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EFFECT OF CEMENT KILN DUST DEPOSITION ON THE PHYSICAL AND CHEMICAL PROPERTIES OF THE SOIL IN THE NEIGHBOURHOOD OF A CEMENT FACTORY

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ABSTRACT

The effect of cement deposition on the soil physical and chemical properties in the neighborhood of Sankar Cements, 6 km away from Tirunelveli town was studied. A negative correlation was observed in the eastern direction for bulk density (-0.9**) and particle density (-0.8**), and a positive correlation for porosity (0.8**). Likewise, in the chemical properties a negative correlation was observed for R_2O_3 (-0.81**), Ca (-0.079**), Na (-0.37**) and K (- 0.87**). The values were deviating from the factory. This shows that a marked influence was observed on the eastern side of the factory due to the cement kiln dust upto 2.0 km from the factory.

KEY WORDS : Cement kiln, dust, soil pollution

Air pollution is considered to be one of the most dangerous and common kind of the environmental pollution that has been reported in most industrial towns and metropolitans of India and abroad. Cement dust is a common air pollutant around cement factories and construction sites and has a significant effect on the soil prorperties. The quantity of cement dust varies with distance. Patel and Pandey (1987) reported that the grain size of the dust fallout particles was found to be varying depending on the distance of the sampling site from the emission source. The size of the particles collected at one km distance was found to be 5-30 micron (60%) and less than 5 micron (40%), whereas at the 4 km distance, the size distribution was 65 per cent for particles smaller than 5 microns and 35 per cent for particles greater than 5 microns. The present study deals with the effect of cement kiln dust on the soil at 40 locations in each direction at varying distances from cement factory.

MATERIALS AND MEHTODS

Forty soil samples were collected from four directions around the factory, with a total of 160 samples. The first sample in each direction was collected at 0.6 km and the 40th sample at 4.5 km away from the factory, with an interval of 10 m between samples.

The soil samples so collected were analysed for various physical properties such as bulk density particle density, porosity, water holding capacity volume expansion on wetting, iron and aluminium oxides total Ca, Mg, Na and K by routine methods.

RESULTS AND DISCUSSION

The physical and chemical properties of 160 surface soil samples were analysed Among the physical properties, lower mean values of porosity were recorded with north (31.57%) and east (36.66%). The mean of bulk density (1.43 g cm^{-3}) and particle density (2.33 g cm^{-3}) was higher for east. Water holding capacity (52.1%) and volume expansion (5.1%) were also found to be higher for east. A marked decline in porosity (r=0.8**) was observed upto 2.2 (r=0.9**) and 2.0 km (r=-0.8**), respectively from the factory in the east. According to the meteorological data wind blows towards east in most of the months in a year. Hence, the eastern side of the factory, which is in the direction of smoke carrying the dust pollutant showed comparatively lower porosity values than on the other sides and it might be du to the occupation of cement dust in the soil voids. This is in accordance with the findings of Parthasarathy *et al.*, (1975) and Saravanan (1994). As the cement dust occupies the voids, the bulk density and particle density were increased.

The soil of eastern direction registered comparatively higher mean values for Sesquioxide (10.4%), Ca (9.2%) and Na (0.07%). A highly

