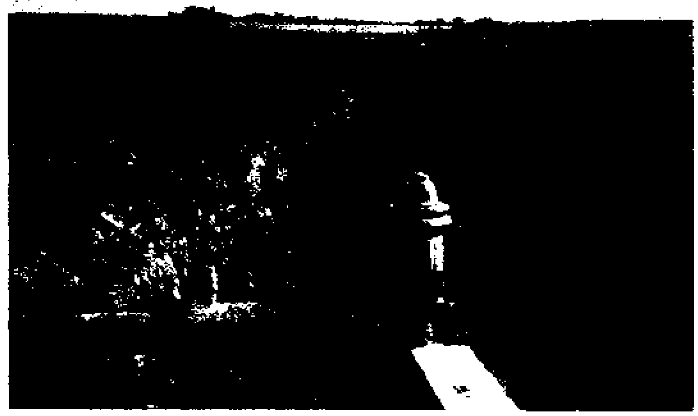
Settling ponds are used to remove soil from surface water used for sprinkler irrigation and to trap soil from runoff water and washwater from fresh vegetable processing. To remain effective, these ponds must be cleaned periodically.



Reclamation and reuse of irrigation sediments

By C. W. Robbins

IRRIGATION canals and drainage ditches often require periodic cleaning to remove wind-blown or water-deposited sediments. Ponds used to trap sediment from irrigation runoff and food processing wastewater also require periodic cleaning if they are to remain effective. The freshly removed sediment is usually piled next to the canals or ponds for drying and temporary storage.

Dredge materials often are stored near the source until the piles become so large they constitute a nuisance. Removal then is necessary. Sediment piles frequently remain in place for 10 years or more.

A case history

Two large irrigation tracts in southern Idaho are served by the North Side Canal Company, which annually removes about 325,000 tons of sediment from its canals and drains, and the Twin Falls Canal Company, which each year removes about 86,000 tons of sediment from its canals and drains (2). These quantities exclude the sediment removed by farmers from sediment ponds within the irrigation tracts. The two irrigation companies supply irrigation water to 363,000 acres.

The logical place to put the sediment is back onto the eroded fields or on areas that need fill. The materials usually are quite fertile with respect to phosphate and sometimes other fertilizer materials (4). Most of the sediments are derived from topsoil (3).

When sediment that has been stored next to canals, ponds, or irrigated fields for many years is spread on cropland or used for landscaping, adverse effects from accumulated salts are often observed in the first crops planted after the sediment application. Large volumes of sediment are now being respread on farmland, necessitating research on the two irrigation tracts to determine the salt concentration in the sediments and the time required to leach the salts from the sediments.

Soil samples were taken from sediment piles of various ages (1 month to 10 years) and at different depths within the piles adjacent to canal banks and sediment ponds on the two tracts. Samples were also taken from 12 canal-bank sediment pile cross sections along a 500-foot reach of canal where sediment had been stored for more than 10 years. This last group of samples were taken before, immediately after, one year after, and two years after the sediment pile was pulled down and spread on adjoining cropland. The sediment pile on the canal bank was leveled to increase the farmable area, improve weed control, and modernize the irrigation system. Saturation paste extracts were made from each sample and the electrical conductivity, a measure of the total soluble salts, of each was determined.

Some observations

Irrigation water for the two tracts, which comes from the Snake River, has an average annual electrical conductivity of about 0.45 millimhos per centimeter (0.45 dS/m or 300 ppm total dissolved solids). Soils irrigated from Twin Falls Canal Company canals are predominantly silt loams, while the soils irrigated from Northside Canal Company canals are a mix of silt loams, fine sandy loams, and sandy loams (2).

Both areas are easily eroded by water,

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and the soils irrigated with Northside Canal Company water are also easily eroded by wind during the winter months. The wind-blown material is deposited in canals and drains and makes up a large portion of the materials that must be removed by the canal company. These soils seldom contain excessive salt concentrations when reasonable irrigation management practices are used. The silt loam soils usually have an electrical conductivity of less than 1.1 millimhos per centimeter and the fine sandy and sandy loams have electrical conductivities of 0.9 millimho per centimeter or less.

