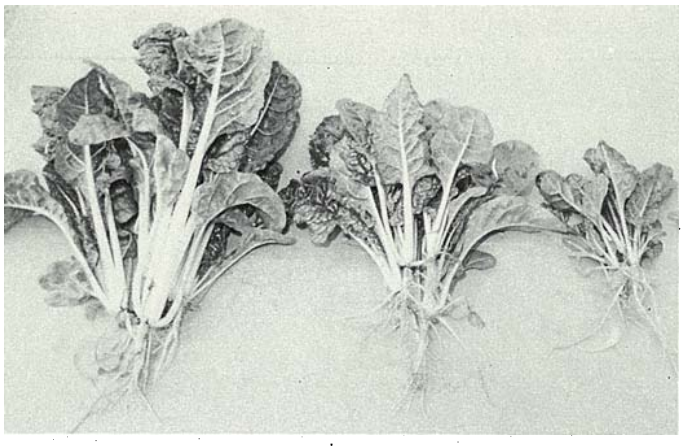
One of the most surprising findings was that plants grown in a glasshouse show a greatly exaggerated uptake of cadmium compared with those grown outdoors. Mr de Vries speculates about the possible cause — differences in temperatures, humidity, light, and so on — but the explanation remains obscure. Nevertheless, the effect is so pronounced that he wonders whether the dire warnings levelled against using sewerage sludge for growing crops are based on misleading pot experiments.

Be that as it may, the field results still give cause for caution in the use of sewerage sludge. Mr de Vries would discourage anybody from fertilizing with sludge those vegetables known to accumulate cadmium — in general, leafy vegetables. Silver-beet grown with a heavy application of sludge (7·2 kg per sq metre) showed a cadmium concentration near 0·2 p.p.m. That is equivalent to the highest reading found in a survey of Adelaide's vegetables in 1976.

The World Health Organization has provisionally recommended that the cadmium intake of humans should be limited to 400–500 μg per week. Two kilograms of silver-beet would provide that amount.

Carrots treated with a lower application of sludge (2·4 kg per sq m) were found to have 0·1 p.p.m. of cadmium. Could anybody eat 4 kg of carrots a week?

Certainly many vegetables respond well to application of sludge. Yields increased as more was applied, even though additional elements are needed to give a



Sludge considerably improved the growth of silver-beet. The largest plant, grown with 7 kg of sludge per sq. metre, also contained a significant amount of cadmium (0·2 p.p.m.).

complete fertilizer. The danger is that, with repeated applications, the metal compounds in the sludge may build up, or change into forms more readily taken up by plants. Mr de Vries therefore advocates the regular monitoring of the cadmium content of vegetables grown using sewerage sludge.

Investigations on the use of sludge as a fertilizer in a market garden area north of Adelaide, South Australia. M. P. C. de Vries. *International Conference on Developments in Land Methods of Wastewater Treatment and Utilisation, Melbourne, October 1978,* 1978.