selection in S_1 generation particularly for those characters showing very high ratios. Further, production of large number of S_0 plants in multiple crosses would be a better strategy to increase the amount of variability. Such suggestion was made by other workers also (Wilcox *et al.*, 1984).

The genomes in groundnuts are genetically related (Wynne and Coffelt, 1982). It is quite possible that the genes pass to the subsequent generation in different blocks reducing within and increasing between family variability (Rachie and Roberts, 1975). In the present study, the crosses involving resistant parent RMP 12 gave higher ratios of between to within family variances as compared to those involving PI 393516 for most of the characters. The Virginia culture RMP 12 belongs to subspecies *hypogaea* while the Valencia culture PI 393516 to subspecies *fastigiata*. The ovule parent *viz.* TMV 2 and JL 24 are Spanish bunch types belonging to subspecies *fastigiata*. Th higher divergence of RMP 12 from the ovu parents might be the possible reason for the high ratios.

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EFFECT OF CEMENT DEPOSITION ON SOIL HORIZONS AT DIFFERENT LOCATIONS AROUND THE CEMENT FACTORY

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ABSTRACT

A study was undertaken in the area around a cement factory to assess the effect of cement kiln dust on the soil. Cement dust deposit varied with direction and distance from the kiln. The effect of cement kiln dust was comparatively high in east than south, west and north around the factory. In the eastern direction, the effect was more pronounced in the first two horizons. The cement dust showed an increase in bulk density and particle density and a decrease in porosity in E_1 and E_2 pedons. High values of pH and EC were recorded for the E_1 and E_2 pedons. Cation exchange capacity, exchange capacity, exchangeable Ca and K were also found to be high in E_1 and E_2 compared to all other pedons in all the four directions. Pedons E_1 and E_2 recorded comparitively higher content of free $CaCO_3$, sesquioxides and acid insolubles.

KEY WORDS : Cement dust, dust pollution, air pollution

Modern industries produce a variety of pollutants and release them into the atmosphere, water and soil which adversely affect the growth of crop plants. Cement industry is one of the major contributors of air pollution. The accumulation of cement dust varies with the distance from the industry. Chemically, it is a mixture of oxides of calcium, potassium, aluminium, silicon and sodium. It has the property of setting into a hard mass forming a thick crust when it comes in contact with water. It leads to a decrease in water holding capacity of soil, increase in pH, conductivity, Ca and Al, and decrease in nitrogen availability thereby affecting the plant growth. The harmful effects of cement exhausts on soil physico-chemical and biological properties are not fully substantiated hitherto and have been questioned by investigators. The present paper deals with the effect of cement dust pollutant on certain physical and chemical properties of soil.

