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EFFECT OF SALINITY, ALKALINITY, PHOSPHATE AND ORGANIC MATTER ON THE MOVEMENT OF NEMATICIDES IN SOIL

by
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There are many problems associated with the application of pesticides in the soil, as reviewed by Bailey and White (1970). Singh *et al.* (1977) found that several factors such as organic matter, calcium carbonate and pH of the soil influenced the movement of nematicides. No attempt has so far been made to determine the effect of different salts, normally present in the soil, on the mobility of nematicides. The present study examines the effect of different saline, alkaline, phosphatic and neutral salts on the movement of dazomet, oxamyl and dichlorofenthion in the soil.

Materials and Methods

Samples of the top layer of soil (0-30 cm) from Aligarh Muslim University farm were crushed and passed through a 100 mesh sieve. The physico-chemical properties were determined:

Sand = 32.1%; Silt = 60.4%; Clay = 7.5%; pH = 8.1
E.C. = 1.6×10^{-3} mmhos/cm; organic matter = 0.38% and
CEC = 9.0 meq/100 g soil.

Salts ($CaSO_4$, $MgSO_4$, Na_2CO_3, $NaHCO_3$, Na_3PO_4 and Na_2SO_4) were added at the rate of 1, 3 and 5 g per 100 g soil. Distilled water was added to each sample to make a slurry, which was later spread onto thin layer chromatography (TLC) plates and dried at room temperature (Helling and Turner, 1968). Dazomet, oxamyl and dichlorofenthion were applied as spots on the plate base line with Lambda pipette. The spots were dried at room temperature and the plates developed using distilled water. The plates were again dried and sprayed with 0.5% brilliant green in acetone as a detector for dazomet and oxamyl and 0.5% silver nitrate in acetone for dichlorofenthion. Dazomet and oxamyl appeared as pale yellow spots against the dark green background without exposure to UV light and dichlorofenthion as black spots after exposure to UV light for 5 to 10 minutes.

Results and Discussion

The addition of sulphate salts to the soil did not appreciably affect pH but did increase the electrical conductivity (Table I). The carbonate and bicarbonate salts increased both pH and electrical conductivity of the soil; this effect was more marked with sodium carbonate. Similarly, phosphate increased both pH and electrical conductivity. Generally the increase in pH and electrical conductivity was proportional to the concentration of the salts added.

On the TLC plates, there were either tailings or lateral movement of nematicides. Consequently, the data has been summarised as frontal R_f-values (Singh *et al.*, 1979).

Table I - *Variations of pH and E.C. of the soil when different salts were added.*

Salts/100g of soil	pH				EC in mmhos/cm x 10^{-3}			
	Natural soil	1%	3%	5%	Natural soil	1%	3%	5%
	8.10	—	—	—	1.60	—	—	—
$CaSO_4$	—	7.60	7.55	7.55	—	2.25	3.00	3.00
$MgSO_4$	—	7.65	7.70	7.70	—	2.10	4.60	6.90
Na_2CO_3	—	9.95	10.15	10.25	—	4.50	9.90	15.90
$NaHCO_3$	—	8.30	8.50	8.70	—	3.30	6.30	10.10
Na_2SO_4	—	8.10	8.10	8.10	—	10.65	12.38	13.95
Na_3PO_4	—	10.80	11.50	11.50	—	2.25	6.60	8.78

Table II - *Effect of organic matter on the movement of some nematicides in soil. (Movement expressed as frontal R_f).*

Nematicides	Soil lacking organic matter	Natural soil	LSD at 1%
Damozet	1.00	0.95	0.14
Oxamyl	1.00	0.90	0.16
Dichlorofenthion	0.87	0.75	0.08
L.S.D. at 1%	0.05	0.17	

The soil was treated with 30% H_2O_2 to remove the organic matter (Dixon *et al.*, 1970). This soil was used as adsorbent with distilled water as a developer. There was a slight increase in the movement of dazomet and oxamyl and a significant increase in the movement of dichlorofenthion (Table II). The removal of organic matter from the soil increased the mobility of all three nematicides probably because of the dispersal of the soil particles, as suggested by Helling (1971). The presence of organic matter in the soil prevented the leaching of the nematicides.