The sediments removed from ponds or canals and placed back onto fields immediately, or those piled only long enough for the excess water to drain from the sediment and to dry sufficiently for easy removal, were usually no saltier than the water from which they were removed. Samples from piles stored for a few months had twice as much salt as the fresh samples, and the electrical conductivities in one-year-old piles were about 2 millimhos per centimeter. Three-year-old piles had values exceeding 4 millimhos per centimeter, while most values in piles more than 10 years old exceeded 10 millimhos per centimeter.

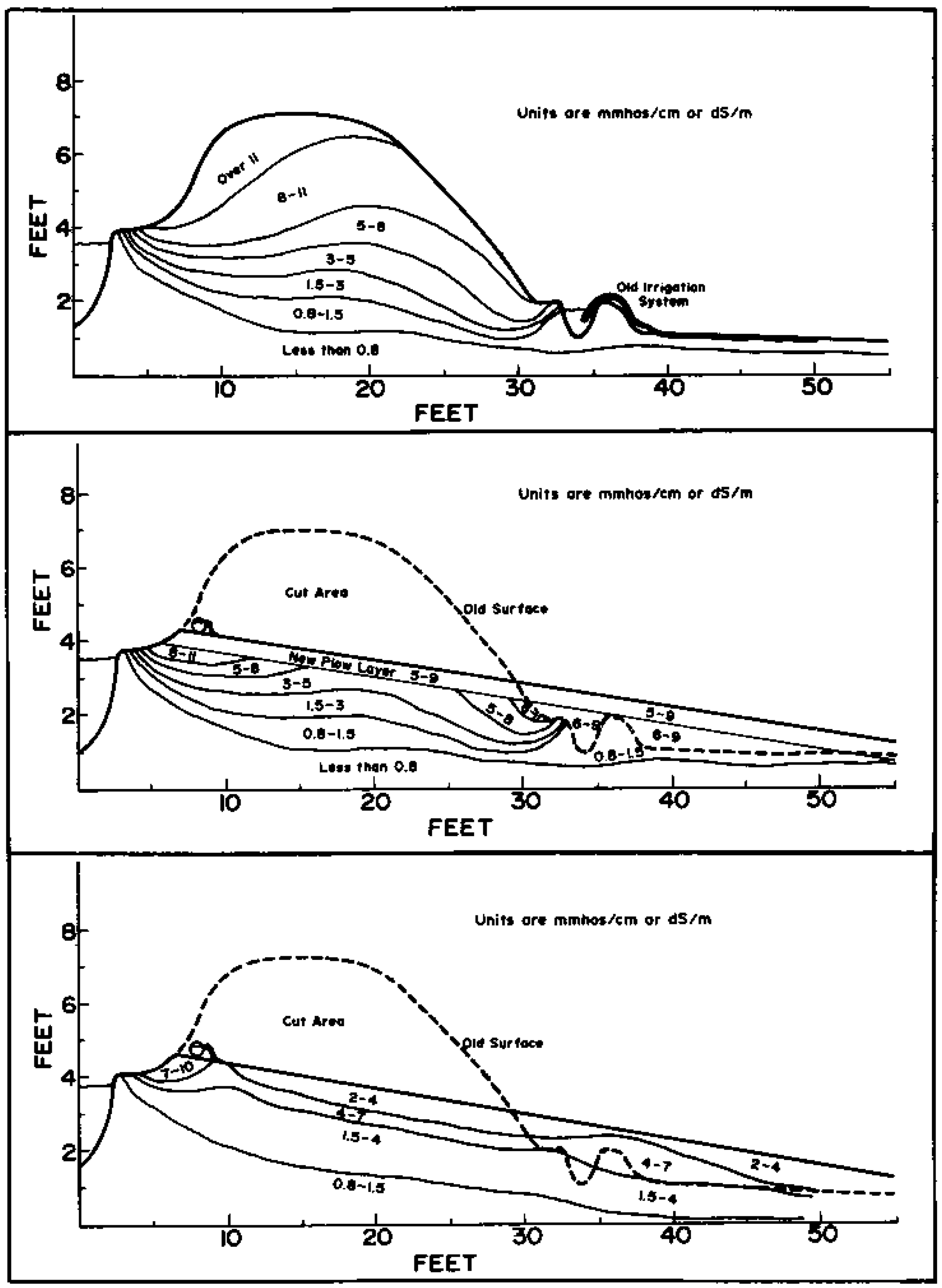
The salt accumulations are the result of capillary water movement from adjoining waterways and irrigated soil. The piles, being higher than the adjoining water and irrigated soils, act as wicks and draw water into the piles. As the water evaporates or is transpired by weeds and grass growing on the piles, the salts are left behind to accumulate in the sediments. Mineral weathering within the soil also releases some salt. The salt accumulation rate depends upon the salt concentration in the irrigation water, the pile's distance from nearby water, soil texture, mineralogy, and rainfall. The salts tend to be nearer the surface of each pile because the salts move with the water.