Table 1. Physical and chemical properties of soil horizons in the east

Horizon	Depth (cm)	Physical properties: Bulk density (g/cc)	Particle density (g/cc)	Porosity (%)	Chemical properties: pH	EC (dS/m)	CEC (me/ 100 g)	Exchangeable bases (me/100 g): Ca	Mg	Na	K	Free $CaCO_3$ (%)	Sesquioxide (%)	Acid insoluble (%)
Pedon E_1														
Ap	0-9	1.95	2.64	28.0	8.72	0.82	30.0	24.5	4.8	0.04	0.13	9.00	16.6	66
Bw	9-31	1.55	2.29	29.0	8.31	1.09	26.3	16.8	7.6	0.05	0.28	7.96	9.6	82
Ic	31-48	1.67	2.45	28.0	8.32	1.14	24.9	16.0	7.6	0.09	0.30	7.04	7.5	82
IIc	48-64	1.68	2.52	30.0	8.44	1.27	20.3	12.2	6.4	0.11	0.45	7.04	5.3	81
IIIc	64-90	1.70	2.53	33.0	8.50	1.30	19.3	12.2	6.4	0.11	0.45	5.60	3.1	85
Pedon E_2														
Ap	0-29	1.95	2.59	35.0	8.63	0.45	29.1	24.5	4.0	0.04	0.28	7.96	16.6	67
Al_2	29-45	1.93	2.58	37.0	8.00	0.49	21.9	15.6	4.0	0.05	0.30	7.04	12.0	81
Al_3	45-58	1.87	2.52	39.0	8.05	0.55	24.3	18.8	4.4	0.05	0.30	6.48	8.1	82
Bw_1	58-73	1.66	2.38	35.0	8.09	0.77	27.7	21.2	4.8	0.05	0.30	4.52	8.1	83
Bw_2	73-200	1.65	2.37	35.0	8.23	0.78	28.4	21.2	4.8	0.06	0.45	4.32	7.6	83
Pedon E_3														
Ap	0-30	1.18	2.26	44.0	8.01	0.71	26.3	17.2	7.6	0.09	0.30	7.12	8.8	73
Bw	30-148	1.14	2.12	33.0	8.12	0.75	28.4	7.6	10.0	0.10	0.45	5.20	7.3	79
Pedon E_4														
I	0-45	1.17	2.19	45.0	8.01	0.35	11.6	8.0	3.2	0.08	0.30	6.48	7.0	74
II	45-62	1.53	2.52	60.0	8.12	0.55	20.3	16.0	3.2	0.08	0.30	6.48	5.2	79
III	60-100+	1.21	2.25	47.0	8.07	0.61	21.9	16.8	4.0	0.10	0.45	3.32	4.9	80

MATERIALS AND METHODS

The experimental area was located in the fields around Sankar Cements factory, 6 km away from Tirunelveli town. Profiles were excavated around the cement factory in all four directions within a radius of 4 km. A total of 16 profiles was freshly opened, four on each direction. On all the four directions, the first profile was opened one km away from the factory. The remaining three profiles on each direction were dug at an interval of one km. In the profiles, soil samples were collected horizonwise for estimating the physical and chemical properties and fix the range in characters.

The soil samples were analysed for various physical properties such as bulk density, particle density, porosity, water holding capacity and volume expansion on wetting by Keen Raczkowski brass cup measurements (piper, 1966). Saturated hydraulic conductivity of compacted soil was estimated by core sampler method (Dhakshinamoorthy and Gupta, 1981). The soil samples were also analysed for p^H, EC, CEC,

Table 2. Physical and chemical properties of soil horizons in the south

Horizon	Depth (cm)	Physical properties: Bulk density (g/cc)	Particle density (g/cc)	Porosity (%)	Chemical properties: pH	EC (dS/m)	CEC (me/ 100 g)	Exchangeable bases (me/100 g): Ca	Mg	Na	K	Free $CaCO_3$ (%)	Sesquioxide (%)	Acid insoluble (%)
Pedon S_5														
Ap	0-45	1.30	2.35	45.0	7.78	0.32	21.9	13.2	6.4	0.10	0.29	2.88	8.0	70
Pedon S_6														
Ap	0-47	1.27	2.21	43.0	8.08	0.30	21.9	13.6	6.0	0.08	0.21	2.56	9.5	72
Bw	47-128	1.17	2.15	35.0	8.12	0.31	23.0	15.2	6.4	0.09	0.23	2.84	11.6	69
B_3	128-150	1.55	2.49	37.0	8.14	0.42	15.2	7.6	6.4	0.10	0.25	3.40	14.1	75
Pedon S_7														
Ap	0-45	1.36	2.51	48.0	7.72	0.47	16.8	7.6	5.6	0.05	0.19	2.56	9.5	74
Bw_1	45-112	1.27	2.45	43.0	7.99	0.51	19.8	12.8	5.2	0.08	0.21	2.68	13.9	72
Bw_2	112-140	1.25	2.31	41.0	8.15	0.53	19.8	13.2	5.2	0.08	0.30	3.64	13.9	70
Pedon S_8														
Ap	0-20	1.43	2.47	44.0	8.05	0.24	22.4	7.6	6.0	0.07	0.21	3.72	5.8	75
Bw	20-85	1.18	2.29	30.0	8.12	0.36	24.3	8.0	5.6	0.07	0.22	4.84	12.4	74

