Environmental impact of intensive horticulture practices on groundwater content of nitrates, sodium, potassium and pesticides

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Recent changes in agricultural practices during the last 20th century have significantly contributed to increase the concentrations of pollutant substances is water, soil and air. Groundwater is a valuable natural resource and as such should be protected from deterioration and chemical pollution. A monitoring program of nitrate, nitrite, potassium, sodium and 28 pesticides was carried out in water samples from an intensive horticulture area in a vulnerable zone from North of Portugal. Eight collecting points were selected and water analyzed in five sampling campaigns, during one year. The multidimensional data analysis methods are very attractive in environmental studies dealing with measurements and monitoring, looking for possible grouping and sources of data variation. The application of such tools is expected to help rationalize confused intrinsic associations within real data and give an insight to identify the pollution sources for effective water resource management and pollution control. Chemometric techniques, such as cluster analysis (CA), principal component analysis (PCA) and discriminant analysis (DA) were used in order to understand the impact of intensive horticulture practices on dug and drilled wells groundwater and to study variations in the hydrochemistry of groundwater.

Nitrates were detected in all water samples and 50% of them exceeded legal limits of 50 mg/l. Inorganic fertilizers such as potassium nitrate were suspected to be the most important factors for nitrate contamination since highly significant Pearson Correlation (p=0.691) was obtained between groundwater nitrate and potassium contents. Sodium content of the groundwaters ranged from 17.4 to 92.9 mg/l contributing to the salinization of coastal aquifers. From a total of 28 pesticides (8 fungicides, 11 insecticides and 9 herbicides) 5 of them were not detected in any sample, acetamiprid, endrin, pendimethalin, phosmet and 2,4D. The most frequent fungicides were cyprodinil, metalaxyl and azoxystrobin. Whereas the most frequent insecticides were pirimicarb and thiamethoxam, followed by dimethoate, dieldrin, cyromazine, o,p'- DDT, methoxychlor and aldrin.

The most frequent herbicides were atrazine and terbuthylazine and their desetyl-metabolites. Furthermore, it should be highlighted that some pesticides not in use nowadays were detected in some samples.

Water from dug wells is especially prone to contamination from the grower and their closer neighbor's practices. Water from drilled wells is also contaminated from distant practices.