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RESEARCH ARTICLE

GROWTH PARAMETERS OF TOMATO (*Lycopersicon esculantum* Mill.) AS INFLUENCED BY CEMENT DUST

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ABSTRACT

A pot experiment was conducted during 2010 in the Department of Agriculture Botany Janta P.G. College Ajeetmal, Auraiya (C.S.J.M. University Kanpur) (U.P.)-India, to evaluate the effect of cement dust (@3g/ pot/ plant) on growth parameters of tomato. Cement dusts showed both inhibitory and promotory effects on growth parameters of tomato. A significant reduction was noted in number of leaves, leaf area, root length, shoot length, dry weight of leaves, dry weight of plant, whereas increase in specific leaf area of plants treated with cement dust. Root/shoot length ratio, specific leaf weight increased but leaf weight ratio and leaf area ratio was decreased in treated plant (at 45 days after planting) as compared to control. But, after 65 days of planting specific leaf weight, root/shoot length ratio was decreased and leaf weight ratio, leaf area ratio increased.

Key Words **: Pollution, cement dust, growth parameters.**

Tomato is one of the most important "protective foods" because of its special nutritive value and wide spread production occupies third place in vegetable crop production after potato and sweet potato. It is used as a soup, salad, pickles, ketchup, puree, sauces and in many other ways. Tomato is a major source of vitamins and minerals. It contains ascorbic acid 15 mg to 20 mg /100g edible portion), citric acid (13 mg/ 100 g edible portion) and mallic acid and glutamic acid mostly present in tomato. Tomato also contains many important minerals like Na (4850 mg), K (1140 mg), Ca (20mg), Mg (15 mg), P (36 mg), K (1.8mg), S (24 mg) ,Cl (38 mg/ 100 g edible portion), Zn and B. The alkaloid present in tomato is called tomatin and the coloured pigment is called lycopene. Tomato is determinate, indeterminate and Semi-determinate in habit and is a day neutral plant, it requires a warm season.

Air pollution has become a major threat to the survival of plants in the industrial areas Gupta and Mishra (1994). Rapid industrialization and addition of the toxic substances to the environment is responsible for altering the ecosystems Iqbal and Shafig (2001). The cement is the source of particulate matter deposits on the buildings and plants, producing a significant effect. The cement also plays a vital role in the imbalances of the environment and produces air pollution hazards Agrawal *et al*., (2006). In comparison with gaseous air pollutants, many of which are readily recognized as being the cause of injury to various types of vegetation, relatively little is known and limited studies have been carried out on the effects of cement on the growth of plants.

Reduction in the number of flowers and yield of black gram due to cement pollution Prasad and Inamdar (1990). The toxic effects of cement on some plants were reported by Gupta and Mishra (1994). The effect of cement on growth of *Albizia lebbeck and Dadonia viscosa* has been studied Iqbal and Shafig (2001). Abdullah and Iqbal (1991) noted stomatal clogging of *Iphonia grantioides and Boiss* up to 81% due to cement and particulate matter.

Reductions in photosynthetic rate (27.1%), test weight (18.8 %), harvest index (8.4%), yield (20.7%), root and shoot lengths of wheat genotype Rai *et al*., (2007). Production of more number of leaves with smaller area in polluted environment Pandey and Agawal (1994). Cement dusts consist of many toxic elements which may be hazardous not only to the humans but also to the vegetation in the surrounding area Wankhade and Garg (1989). Keeping this in view, the present study was undertaken to find out the effect of cement dust on morphological parameters of tomato (*Lycopersicon esculantum L*.).

MATERIALS AND METHODS

A pot experiment was conducted at the Department of Agriculture Botany, Janta P.G. College Ajeetmal, Auraiya (C.S.J.M. University Kanpur) (U.P.)-India during 2010 to evaluate the effect of cement dusts @3g/ plant on growth of tomato. Tomato seedlings were raised from randomly grown seeds in small pots filled with loam soil (2:1; fine sand: natural manure). The cement dust ($Ca_3SiO_{5,}$ 50-70%: $Ca_2SiO_{4,}$ 15-30%: $Ca_3Al_2O_{4,}$ 5-10%:$Ca_4Al_nFe_{2-n}O_{7,}$ 5-15% and 3-8% oxides of calcium and magnesium) @ 3g/plant/pot was spread by bulb sprayer on the treated plants twice a week. After every week, position of the pots was changed for obtaining results. Three replicates were maintained for each treatment and irrigation was provided by tap water. At the end of the experiment, the plants were uprooted carefully from the pots and were washed under tap water. Data on growth parameters *viz.*, number of leaves, leaf area, root and shoot length, plant circumference, dry weight of leaves, dry weight of plant, root/shoot length ratio, specific leaf area, specific leaf weight, leaf weight ratio and leaf area ratio were recorded at two stages i.e., 45 and 65 days after planting (DAP). A uniform size of plant was selected in each of the control and treatment pots for growth analysis. Plant samples were separated into stem, root and leaves and their leaf area was measured by plotting the plucked leaves on graph paper and area was calculated. Dry weight of the plant was calculated on oven dry basis. The plant material in an electric hot air oven at 80^0C for two days. The leaf area ratio (LAR) and specific leaf weight (SLW) were calculated by the formula suggested by Gardner *et al*., (1985).

Root/Shoot length ratio (cm cm^{-1}) = Root length / Shoot length

Leaf weight ratio (g g^{-1}) = Leaf dry weight / Total plant dry weight

Specific leaf area (cm^2 g^{-1}) = Leaf area / Leaf dry weight

Leaf area ratio (cm^2 g^{-1}) = Leaf area / Total plant dry weight

Specific leaf weight (g cm^{-2}) = Leaf dry weight / Leaf area

Statistical analysis is based on the method "analysis of variance" by Panse and Sukhatme (1978) and the critical differences were computed at 5 % level of significance.