Table 3. Physical and chemical properties of soil horizons in the west

Horizon	Depth (cm)	Physical properties: Bulk density (g/cc)	Particle density (g/cc)	Porosity (%)	Chemical properties: pH	EC (dS/m)	CEC (me/100 g)	Exchangeable bases (me/100 g): Ca	Mg	Na	K	Free $CaCO_3$ (%)	Sesquioxide (%)	Acid insoluble (%)
Pedon W_9														
Ap	0-11	1.21	2.46	50.0	7.95	0.34	19.3	12.0	5.6	0.01	0.18	3.44	9.1	71
Bw	11-21	1.14	2.34	44.0	7.99	0.43	24.9	16.4	6.4	0.05	0.37	3.76	11.0	73
Ic	21-34	1.35	2.52	53.0	8.01	0.52	10.6	7.2	2.8	0.05	0.39	4.12	11.0	72
IIc	34-90	1.37	2.54	56.0	8.16	0.56	14.7	8.0	5.6	0.07	0.41	4.44	11.9	72
Pedon W_{10}														
Al_1	0-20	1.30	2.43	47.0	8.18	0.25	17.3	11.2	5.6	0.01	0.10	4.88	13.2	76
Al_2	20-32	1.34	2.55	59.0	8.20	0.32	8.5	5.2	2.4	0.07	0.41	3.76	14.7	77
Pedon W_{11}														
Ap	0-16	1.20	2.18	38.0	8.05	0.31	21.9	13.2	7.2	0.08	0.13	2.20	5.2	77
Ic	16-25	1.44	2.39	54.0	8.08	0.87	11.1	8.0	2.4	0.09	0.18	3.76	6.9	76
IIc	25-34	1.28	2.10	50.0	8.16	0.37	20.4	14.0	5.6	0.13	0.18	4.12	9.1	75
IIIc	34-80	1.39	2.21	49.0	8.28	0.52	17.8	11.2	5.6	0.13	0.44	3.44	9.1	77
Pedon W_{12}														
AI	0-24	1.49	2.20	42.0	7.58	0.15	20.4	12.4	7.2	0.07	0.13	2.20	7.2	76
Bw	24-100	1.45	2.31	46.0	7.73	0.17	21.9	12.0	7.2	0.08	0.18	2.20	11.0	75
Cr	101⁺	1.45	2.31	46.0	8.04	0.22	9.6	5.6	3.2	0.12	0.19	3.44	12.0	77

Exchangeable bases, free $CaCO_3$, Sesquioxides and Acid insolubles using standard procedures.

RESULTS AND DISCUSSION

The results on the cement dust falls in the vicinity of cement factory are given in Tables 1, 2, 3 and 4. The effect of cement kiln dust was found to be more in the soils which are nearer to the cement factory and in the windward direction. When all the 16 profiles were examined, it was observed that the effect was more on the profiles E_1 and E_2. As per the meterological data, wind was blowing mostly on the eastern direction. Since E_1 and E_2 pedons were close to the factory and on th windward direction, the influence due to cement kiln dust may be high. The bulk density and particle density were comparatively higher and porosity was lower in the pedons E_1 and E_2. This might be due to the nearness of these areas to the direction of smoke carrying the cement dust. The voids of soils in these area might be occupied by cement dust and such thing might affect the crop growth because of less soil air in reduced pore space. Similar results were reported by Parthasarathy *et al.* (1975). However, water

