

Pollution control for agriculture

Of the many dangers that face our agrarian economy, water pollution poses a real threat to the fields of Pakistan

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PAKISTAN is an agrarian economy. Nearly 70 per cent of the country's rural population is dependent on agriculture, while 50 per cent of the labour force is engaged by it. However, the country's growing population has put strain on the agricultural capacity, and though more land is now cultivated and higher yield derived expansion in agriculture has also meant increased irrigation water supplies as well as more use of fertilizers and pesticides. As expected, this has brought about new problems. One of them is the water pollution.

Problems related to water pollution from agriculture are so many that today these cannot be controlled. The result is that the agriculture sector continues to pollute the surface and groundwater resources.

FUTURE WATER REQUIREMENTS: It is estimated that the volume of water used for irrigation in the 2000 was 95 billion cubic meters per year. In the coming twenty-three years, this figure is expected to rise up to 132 billion cubic meters per year. Other than this fact, the quantity of water used for irrigation, in future, will be dependent on many factors. These factors include, irrigation efficiency, seepage losses, water conservation, etc.

cides (vertebrate poisons) and nernatocides (nematodes).

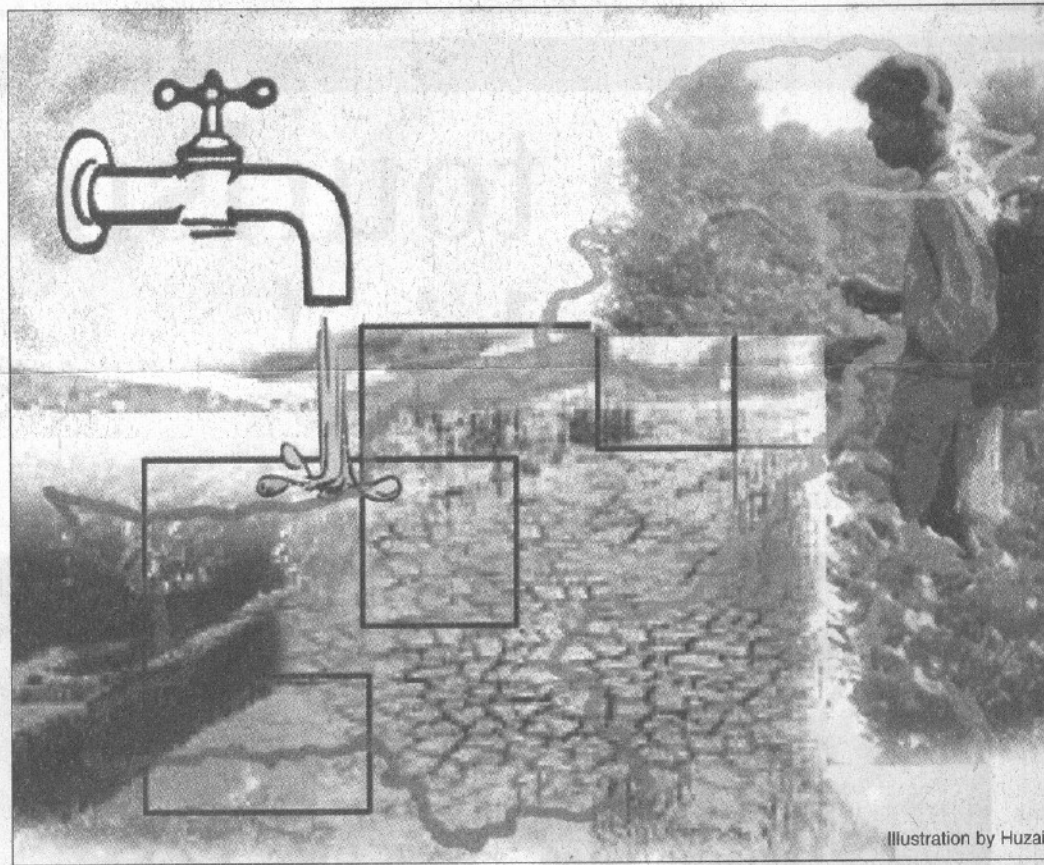
In absence of the wide-spread use of IPM (integrated pest management) in Sindh, the use of pesticides is indiscriminate in the province. During the course of irrigation and during wet season, the pesticides are washed down to surface water bodies, and in some cases, the groundwater resources as well. Agricultural use of pesticides in Sindh is the single most important factor of water

may be more toxic than the original pesticide); persistence (some pesticides are relatively more persistent in the environment, e.g., DDT); toxic response (the response may be acute, chronic, carcinogenic, teratogenic, inhibited reproduction, etc); environmental fate (affinity of pesticide for solid, liquid, gas phases and biota).

The ecological impacts of pesticide runoff on aquatic life are also governed by the ability of the pesticide to bio-concentrate and biomagnify at the organism level and, at

Phosphorus readily precipitates as calcium, aluminium or iron phosphate, depending upon the nature of soil. Also, potassium has a restricted mobility.

The build-up of nitrate in the groundwater is a matter of deep public concern. Nitrate, in itself, is relatively non-toxic to humans. Health problems arises after nitrate enters the body and, is converted to nitrite, which is the chemical form of nitrogen. In infants, under six months, nitrite causes a condition called methemoglobinemia



pollution

various trophic levels along (blue-baby syndrome), under

Illustration by Huzai

include, irrigation efficiency, seepage losses, water conservation measures in place, water management, type of crops and water requirements of crops. However, all these will become nullified in the face of water pollution.

