THE NEED FOR CAREFUL CROP WATER MANAGEMENT TO PREVENT DETERIORATION OF GROUNDWATER QUALITY IN NORTH WESTERN REGOSOL BELT.

D.S.P.KURUPPUARACHCHI, A.R.LAWRANCE[2]

W.A.R.N.FERNANDO[1]

Introduction and background:

In Kalpitiya peninsula (on the west coast of Sri Lanka) intensive agriculture is gaining increased importance. Kalpitiya soils are highly permeable regosols, overlying fine to coarse sands with a shallow groundwater layer used both for irrigation and potable needs. The main crops grown are onions, chillies, potatoes and vegetable crops including gherkins; the latter being recently introduced. Fertilizer application sometimes exceed 700kg N/ha per annum, when three crops a year are raised and therefore the risk of nitrate leaching to the groundwater in these permeable soils can be considered high and significant.

The deterioration of groundwater quality due to long term leaching of agrochemicals(on intensively cultivated land) has been identified in many countries. In the United Kingdom, during the last 10-15 years, groundwater nitrate concentrations have exceeded the EC guideline value of 10mg N/L in some areas due to increased use of N-fertilizers, following the intensification of agriculture during the 1950's and 1960's.

Groundwater monitoring has shown that pesticide residues, at concentrations above the recommended "drinking water guideline value" can occur, particularly where the water-table is shallow and

the "unsaturated zone" is relatively permeable. For example, on Long Island (New York) the use of the soil insecticide Aldicarb was discontinued because of its widespread occurrence in groundwater (Pacenka et al 1987).

1. Research officers, Agricultural station, Kalpitiya.
2. Hydrogeologist, British Geological Surveys,U.K.

Adequate numbers of detailed studies on the contamination of groundwater due to leaching of agrochemicals must be conducted in the developing countries,because of the high rates of applications of both fertilizers and pesticides
on crops (with irrigation, even upto three crops per year) while shallow groundwater is often the only source of potable water.

A small scale research project funded by overseas Development Administration, UK is currently being undertaken by the Agriculture Department, Ceylon institute of scientific and Industrial Research (C.I.S.I.R.) and the water Resources Board in collaboration with British Geological Survey to investigate the leaching of nutrients and specific pesticide compounds in to groundwater in the Kalpitiya peninsula.

Results and discussion

Preliminary results of a study indicated that the nitrate concentrations of shallow groundwater, beneath intensively cultivated soils are higher than 30 mg W/L for most of the year, and exceed 50 mg N/L during some months. These values are very high compared with the low groundwater nitrate concentrations of less than 2-3 mg N/L observed in

areas where intensive cropping is not practised. Excessive nitrate in drinking water can cause " Methaemo globinaemia" in young infants which can be fatal. A possible link between high nitrate content of drinking water and stomach cancer has been suggested by Fraser et al (1980). High nitrate observed in the Jaffna Peninsula is Perhaps due to leaching of agrochemicals from intensively cultivated soils, Nagarajah et al, 1988).

Change in EC of ground ater at Kalpitiya

Month	Domestic well		Agricultural Wells	
	Period 1 1984-1985 (ds/m)	Period 2 1986-1987 (ds/m)	Period 1 1984-1985 (ds/m)	Period 2 1986-1987 (ds/m)
June	0.16	0.18	0.31	0.81
July	0.22	---	0.35	---
August	0.35	0.18	0.42	0.75
September	0.54	0.17	0.54	0.78
October	0.32	0.32	0.42	0.78
November	0.42	0.39	0.35	0.51
December	0.35	---	0.35	---
January	0.35	0.32	---	0.50
February	---	0.34	---	0.84
March	0.42	0.31	0.42	0.75
April	---	0.35	---	0.77
May	0.40	0.31	0.41	0.87

Above table shows the electrical conductivity (EC) values of one agricultural and one domestic well during the periods of May 1984 to May 1985 and May 1986 to May 1989. While EC of the domestic well reemained the same over the two periods concerned, EC of the agricultural well located about 8 km. away from the domestic well shows higher value during the latter period indicating a gradual built up of salinity in the ground water. It is clear that in the areas where the soils are highly permiable and the water table is shallow, consideration needs to be given to measures to reduce the harmful environmental impact of intensive cultivation, if agriculture is to be sustained in the longer-term. Apart from the risk to potable supplies, such high nitrate concentrations also represent a considerable loss of valuable plant nutrients.

The soil insecticide carbofuran has also been studied under this programme and there is evidence to suggest that upto 25% of the applied dosage may be leached below the root zone. However, carbofuran is not detected in round water although one of its breakdown products has been widely observed and appears to be persistant in groundwater for at least several months.

The authors wish to acknowledge Dr.S.D.I.E. Gunawardana, Director of Agriculture for his special interest in the above study and Research Management of the Department of Agriculture for their assistance at various stages of the study.

REFERENCES:

Fraser,P., Chilvers,C., Beral.V., and Hull,M., 1980. Nitrate and human cancer: A review of the evidence.

International Journal of Epidemiology 9, (1), 3-11.

Nagarajah,S., Emerson,B.N., Abyakoon.V. and Yogalingam, 1988. Water quality of some wells in Jaffna and Killinochchi with special reference to nitrate pollution. Tropical Agriculture, 144.

Pacenka, S., Porter, K.B., Jones, R.L., Zecherias, K.B. and Highen, H.B.F., 1987. Changinmg aldicarb residue levels in soil and ground water, Eastern Long island, New York. Journal of contaminant hydrology, 2; 73-91.