Table 4. Physical and chemical properties of soil horizons in the north

Horizon	Depth (cm)	Physical properties: Bulk density (g/cc)	Particle density (g/cc)	Porosity (%)	Chemical properties: pH	EC (dS/m)	CEC (me/100 g)	Exchangeable bases (me/100 g): Ca	Mg	Na	K	Free $CaCO_3$ (%)	Sesquioxide (%)	Acid insoluble (%)
Pedon N_{13}														
AI	0-28	1.45	2.42	47.0	7.12	0.32	15.7	11.2	4.0	0.04	0.10	2.88	7.6	73
Bt	28-38	1.14	2.19	55.0	7.14	0.74	16.8	10.8	4.4	0.06	0.10	3.40	10.2	69
Pedon N_{14}														
Ap	0-16	1.43	2.39	50.0	7.00	0.13	15.7	10.8	4.4	0.04	0.08	2.44	9.3	72
Bw	16-37	1.27	2.19	44.0	7.04	0.13	18.3	10.8	6.0	0.04	0.09	3.40	13.1	73
Ic	37-60	1.61	2.43	60.0	7.08	0.30	[illegible]	7.2	3.2	0.05	0.10	4.20	11.4	72
IIc	60-100	1.47	2.41	55.0	7.14	0.31	11.1	6.4	2.8	0.06	0.10	4.52	5.9	76
Pedon N_{15}														
AI	0-10	1.35	2.28	48.0	6.88	0.15	11.1	7.6	3.2	0.05	0.09	2.12	9.5	70
Bw	10-35	1.23	2.12	57.0	6.93	0.20	13.7	10.0	2.8	0.06	0.09	3.04	7.4	66
Pedon N_{16}														
AI	0-10	1.55	2.49	48.0	6.88	0.12	11.1	6.8	3.2	0.04	0.09	2.40	10.1	75
Bw	10-21	1.39	2.33	55.0	7.14	0.16	15.7	8.0	6.0	0.04	0.11	2.52	10.3	72

holding capacity, volume expansion and hydraulic conductivity did not show a defenite trend in all the directions with respect to cement kiln dust deposition.

Among the chemical properties, p^H and EC were comparatively higher for E_1 and E_2 pedons. This might be attributed to the release of Ca^{++}, Mg^{++}, Na^+ and OH^- ions from the cement kiln dust. This was in accordance with the results of Prasad *et al.* (1991). The cation exchange capacity of the surface horizons of E_1 and E_2 pedons was comparatively higher than the other pedons. This might be due to the enrichment of cations from the cement kiln dust. Oblisami *et al.* (1978) reported similar results. Among the exchangeable cations, Ca of E_1 was remarkably higher than other pedons. Apart from this, free $CaCO_3$, sesquioxides and acid insolubles were higher in E_1 and E_2 pedons when compared to all other pedons in all the four directions, which may be due to the nearness of these area to the cement dust transport which contained considerable amount of Ca, Fe, Al and SiO_2 in the cement kiln dust.

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COMPONENTS PRODUCTIVITY IN LOWLAND INTEGRATED FARMING SYSTEMS

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ABSTRACT

Field investigations were carried out under lowland farming at the Department of Agronomy. Tamil Nadu Agricultural University, Coimbatore for two years (1993-94 and 1994-95) to identify best mix from among poultry, pigeon, fish and mushroom components with cropping as base activity in comparision with cropping alone, Productivity of each component was recorded on their economic products and expressed as rice grain equivalent yield after conversion on the basis of unit price. Results indicated that integration of cropping with components like fish and mushroom as well as poultry and pigeon resulted in higher productivity than cropping alone under lowland integrated farming system.

KEY WORDS : Integrated farming System, component productivity, rice grain equivalent yield.

The average holding of farm in India has been declining and over 80 million out of 105 million operational holdings are below the size of one ha (Mahapatra and Bapat, 1992). Because of ever increasing population and decline in per capita availability of land in India, there is hardly any scope for horizontal expansion of land for food, feed and fibre production. Vertical expansion by integrating appropriate farming components requiring lesser space and time and ensuring higher total productivity of the system is the only alternate option left out. Aiming for increased total productivity per unit area in specified time is the ultimate way for sustainability of food production. Hence, the sustainable farming systems, economically viable and ecologically compatible encompassed with higher productivity to meet the present and future needs without jeopardizing the