WATER POLLUTION: This type of pollution occurs in three ways. One is the pollution caused by the use of pesticides whose source of pollution is very pronounced in this country. The second is pollution by fertilizers which is also fairly common. The third source, to which no attention has been paid as yet, as it not known to many, is the pollution caused by sediments.

The "cide" in the word "pesticide" means "to kill." Hence, pesticides kill insects, pests and, in case of Sindh province, human beings too, as many cases have been documented of pesticides killing men, during pesticide's spray, use and handling. In agriculture, pesticide includes insecticides (insects), herbicides (weeds), fungicides (fungi), rodenti-

pollution.

In addition to the toxic active ingredients of the pesticides, most pesticides contain inert substances to improve absorption. These inert substances, quite often, are not included in the contents shown on the product's label. Chloroform and carbon tetrachloride are sometimes used as inert substances. They are toxic to liver and central nervous system.

Irrigation of lands in Sindh usually creates a habitat, which encourages mosquito breeding. To control this menace, agrochemicals (usually, DDT) are used to kill mosquitoes. Use of DDT is banned in developed countries, because of its major public health impact, pollution of water bodies and disruption of marine and terrestrial eco-systems.

The toxicity of pesticides in aquatic environment is governed by certain important influencing factors. These include degradation (pesticide, after degradation may form components, which

various trophic levels along the food chain.

In Sindh, the drinking-water treatment plants (rapid-sand filters and slow-sand filters) are not designed to remove pesticides in the drinking-water. So, if the raw water contains pesticides (which most likely it does), they will pass on to the finished drinking-water and, on to the human beings. Since, the cost of removal of pesticides from raw waters is prohibitive, it is prudent to prevent generation of pesticide runoff. This will also prevent environmental pollution.

FERTILIZERS: These are used to improve and increase the agricultural yields. Nitrogen, phosphorus and potassium are the main ingredients of fertilizers. Usually, it is the nitrogen, which appears in the fertilizer runoff, as nitrate. Typically, about 50 per cent of the nitrogen application is washed away. Phosphorus is not mobile in the soil, but rains may wash down phosphorus in the runoff.

(blue-baby syndrome), under which the oxygen-carrying capacity of blood is reduced. Haemoglobin carries oxygen in the blood; methemoglobin do not. High pH of an infant's stomach creates a favourable environment for conversion of nitrate to nitrite. Infant methemoglobinemia is the basis for nitrate-nitrogen drinking water standard. In addition, recent research suggests that, nitrite assist in the formation nitrogen-nitrosamine compounds, which may cause stomach cancer.

The US EPA has set the standard of less than 10mg/l (milligrams per litre) of nitrate-nitrogen in drinking-water. Who, also has the guideline value of nitrate-nitrogen in drinking-water as 10mg/l. However, the 1996 version of Who, drinking-water guidelines gives the nitrate value of 50mg/l and of nitrite as 3mg/l, but the sum of the ratios of the concentrations of each to its respective guideline value should not exceed one.

A significant feature of nitrate problem in the lag time, between the fertilizers' application and, their arrival in groundwater. Nitrate move through the soil at an approximate rate of one metre per year. Water drawn from wells, at the depth of 20 metres, would reflect the conditions of fertilizer used twenty years ago. During the last twenty years, there has been a significant increase in the use of fertilizer application.

When high levels of nitrate are present in raw water, other contaminants (coliform bacteria, chemical pollutants) may also be present. Removal of nitrate from water entails costly treatment units. Boiling the water will not remove the nitrate. On the other hand, boiling will increase the concentration of nitrate in the water.

Controlling water pollution from fertilizer runoff requires a well-managed approach. Eutrophication of water bodies (excessive weed growth due to excessive nutrients) is an indication of fertilizer runoff. This requires regular qualitative assessment of the trophic state of water bodies. Other controlling measures include reducing leaching of nutrients, rational nitrogen application (nitrogen requirements should be calculated on the basis of crop nitrogen balance); good irrigation and agricultural practices; planting of green manure crops; delaying ploughing of straw and leaves into the soil; and keeping a vegetative cover on soil.

SEDIMENTS: Much of the sediment supply to rivers and other water bodies, is attributed to agriculture, as a result of erosion. The loss of top soil by sheet erosion and gully erosion, generates sediment, which moves down to rivers and lakes. Soil erosion is usually the result of poor agricultural and irrigation practices. It is known that, soil is rendered as a wasteland due to the practices, which are not conducive to conservation of soil. The result,

dered as a wasteland due to the practices,

er which are not conducive to
g proper use of soil. The result-
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en jected to erosion, due to
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t's ing sediment load, which
le finds its way to water bodies.
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nt that is caused in water bod-
he ies, due to sediments, ecolog-
en ical impacts are caused, as a
In result of deposition in river
ch beds. These ecological
in impacts are more pro-
en- nounced in downstream
ds, areas.

ch There is also a chemical
dimension to the sediments.
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g/l (less than 63 micrometer, in
of size) carries chemicals,
ng- heavy metals, chlorinated
the pesticides and phosphorus
ate- that are 'adsorbed' to the
r as sediments, and are trans-
996 ported to the aquatic sys-
ing- tems.

the Measures, that can control
d of erosion, includes vegetative
sum cover, contour farming, con-
cen- trolling downslope runoff by
pec- diversions, grassed water-
ould ways, strip cropping and ter-
racing, among others. ■