Table 1. Physical analysis of surface soil samples east

Distance (km)	Porosity (%)	Bulk density ($g\ cm^{-3}$)	Particle density ($g\ cm^{-3}$)	Water holding capacity (%)	Volume expansion (%)
0.6	28.5	1.71	2.64	44.4	5.21
0.7	29.5	1.70	2.69	57.1	5.44
0.8	30.3	1.69	2.60	53.1	5.89
0.9	29.5	1.68	2.65	55.1	5.9
1.0	29.4	1.65	2.61	57.8	6.4
1.1	30.4	1.65	2.63	53.1	6.12
1.2	30.0	1.64	2.60	52.7	5.4
1.3	30.4	1.62	2.60	49.1	4.95
1.4	29.6	1.65	2.62	45.6	4.94
1.5	28.5	1.62	2.64	49.8	4.98
1.6	27.9	1.64	2.65	50.9	5.01
1.7	28.1	1.69	2.66	45.0	4.37
1.8	29.4	1.62	2.60	54.2	5.14
1.9	30.6	1.62	2.60	53.6	5.29
2.0	31.2	1.62	2.63	55.7	5.31
2.1	38.2	1.44	2.51	50.0	4.96
2.2	41.9	1.71	2.41	53.6	5.27
2.3	45.2	1.40	2.32	50.7	5.11
2.4	40.9	1.34	2.31	54.3	5.18
2.5	40.2	1.30	2.41	57.3	6.01
2.6	41.0	1.40	2.39	55.3	4.94
2.7	35.8	1.32	2.42	56.2	4.86
2.8	35.9	1.32	2.51	51.6	4.92
2.9	40.6	1.24	2.39	2.5	5.03
3.0	41.8	1.32	2.18	47.2	4.87
3.1	39.5	1.34	2.28	48.4	4.94
3.2	40.3	1.39	2.27	46.3	5.89
3.3	39.2	1.34	2.25	54.1	4.37
3.4	40.1	1.29	2.18	54.7	5.14
3.5	38.2	1.31	2.31	55.4	6.40
3.6	39.5	1.21	2.25	55.3	5.19
3.7	42.9	1.31	2.42	54.5	4.96
3.8	41.4	1.21	2.25	56.3	5.12
3.9	43.1	1.18	2.21	43.9	5.99
4	47.1	1.42	2.21	52.9	5.31
4.1	36.2	1.39	2.42	47.5	5.27
4.2	35.1	1.21	2.39	49.5	4.67
4.3	46.5	1.20	2.40	55.2	5.18
4.4	48.3	1.18	2.29	52.1	4.87
4.5	47.5	1.21	2.39	50.1	5.30
Mean	36.7	1.40	2.40	52.1	5.10
SD	6.0	0.20	0.20	3.8	0.70
r	0.8**	-0.9**	-0.8**	0.03NS	-0.30NS

significant and negative correlation was observed between soil sesquioxide (r=0.81**), Ca(=-0.79**), Na (=-0.37**) and K (r=- 0.87**) content and cement kiln dust deposition. The maximum values of R_2O_3, Ca and K were found respectively upto 2.0 km, 2.2 km and 1.9 km away from the factory

Table 2. Total nutrient analysis of surface soil samples - east

Distance (km)	R_2O_3	Ca (%)	Mg (%)	Na (%)	K (%)
0.6	15.20	11.8	0.60	0.06	0.33
0.7	14.00	12.0	0.51	0.06	0.34
0.8	18.40	11.9	0.57	0.07	0.32
0.9	14.40	11.7	0.60	0.06	0.31
1.0	14.10	11.8	0.57	0.07	0.32
1.1	15.30	12.2	0.51	0.07	0.30
1.2	14.00	12.6	0.51	0.07	0.29
1.3	15.20	11.8	0.60	0.07	0.28
1.4	15.70	11.8	0.54	0.07	0.28
1.5	14.00	11.7	0.60	0.07	0.28
1.6	15.70	1.25	0.57	0.07	0.29
1.7	14.00	11.7	0.51	0.07	0.28
1.8	1.390	12.1	0.45	0.08	0.28
1.9	14.90	11.7	0.51	0.08	0.25
2.0	15.40	12.8	0.54	0.07	0.14
2.1	7.10	11.8	0.60	0.07	0.12
2.2	8.50	12.2	0.45	0.06	0.17
2.3	7.60	9.2	0.51	0.06	0.13
2.4	8.60	9.0	0.45	0.08	0.11
2.5	7.10	8.9	0.51	0.19	0.11
2.6	8.20	8.5	0.45	0.08	0.11
2.7	7.40	8.8	0.60	0.08	0.11
2.8	8.20	8.9	0.60	0.07	0.14
2.9	6.10	8.6	0.63	0.06	0.12
3.0	6.50	8.2	0.60	0.07	0.12
3.1	9.70	7.7	0.57	0.06	0.14
3.2	8.10	7.6	0.51	0.08	0.13
3.3	7.30	7.5	0.51	0.07	0.11
3.4	6.50	6.6	0.54	0.06	0.12
3.5	8.70	6.9	0.48	0.05	0.12
3.6	8.50	6.6	0.45	0.09	0.11
3.7	7.50	6.5	0.45	0.06	0.11
3.8	8.70	6.6	0.45	0.06	0.08
3.9	8.80	6.9	0.57	0.04	0.12
4.0	7.70	7.5	0.60	0.06	0.11
4.1	8.00	7.7	0.57	0.06	0.11
4.2	8.10	6.9	0.54	0.06	0.14
4.3	7.5	7.5	0.54	0.06	0.12
4.4	7	6.5	0.55	0.06	0.13
4.5	7.2	6.6	0.54	0.07	0.12
Mean	10.4	9.2	0.54	0.07	0.19
SD	3.50	2.4	0.05	0.01	0.08
r	-0.81**	-0.79**	-0.41NS	-0.37**	-0.87**

