THESIS

STUDY OF NITRATE LEACHING UNDER SHALLOW WATER TABLE CONDITIONS IN A TILE DRAINAGE PROJECT

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ABSTRACT

Methaemoglobinaemia ('blue-baby' syndrome) is a well recognized medical condition arises where ingested nitrate impairs the oxygen carrying capacity of human blood. With transformation of nitrates in the human body by gastrointestinal bacteria, the production of nitrite results in oxidation of hemoglobin, ultimately restricting its ability to carry oxygen and resulting in a bluish-tinged or oxygen starved babies. The greatest risk is likely to be in rural agricultural areas in developing countries where nitrate fertilizer applications are progressively increasing and water quality in respect of nitrate is being less closely monitored.

This study was carried out to compare the groundwater contamination from Nitrates in groundwater underlying the field area of Fourth Drainage Project, to that of outside tile drainage system in Faisalabad Division in Punjab Province of Pakistan. Other objectives included the evaluation of magnitude and severity of nitrate contamination in the proposed area, identification of various factors responsible for groundwater contamination by nitrate, and investigation of the role of tile drainage in nitrate leaching.

Results of the study near Faisalabad show that the nitrate-nitrogen concentration varies from 0.03 to 3.25 mg/l in the water samples collected from the Tile Drainage areas which is much below the maximum permissible limit of 10 mg/l. The nitrate-nitrogen concentration exceeded the permissible limit in about 15% samples collected from outside the tile drainage areas. In general, it is revealed that there is no danger of shallow groundwater pollution by nitrate if the agriculture drainage system (Tile Drains) is well functioning. In contrast to this, there are chances of groundwater pollution where there is no such drainage system.

Untreated industrial and domestic effluents are being disposed off into a number of surface drains crossing the area of study. These are posing a potential danger of groundwater pollution. Their regular monitoring is highly desirable.

Analysis of the water samples collected from hand pumps and tubewells indicates that the nitrates accumulate in the top surface of groundwater after their leaching with downward percolated water. For this reason, the concentration of nitrate is maximum in the shallower groundwater. It decreases rather sharply with increase in groundwater depth. Thus it is safer to tap deeper groundwater to lessen the danger of pollution by nitrates.

The results further indicate that soil texture has significant impact on production of nitrates as well as their leaching and subsequent pollution of groundwater. There is more risk of groundwater pollution in areas occupied by coarse textured material containing more than 50 percent sand particles.