While calcium sulphate caused no changes in the movement of the nematicides, magnesium sulphate induced significant reduction in movement at concentrations of 3 and 5 percent (Table III).

Sodium carbonate decreased the movement of dazomet at all three concentrations and increased the movement of dichlorofenthion only at lower concentrations. The movement of oxamyl remained unaffected at lower concentrations, but decreased at higher concentrations. The concentration of sodium bicarbonate had no effect on the movement of the nematicides.

Sodium sulphate and sodium phosphate significantly decreased the movement of dazomet and oxamyl at all concentrations whereas the movement of dichlorofenthion decreased only when the chemicals were applied at 3 and 5 percent (Table III).

The average movement of the three nematicides in descending order is:

Dazomet: $CaSO_4 > MgSO_4 > Na_3PO_4 > NaHCO_3 > Na_2CO_3 > Na_2SO_4$
Oxamyl: $CaSO_4 > MgSO_4 > Na_3PO_4 > NaHCO_3 > Na_2CO_3 > Na_2SO_4$
Dichlorofenthion: $NaHCO_3 > Na_2CO_3 > Na_3PO_4 > CaSO_4 > MgSO_4 > Na_2SO_4$

Table III - *Effect of different salts on the movement of some nematicides in the soil. (Movement expressed as frontal R_f).*

Nematicides/salts	Movement of nematicides in different percentages of salt added to the soil				LSD at 1%
	Natural soil	1%	3%	5%	
$CaSO_4$:					
Dazomet	0.95	1.00	1.00	1.00	0.07
Oxamyl	0.90	1.00	1.00	1.00	0.07
Dichlorofenthion	0.75	0.73	0.73	0.64	0.16
L.S.D. at 1%	0.17	0.92	0.13	0.10	
$MgSO_4$:					
Dazomet	0.95	0.91	0.76	0.75	0.15
Oxamyl	0.90	0.90	0.88	0.78	0.11
Dichlorofenthion	0.75	0.72	0.64	0.50	0.11
L.S.D. at 1%	0.17	0.94	0.08	0.08	
Na_2CO_3:					
Dazomet	0.95	0.81	0.69	0.54	0.16
Oxamyl	0.90	0.87	0.71	0.66	0.16
Dichlorofenthion	0.75	0.83	0.81	0.77	0.06
L.S.D. at 1%	0.17	0.08	0.17	0.26	
$NaHCO_3$:					
Dazomet	0.95	0.82	0.74	0.65	0.17
Oxamyl	0.90	0.88	0.83	0.69	0.15
Dichlorofenthion	0.75	0.90	0.94	1.00	0.15
L.S.D. at 1%	0.17	0.17	0.15	0.17	
Na_2SO_4:					
Dazomet	0.95	0.79	0.52	0.50	0.19
Oxamyl	0.90	0.69	0.57	0.53	0.21
Dichlorofenthion	0.75	0.67	0.43	0.41	0.19
L.S.D. at 1%	0.17	0.26	0.08	0.26	
Na_3PO_4:					
Dazomet	0.95	0.90	0.75	0.66	0.006
Oxamyl	0.90	0.90	0.89	0.72	0.009
Dichlorofenthion	0.75	0.74	0.71	0.55	0.052
L.S.D. at 1%	0.17	0.08	0.17	0.22	

In conclusion the movement of dazomet and oxamyl was greatest in the presence of saline salts and that of dichlorofenthion in the presence of alkaline salts.

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SUMMARY

Studies on the influence of various salts on the movement of dazomet, oxamyl and dichlorofenthion in the soil indicated that the movement of dazomet and oxamyl was greatest when saline salts were mixed; the movement of dichlorofenthion was influenced mostly by alkaline salts. In the presence of sodium sulphate, a neutral salt, the movement of all three nematicides was lowered.

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