ROBERT RODALE

Exciting New Ideas from the Sea

RAIN WATER CONTAINS practically no minerals. For millions of years rain has been soaking into the soil, dissolving its minerals and washing them into the sea. As a result, the oceans have become a reservoir of minerals that is vast beyond comprehension. I hesitate to use the word "inexhaustible" because modern man seems to be able to find ways to exhaust every natural resource sooner or later, but at this time it does appear that the mineral resources of the sea cannot be used up.

There has been a lot of thought given lately to the idea of taking these minerals out of the sea and putting them back on the land, chiefly with the hope that the trace minerals in the sea will supply a missing link that will make our plants and ourselves healthier. Dr. T. L. Senn of the University of South Carolina recently attracted a lot of interest with his discovery that an unknown growth factor in seaweed made some plants grow larger than others – and other plants grow smaller. He is now engaged in trying to identify this growth factor. Here is his comment about his work: "All we've done so far is to completely baffle ourselves. We've proved that seaweed does have something that can either speed up or slow down metabolism of other plants. Now, the problem is to find out what it is."

Even more exciting is the large-scale experiment done by New Zealand soil scientists which showed that a section of land in that country which had been raised from the sea by an earthquake in the 1930's produced food which was richer in minerals than food grown on other nearby land. People eating this food grown on land raised from the sea had fewer cavities in their teeth than their neighbors. My article, "The Soil – Key to Proper Mineral Nutrition," in the May, 1962, issue reported on that experiment.

This morning I received an advance copy of a book that adds a great deal to the idea of trying to use the wealth of the sea to produce better food and healthier people. Called *Health From the Sea and Soil,** it is written by Charles B. Ahlson of Wat-

*Published by Exposition Press.

sonville, California. He speaks with authority on matters concerning the soil, because before his retirement in 1958 he served as an agronomist with the U.S. Department of Agriculture for 23 years. Mr. Ahlson goes further than recommending seaweed as a soil amendment. He thinks it would be a good idea to use sea water itself for irrigation, diluted in fresh water, of course. Rather than try to paraphrase his thoughts, I will reprint here his entire chapter on the agricultural applications for sea water, titled "Treating Plants With Sea Water."

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Sea water always seems to give a favorable response regardless of how, when or where used. The chemical composition of water from all the oceans is the same with only two or three minor exceptions. The favorable results are due to the fact that nature has put in sea water the riches of minerals that are essential for the welfare of everything that lives and grows. Nature expects us to use these minerals. They add up to health, strength, vitality and joy in living and working.

A tremendous outlet for the use of sea water exists in the agricultural field. We need many well-designed experiments to determine the optimal quantity of sea water required for better quality produce from the land. George Hutchinson, another soil scientist and Federal Land Bank appraiser, and I have experimented in a limited way with plants, chiefly with some vegetables eaten at our family tables. Sea water was applied to a garden plot with the following results:

The first test began with dividing a sizable area of carrots into two plots. To one plot was added a single application of sea water, at the rate of 50 gallons per acre; the other equal-sized plot was not treated at all. At the right time in their growth, these carrots were harvested. The untreated carrots wilted over night, but the treated carrots did not.

The test was carried several steps further, to ascertain the keeping quality of both lots of carrots. The treated carrots were packed in sphagnum moss saturated with water, in one half of an orange crate. The untreated carrots were packed in the same way, in the other half of the crate. The crate then was put in the sun on the south side of the house and left there throughout August and September without the application of water.

The crate was opened and contents checked. The untreated carrots had become a mushy mess. The treated carrots had not deteriorated. They were firm and sound all the way through. And we ate them at our meals. A mineral analysis was made by incineration in which the ash contents from the carrots which had been treated with sea water showed a mineral increase of 28 per cent above the carrots which had not been treated with sea water, proving thus the power of the carrot to absorb its mineral elements. Worked out in terms of commercial values, this would mean much to producers and marketers for improving and extending the keeping qualities of their vegetables.

The next experiment was done with tomato plants, shortly before their blooming stage. To every other plant in the row, one ounce of sea water diluted in a pint of drinking water was applied. Tomatoes from the treated plants matured 7 to 10 days earlier than those from the untreated plants. Besides, the treated plants yielded 31 per cent more tomatoes than the untreated plants. And their flavor was superb.

Zucchini squash came next. Sea water was added to irrigation water in approximately the same ratio for the zucchini which were under the test as was used on the carrots. Other zucchini plants were irrigated at the same time, but without adding the sea water. The differences in results were conspicuous. The area treated with sea water produced squash until frost; leaves, stems and fruit were seemingly

