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CONTAMINATION OF FORAGE CROPS WITH LEAD FROM VEHICLE EXHAUST

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Contamination of fodder crops growing near the highway with lead from vehicle exhaust was determined. Lead contamination in *Pennisetum typhoideum* (65.0-82.0 ppm), *Trifolium alexandrinum* (56.8-76.1 ppm), *Cynodon dectylon* (42.2.60.3 ppm), *Oryza sativa* (52. 1-70.2 ppm) and *Avena sativa* 54.0-72.2 ppm) was maximum in the vicinity of the highway. An inverse relation was found between lead accumulation and distance from the road side.

INTRODUCTION

Evidence has accumulated over the years about contamination of the environment with lead emitted from exhausts of vehicles [1]. Elevated levels of lead in the atmosphere and vegetation adjacent to major roads are well documented [2]. It has been reported [3-5] that soils and plants growing near roads contain an excess of lead which is due to the accumulation of lead emitted by automobile exhaust on the surface of the plants and soils. Lead content of the soils near traffic lanes varied from 27-290 ppm as compared to 12-30 ppm in places away from the highway. Grasses and leafy vegetables growing near the roads have been reported [6] to contain 8-20 times more lead than normal contents.

The present paper reports contamination of forage crops with lead in Pakistan as a function of distance from roadsides.

MATERIALS AND METHODS

Samples of four commonly grown forages and naturally growing grasses were collected from both sides of G.T. Road, Lahore between Shalimar and Batapur (10-100 m. from the centre of the road during the years 1982-84). The samples were dried at 100-105°C for 20 hr. and ground to fine powder.

DETERMINATION OF LEAD

Lead was determined according to the method of Jan *et al* [7] by the atomic absorption spactrophotometer model 170-10 (Hitachi Ltd.) using air-acetylene flame at spectral line 283.3 nm.

RESULTS AND DISCUSSION

The results of the studies on the contamination of forage crops with lead are reported in Table 1. The maximum amount of lead (82 ppm) was recorded in *Pennisetum typhoideum* harvested from a distance of 10 m. from the centre of the road. 50 m. away it was 38-50 ppm and further decreased to 7-12 ppm in the samples collected from fields at a distance of 100 m. A similar trend was observed in other crops. This clearly indicated that auto traffic at highway noticeably increased the lead content of vegetation near the road. Regression analysis [8] of the data also confirmed this observation. The calculated value of the correlation coefficient (r) for most of these crops were negative and exceeded the theoretical value at P (0.05). This indicated an inverse relation between lead contamination and distance from the road.

These results are supported by the findings of Horak and Huber [9] who reported much higher (220 ppm) lead content in plants growing near traffic lanes. Rameau [6] observed 8-20 times more lead contamination of roadside crops compared with those from remote locations. Contamination levels recorded in the present studies at 10 m. from the road were 6-13 times higher than those detected at 100 m.

Among the crops *Pennesetum typhoideum* was found to be heavily contaminated (Table 1) than other crops. This may be attributed to the leaf size of *Pennisetum typhoideum* which is much larger than that of other crops. Larger leaf size provides a greater surface area for the accumulation of lead-contaminated dust. Lead contents of

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Table 1. Lead Content* of Forage Crops from Road Sides (1982-84)

Forage Crops	No. of samples	Distance (metres) from the road sides			Correlation coefficient (r)
		10	50	100	
		Range (ppm)	Range (ppm)	Range (ppm)	
"Bajra" *(Pennisetum typhoideum)*	30	65.0–82.0 (±6.01)	38.0–50.0 (±4.20)	7.0–12.0 (±1.62)	–0.999
"Berseem" *(Trifolium alexandrinum)*	30	56.8–76.1 (±5.74)	19.0–28.2 (±3.20)	6.1–10.8 (±1.40)	–0.946
Grass *(Cynodon dectylon)*	30	42.2–60.3 (±6.37)	12.2–26.3 (±4.33)	4.0–8.2 (±1.45)	–0.905
"Moonji" *(Oryza sativa)*	30	52.1–70.2 (±6.36)	16.1–30.2 (±4.86)	4.1–38.2 (±1.31)	–0.973
Oat *(Avena sativa)*	30	54.0–72.2 (±7.18)	17.1–32.1 (±5.62)	5.2–9.0 (±1.20)	–0.976

* Calculated on dry weight basis.
Figures in parentheses indicate standard derivations.

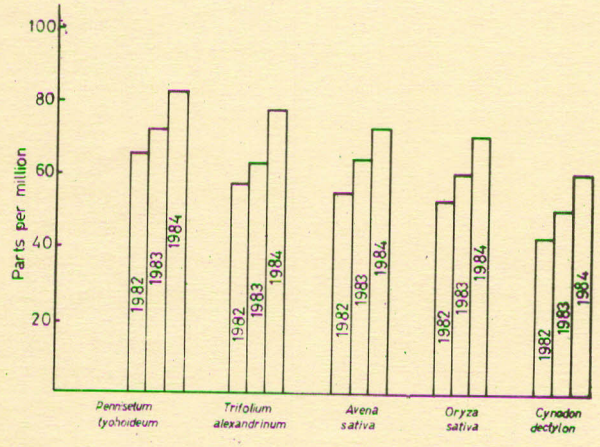

Fig. 1. Lead Content of forage crops from roadside.

Oryza sativa and *Avena sativa* were comparable and did not differ significantly. This may be due to approximately identical plant height and leaf size of these crops.

A gradual increase in lead contamination during the period (1982-84) of these studies was also observed (Fig. 1). The increasing trend in the contamination of these crops seems to be due to increasing traffic density during this period. Long-term accumulation of lead in the cropland near the roads also affects the absorption of lead by plants growing on such soils [9].

The levels of pollution caused by atmospheric lead may fluctuate during the years due to seasonal variations and other environmental factors. However, the findings of the present studies indicate that contribution of atmospheric lead to the contamination of forage crops is significant and may prove hazardous for animal and public health. It is thus suggested that forage crops and natural vegetation near the highways should be fed cautiously to cattle and other animals.

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