RESULTS AND DISCUSSION

Cement dust (Table 1) caused both inhibitory and promontory effects on tomato plant. The inhibitory effect reduced the number of leaves, root length, shoot length, leaf area, dry weights of leaves and plant. The root/ shoot length ratio and specific leaf weight initially increased (up to 45 DAP) thereafter it decreased (at 65 DAP) as compared to control. Specific leaf area increased, leaf weight ratio and Leaf area ratio decreased after 45 days after planting. But after 65 days,

Table 1 : Growth parameters of tomato as influenced by cement dust

Sr. No.	Growth parameters	45 DAP Control	45 DAP Cement Dust (@ 3 g/Plant)	65 DAP Control	65 DAP Cement dust (@ 3 g/Plant)
1.	Number of leaves	22.33 ± 0.57	9.00 ± 1.11	32.00 ± 2.00	10.50 ±1.32
2.	Root length (cm)	16.66 ± 0.28	12.40 ± 0.40	22.16± 0.76	11.16±0.76
3.	Shoot length (cm)	56.00 ± 2.00	20.5 ± 2.50	61.6 ±1.52	32.00 ±2.64
4.	Leaf area (cm^2)	78.66± 1.52	23.6 ±2.51	80.66 ± 1.15	25.33±2.51
5.	Leaf dry weight (g)	3.23 ± 0.05	0.9 ± 0.06	5.56 ±0.07	1.57 ± 0.08
6.	Plant dry weight (g)	6.29 ± 0.01	2.41 ± 0.01	12.46 ±0.04	3.08 ± 0.07
7.	Root/shoot length ratio (cm cm^{-1})	0.29 ± 0.00	0.60 ± 0.05	0.35± 0.00	0.34 ± 0.01
8.	Specific leaf area (cm^2 g^{-1})	24.33 ± 0.88	24.3 ±2.59	14.49 ± 0.21	16.18 ±2.14
9.	Specific leaf weight (g cm^{-2})	0.04 ± 0.00	0.04 ± 0.00	0.06 ± 0.00	0.06 ± 0.00
10.	Leaf weight ratio (g g^{-1})	0.50± 0.01	0.39 ± 0.00	0.44 ± 0.00	0.50 ± 0.02
11.	Leaf area ratio(cm^2 g^{-1})	12.50±0.23	9.78 ± 0.99	6.47 ± 0.01	7.78 ± 0.14

leaf weight ratio and leaf area ratio were increased as compared to control. Effect of cement dust reveled that with respect to number of leaves, root length (cm) and shoot length (cm) in treated plant were decreased up to 59.69%, 67%, 25.39%, 49.64% and 63.39% and 48.11% as compared to control. Leaf area (cm^2) decreased up to 69.92%, 68.59% and leaf dry weight (g) decreased up to 69.97% and 71.76% (significant at 0.01%). The plant dry weight (g) decreased up to 61.68% , 75.28%; root/shoot length ratio cm^{-1}) increased up to -106.89 and decreased up to 2.85% and specific leaf area (cm^2 g^{-1}) increased up to -0.25% and -11.66% . The specific leaf weight (g cm^{-2}) increased up to -2.5% and decreased up to 7.35% ; leaf weight ratio (g g^1) and leaf area ratio (cm^2g^{-1}) both decreased up to 21.73% and 21.76% after 45 days of seedling growth as compared to control. But, after 65 days of seedling growth, both the parameters were increased up to -14.89% and -20.25% (both significant at 0.01%) as compared to control. This study indicated that cement dust had a significant effect on the growth of tomato.

Toxic compounds such as fluoride, magnesium, lead, zinc, copper, beryllium, sulfuric acid and hydrochloric acid were found to be emitted by cement manufacturing plants. Reduction in plant height, number of leaves, leaf area, dry weight, specific leaf area and weight and leaf area ratio and weight ratio of tomato showed that the losses are generally attributed to the cement dust which contained toxic metals. Decreased plant height of tomato might be due to the decrease in biomass production and chlorophyll content in leaves.

Adverse effects of air pollutants on biomass of several crops (Keutgen *et al*., 2005). Reductions in plant height under elevated pollutant (Rai *et al*., 2007). Significant reduction of 25.4 % was recorded in the plant height of palak experiencing ambient concentrations of 13.3, 31 and 55.7 ppb of SO_2, NO_2 and O_3, respectively. The reduction in leaf area and number of leaves plant^{-1} of strawberry when they were grown under 78 ppb O_3 (Keutgen *et al*., 2005). Various workers have also reported the reduction of plant growth as a consequence of pollution stress (Maruthi *et al*., 2007). A significant reduction in leaf area index; dry matter production and grain yield in blackgram were reported by Subha and Dakshinamoorthy (2000).

It may conclude that growth parameter of tomato was affected by cement dust which might be due to the presence of different toxic pollutants in cement dust. The phenological behavior of tomato was found to be highly affected by cement dust pollution. The tomato is a sensitive plant for soils and air of industrial areas, particularly with respect to cement factory in different parts of the country. Tomato should not be planted in the vicinity of cement industrial areas. The pollution tolerant plants species, like *Peltophorum pterocarpum*, *P. pterocarpum*, *Thespesia populnea* and *Ricinus communis etc.* should be planted around the cement industrial areas. In other industrial areas, tolerant tree species should be chosen according to the level of industrial pollution.

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