ELEMENTS IN SOLUTION IN SEA WATER

Element	*Parts per Million*	*Element*	*Parts per Million*
CHLORINE	18980.0	COPPER	0.001-0.01
SODIUM	10561.0	ZINC	0.005
MAGNESIUM	1272.0	LEAD	0.004
SULPHUR	884.0	SELENIUM	0.004
CALCIUM	400.0	CESIUM	0.002
POTASSIUM	380.0	URANIUM	0.0015
BROMINE	65.0	MOLYBDENUM	0.0005
CARBON	28.0	THORIUM	0.0005
STRONTIUM	13.0	CERIUM	0.0004
BORON	4.6	SILVER	0.0003
SILICON	0.02-4.0	VANADIUM	0.0003
FLUORINE	1.4	LANTHANUM	0.0003
NITROGEN (COMP.)	0.01-0.7	YTTRIUM	0.0003
ALUMINUM	0.5	NICKEL	0.0001
RUBIDIUM	0.2	SCANDIUM	0.00004
LITHIUM	0.1	MERCURY	0.00003
PHOSPHORUS	0.001-0.1	GOLD	0.000006
BARIUM	0.05	RADIUM	0.2-3 x 10-10
IODINE	0.05	CADMIUM	
ARSENIC	0.002-0.02	CHROMIUM	
IRON	0.002-0.02	COBALT	
MANGANESE	0.001-0.01	TIN	

perfect, and the fruit was a rich, bright-green color. The zucchini area that had not been treated with sea water produced only one crop that season.

The difference in yield on the per-acre basis was significant. Figuring the number of treated plants per acre, the yield per acre would be 19 tons. The yield for the untreated area on a similar basis would be 8 tons. More tests with other vegetables on different varieties of soil will get under way as they can, to determine the per acre volume of sea water that will yield best results from particular soils.

At Walnut Creek, California, an orchardist applied sea water to a cover crop of vetch and cereal in his walnut orchard located only a few miles from the Pacific Ocean. He hauled several tankloads of sea water to his orchard and sprayed the cover crop at the rate of about 500 gallons per acre. The result was that his orchard was practially free of aphids though other orchards in the area were literally infested.

From this one application of sea water in this walnut orchard, the yield of walnuts was reported to average approximately 22 per cent more nuts, over a 3-year period, in comparison with other near-by orchards of similar size and age. These factual results from the use of sea water with vegetation are indicative of what one may reasonably expect.

A contractor near Seattle, Washington, had built his residence on a steeply sloping hillside where excavation had been heavy. When the lawn area was ready to be seeded, the surface was found to be hopeless-looking clay. To help develop the beautiful lawn he desired, he hauled muck that was high in organic matter and well saturated with elements of the sea from the

shore of Puget Sound. This he spread about an inch deep over the lawn area. Then he seeded it. Almost incredibly soon, his lawn became outstanding in the community for beauty and richness of texture and color.

Amount of Sea Water to Use

All the minerals in sea water have important functions to perform for the proper nutrition of plants. One excellent way to guard against deficiencies in the soil is through irrigation – furrow or sprinkler.

Sea water contains 2.72 per cent sodium chloride, which is common table salt. A hundred gallons of sea water added to one acre-foot of irrigation water would increase the salt content by 8.54 parts per million, or the chlorine content by 5.12 parts per million.

Another approach may be considered by taking the total mineral content of sea water, which is 3½ per cent. Consider that 0.2 per cent salt in the soil is generally considered the upper limit that can be used without crop damage. Some say 0.1 per cent is better. Then you could not add more sea water (3½ per cent of total salt) than enough to bring the soil in the root zone (the root zone is tricky) to 0.2 per cent or 0.1 per cent.

Using the latter figure (0.1 per cent) this would allow a maximum application of about 8,000 gallons per acre to a depth of 6 inches. This figure looks fantastic, but carefully checked trials at this rate would soon establish whether this is within tolerance. One application of this rate should last for several years.

This means that the addition of 100 gallons or even 500 gallons of sea water would make only a slight increase in the salt content per acre irrigated. The value of sea water in irrigating lies in applying all the trace minerals to the soil.

Dr. Chester reports: "Astounding crop improvements occur when a few parts per million of a trace element were added to a soil which lacked it." What soil will do for these our plant factories when we keep the soil properly nourished, well tended and carefully managed, is a never-ceasing wonder!

The feasibility of applying sea water is another matter or problem. The solution to this may be the use of Bittern Brine – a by-product of a salt-extraction plant supplying salt for the live-stock and dairy industries. Bittern Brine is the residue accumulating in such a plant – sea water from which most of the salt has been removed.

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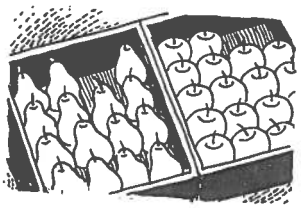
To this chapter from Mr. Ahlson's book I would like to add only one other thought. Perhaps that value of sea water to the soil can be attributed to the *mixing* action of the oceans, which combine minerals and trace elements washed from soils in every nook and cranny of the world. It is well known that soils in some areas are deficient in particular elements, so it is logical to guess that treating soil with minerals washed out of all the continents of the world would be likely to supply some element that is missing. We are not recommending that you apply sea water to all of your land by Mr. Ahlson's method, but it is an idea worth trying on an experimental basis.

Almost 3,000 Varieties of Apples and Pears



■ About 2,000 varieties of apples and about 900 varieties of pears exist in this country. Since the selection of varieties is such a regional problem, we have in many cases not recommended specific ones, excepting those known to be resistant to certain pests and diseases. Readers interested in varieties for certain particular areas should check with the horticultural staff of their state experiment station. ■