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IRRIGATION USE OF FOOD INDUSTRY WASTE WATER (ISPOL' ZOVANIYE NA--ETC(U)
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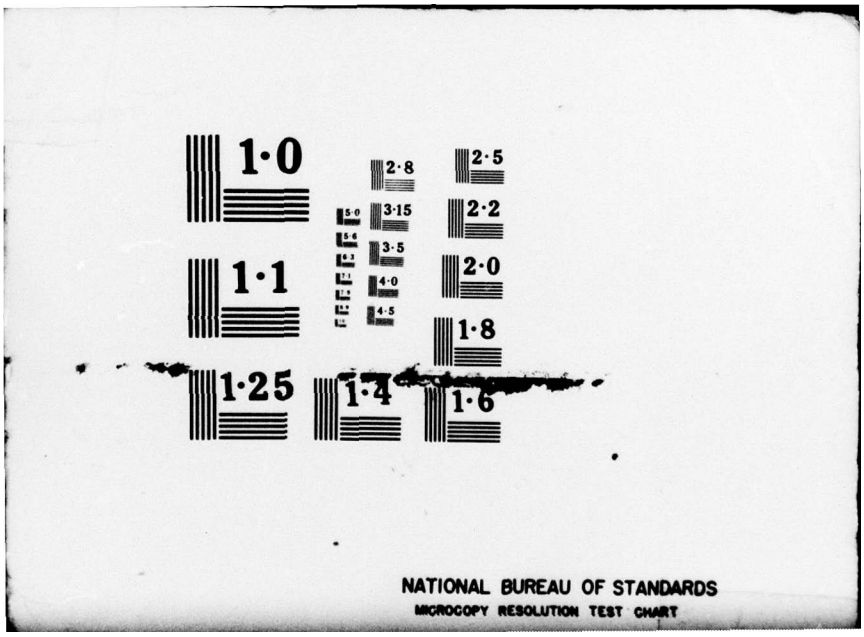
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IRRIGATION USE OF FOOD INDUSTRY WASTE WATER

V.T. Dodolina

April 1978

CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
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Studies conducted by the All-Union Scientific Research Institute for the Agricultural Utilization of Waste Water (VNIISSV) have established that the waste water of starch plants and sugar refineries could be used for irrigation. Such waste water is of considerable and, frequently, high fertilizing value. After treatment such water is suitable for the irrigation of meadows, pastures and fodder, grain, and industrial crops.

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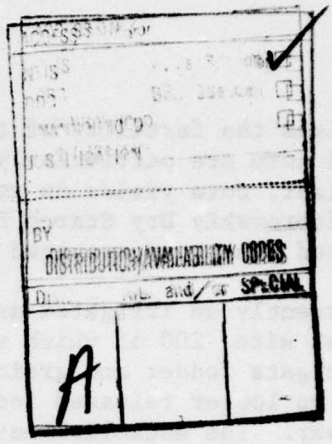

IRRIGATION USE OF FOOD INDUSTRY WASTE WATER

Kupavna ISPOL'ZOVANIYE NA OROSHENIYE STOCHNYKH VOD PREDPRIYATIY PISHCHEVOY PROMYSHLENNOSTI in Russian 1976 pp 1-4

[Prospectus by Candidate of Agricultural Sciences V. T. Dodolina, All-Union Scientific Research Institute on the Agricultural Utilization of Waste Water]

Our country has a number of food industry enterprises. The principal among them are sugar, starch, and hydrolysis plants. Most of them release large amounts of waste water in filtration fields or surface waters (rivers, ponds and others). In the first case a large area of fertile soil is removed from farm use; in the second, surface water sources become polluted.

Studies conducted by the All-Union Scientific Research Institute for the Agricultural Utilization of Waste Water [VNIISSV] have established that the waste water of starch plants and sugar refineries could be used for irrigation. Such waste water is of considerable and, frequently, high fertilizing value. After treatment such water is suitable for the irrigation of meadows, pastures and fodder, grain, and industrial crops.

The waste water of starch plants is characterized by a low acid reaction (pH=5.3-5.6), a relatively low concentration of dissolved substancss (2.0 grams per liter), and a bicarbonate-sulfate composition. Frequently salts of univalent cations (K, Na) predominate. Inherent in such water is a high content of organic matter. This is indicated by the level of bichromatic oxidability, which ranges from 3 to 5 grams per liter of O_2 depending on production technology and the nature of the preliminary waste water treatment. The waste water has a high fertilizing value. It has a content of 30-150 milligrams per liter nitrogen, 85-180 milligrams per liter potassium, and 20-40 milligrams per liter phosphorus. Studies have shown that, compared with waste water from the production of corn starch, waste water from the production of potato starch is better in terms of structure and fertilizing value. With an irrigation standard of 3,000 cubic meters per hectare, considered average for a number of farm crops, the soil receives 7 to 12 quintals per hectare of nitrogen, 6 to 13 quintals per hectare potassium, and 3 to 5 quintals per hectare phosphorus fertilizers converted in terms of chemical fertilizer. The high content of nutritive elements in waste water released by starch-making plants, used for irrigation,

raises the fertility of the soils and farm crop yields. Perennial grasses and corn are particularly responsive to such irrigation. In Ryazanskaya Oblast, corn yields on gray forest soils irrigated with waste water of the Zadubrovskiy Dry Starch Plant were 2-3 times higher compared with nonirrigated areas and averaged 420 quintals per hectare of green mass.