in the east, beyond which there was a gradual decline upto 4 km. This may be to the cement dust deposition which is chemically a mixture of oxides of calcium, potassium, aluminium, silica and sodium (Singh and Rao, 1978 ; Indhirabai *et al.*. 1989). The decrease in Ca content from the factory premises to outside locations was also reported by Asubiojo *et al.* (1991). The major effect on soil due

Table 4. Total nutrient analysis of surface soil samples (Correlation values)

Direction	R_2O_3	Ca	Mg	Na	K
East	-0.81**	-0.79**	-0.14^{NS}	-0.37**	-0.87**
West	-0.1^{NS}	-0.1^{NS}	-0.14^{NS}	-0.31^{NS}	-0.12^{NS}
South	-0.3^{NS}	-0.1^{NS}	-0.18^{NS}	-0.13^{NS}	-0.10^{NS}
North	0.2^{NS}	0.1^{NS}	0.22^{NS}	0.20^{NS}	0.05^{NS}

Table 3. Physical analysis of surface soil samples (Correlation values)

Direction	Bulk density	Particle density	Porosity	WHC	Volume Expansion
East	-0.9**	-0.8**	0.8**	-0.30**	-0.30^{NS}
West	0.06^{NS}	0.01^{NS}	-0.20^{NS}	0.22^{NS}	0.12^{NS}
South	-0.23^{NS}	0.02^{NS}	0.07^{NS}	0.19^{NS}	-0.15^{NS}
North	0.30^{NS}	0.18^{NS}	0.11^{NS}	0.18^{NS}	0.12^{NS}

cement kiln dust was observed only upto 2.0 km om the factory approximately, this may be ecause of the wind velocity in the factory area 7.79 km hr^{-1}) which was sufficient enough to eposit only upto 2.0 km in the windward direction e., east.

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CHARACTER ASSOCIATION AND PATH ANALYSIS IN BLACK GRAM

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ABSTRACT

Forty black gram hybrids along with 14 parents were studied for genotypic correlation and path analyses. Seed yield exhibited significant positive association with primary branch number, cluster number, pod number, pod length, seed number per pod, 100 seed weight and total dry matter production. The path analysis indicated that maximum direct effect on seed yield was exerted by pod number followed by total dry matter production, primary branch number, cluster number, seed number per pod and 100 seed weight.

KEY WORDS : Black gram, correlation, path analysis

Metric characters of economic importance are often associated with one another, and particularly yield is dependent on several other component characters. Knowledge of correlation between yield and other yield component characters is helpful in selection of superior plant type. When more