One reclamation test showed how dramatically the quality of sediments can be improved over a relatively short period of time (see salinity profiles in box). A canal bank sediment pile more than 10 years old was leveled. The area was then plowed and irrigated with good quality water for two years. After the second season, the salt concentration had dropped below 1 millimhos per centimeter in most samples, indicating that the salty soil had been reclaimed. After two years' irrigation there were a few small spots that still showed salt effects, but for the most part salt concentrations were reduced to near normal.

The rapid reclamation of the materials was due in part to their being spread over nonsalty soil material with high infiltration rates. This permited the salts to be leached readily from the root zone with good quality water. For these soils, sodium was not a problem. In other cases where the water or soil may contain higher sodium levels, high sodium adsorption ratios and high exchangeable sodium percentages may be a factor and must be considered in managing the redistributed materials.

Management suggestions

When sediments stored in piles next to water bodies or irrigated fields for more than a year are to be spread over cropland or used for landscaping, care should be taken to determine the salinity status of the sediment and the soil surface after the sediment has been spread and mixed with the original soil. Crops or plants should be selected that can be grown on the saltier conditions encountered during the first few years after spreading the sediment on the land. In the research mentioned here, bar-



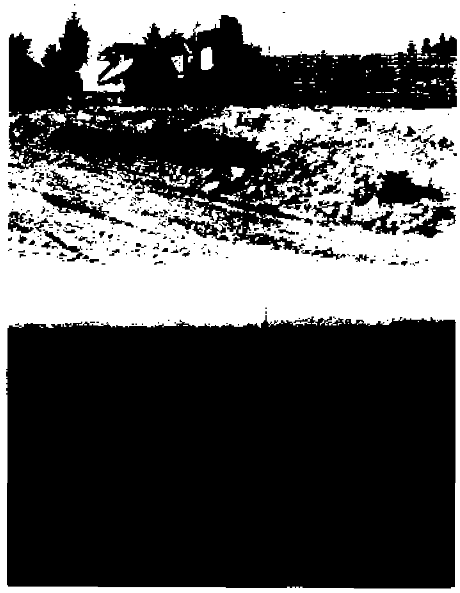
Salinity profile of a canal bank before it was leveled and spread over adjoining cropland (top). Salinity profile of the area extended by levelling the canal bank and then plowing the area (middle). Salinity profile of the area after irrigating for one growing season (bottom).

ley, sugar beets, or cotton would have been good choices for the first year. Alfalfa or wheat could have been grown successfully the second year, and most any crop could have been grown the third year, depending, of course, on climate.

Sufficient water must be applied to the salty sediments to leach the excess salts from the root zone. The amount needed will depend upon the crops grown, the soil texture, and the salt concentration in the irrigation water. If the sediment is spread in the fall, while irrigation water is still available, leaching the area once and going into the winter season with a wet profile will also speed the reclamation process. This increases the effectiveness of winter precipitation in leaching salts from the profile.

Once salts are leached out, more salt-sensitive crops can then be grown. References showing the salt and sodium sensitivity of many crops are available to determine which crops can be grown successfully at various salinity or sodium levels (*1*). Use of these references as guidelines can help avoid crop failure on salty areas.

Salt buildup in sediments taken from ponds, canals, and drains can be avoided by placing the soil back onto the land as soon as it is dry enough to move. The sediment can also be spread during the following fall and winter when more time is available to farmers or canal company personnel and when crops are not growing on the land. Thus, land is not tied up for sediment storage, and the sediment piles are not producing weed crops and weed seed. The sediment can also be a valuable addition to eroded areas or low spots in fields. In many cases sediment spreading will increase the farmable area or improve the production potential on shallow or otherwise nonfarmable areas.



If the sediment is stockpiled for more than a few months (top), salts accumulate in the soil and salinity problems develop when the sediments are spread back on productive land. Sediment can be placed on eroded areas, used to improve field shape, or used to fill low areas and combine small fields into larger, more practical farming units

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