Currently an irrigated area covering 600 hectares has been established at that site, 200 of which are in use. Most of the waste water is used to irrigate fodder and grain crops. As a result of this untreated waste water is no longer released into the Yaroslavna River which flows into the Oka River. The establishment of an irrigated field at the site has blocked the pollution of the basin of the Oka River. Before it can be used for irrigation, the waste water of starch plants must undergo treatment consisting of averaging and sedimentation. Starch plant waters may be used for the irrigation of farm crops in all soil and weather zones: Chernozem, gray forest, and soddy-podzolic soils of different mechanical or similar structures.

The waste water of sugar refineries has a lesser fertilizing value and a higher suspended precipitation content.

Currently the waste water of sugar refineries is treated through filtration systems. Such systems consist of sedimentation ponds and filtration fields which remove from cultivation huge areas of fertile Chernozem soil within whose area the bulk of sugar refineries is located.

The studies made by our institute have shown that the waste water of sugar refineries is suitable for the irrigation of farm crops on Chernozem soils.

The waste water of sugar refineries is characterized by an alkaline reaction (pH=7.5-8.5), a bicarbonate content, high content of organic matter, and average fertilizing value. On an average it contains 45 milligrams per liter nitrogen, 75 milligrams per liter potassium, and very little phosphorus (2.5 milligrams per liter).

With an irrigation norm of 3,000 cubic meters per hectare the soil receives 4 quintals per hectare of nitrogen, 5.6 quintals per hectare of potassium, and 0.5 quintals per hectare of phosphorus fertilizers.

The waste water of sugar refineries has a high content of suspended sediment, averaging 50 grams per liter. The sediment contains lime and soil particles. Its high content hinders the utilization of waste water for irrigation. This calls for advanced treatment which includes averaging and sedimentation. The sedimentation process takes place in the sedimentation ponds which are always found on filtration fields. The clarified waste water has a better chemical composition. However, its fertilizing value is 15 to 20% below that of unclarified waste water.

The results of the studies made by the VNIISSV at sugar refineries of Krasnodarskiy Kray showed that irrigation with clarified waste water has a positive influence on the fertility of Chernozem soils and on farm crop yields. The content of mobile forms of nitrogen, phosphorus and potassium rises in the soils. Such irrigation does not cause soil salinization or solonetzization processes. Extensive studies conducted at the Timashevsk Sugar Refinery in Krasnodarskiy Kray proved the high effectiveness of the utilization of waste water in the irrigation of corn, sudan grass, sugar beet, wheat and stubble crops. With irrigation crop yields rose from 50 to 150% compared with unirrigated areas. In 1970 yields of controlled sudan grass averaged 115 quintals per hectare; irrigated with clarified waste water at the rate of 2000 cubic meters per hectare yields reached 165 quintals per hectare; irrigated with unclarified waters in the same yields reached 215 quintals per hectare. Stubble crop yields (peas with oats) increased with higher irrigation norms. Without irrigation they averaged 58 quintals per hectare; they rose to 94 quintals per hectare with an irrigation norm of 1000 cubic meters per hectare, and 145 quintals per hectare with 2,000 cubic meters per hectare irrigation.

Practical experience has been developed in the utilization of of the waste wate of sugar refineries by the Kollektivist Plant in Kurskaya Oblast, and the Nizhniy Kislyay Sugar Refinery in Voronezhskaya Oblast. The results of the studies were tested under industrial conditions. At these projects sovkhoz land was used for irrigation with waste water. The irrigated areas ranged from 20 to 150 hectares.

In 1975 irrigation with clarified waste water of the Timashevsk Sugar Refinery was used by the Timashevskiy Sovkhoz over an area of 500 hectares. The waste water from the collector was fed to the existing sovkhoz irrigation network. In the course of 1975 corn and alfalfa were irrigated with waste water.

Waste water was simultaneously treated at the irrigation fields. Water was promptly received from filtration fields which enabled the plant to operate normally and rhythmically in the new production season. The use of waste water for irrigation made possible to resume crop cultivation on some of the filtration area.

Calculations showed that the treatment and utilization of waste water of the Timashevsk Sugar Refinery yielded tremendous results. Compared with total biological treatment, now planned for many sugar refineries, the annual savings from the utilization of waste water for irrigation equalled 833,000 rubles.

Scientific research and practical experience showed that the use of waste water of the sugar refinery for irrigation is a promising measure which must be extensively applied in agricultural production practice.