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Study on Impact of Vehicular Emission on Road Side Agricultural Land at Chapra, with Particular Reference to pH, Organic and Selected Nutrients

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ABSTRACT

Due to extraordinary growth in population, and transport facilities, vehicular emission has also increased tremendously. It has become a global problem as it is damaging our environment, water bodies, soil and human health as well. The present research was conducted with the objectives to assess the impact of vehicular pollutants on the health of the agricultural lands along the main road of Chapra that is head quarter of Saran district in Bihar. Along the road side two sites were selected and soil samples were collected from four locations such as L1, L2, L3 and L4 which were 10M, 20M, 30M and 500M away from the road side. Soil samples were collected randomly from these sites in four different season's such as spring, autumn, summer and winter for the analysis of nutrients, pH was also taken at these sites in different seasons. However, organic matters were also analyzed from these sites. It was observed that pH mean was highest 7.98 at L1 in all the seasons, which gradually decreased along the increasing distance of the location. Further even at L1 pH were 8.0 that were at SITE-2 and higher than SITE-1. Organic matter was higher in summer at all the locations at both SITE-1 and SITE-2. Contents of nitrogen (N), phosphorus (P) and potassium (K) were also analyzed at different location in different seasons. Here L4 site of SITE-2 revealed the higher concentrations of N (238.8 mg/kg), phosphorus (P) 26.42 mg/kg, and potassium (K) 112.74 mg/kg of the soil in summer. This was followed by Autumn N (209.6 mg/k) P 21.52 mg/kg, and K 95.20 mg/kg of soil. In this way minimum concentrations of (N), (P) and (K) at L4 of Site1 and Site2 was obtained in spring.

Keywords : Vehicular pollutants, Global problem, Road side land, Organic carbon, Available nutrients, Nitrogen, Phosphorous, Potassium.

I. INTRODUCTION

Automobile exhaust is a serious environmental problem, Odoh *et al*; (2013). Different vehicles are running either by burning diesel or petrol a fossil fuels. There are extra ordinary such vehicles being used for public transport, transporting different goods. In addition to the private cars, tow wheelers, the numbers of three wheelers, tractors, trucks of different models, buses, and local made three wheelers are running on the roads of town. Due to narrow roads, increase in number of vehicles the problems of traffic jams are always noticed in the roads of the town. Similarly, the roads are congested with high proportions of old vehicles and heavy traffic load using leaded gasoline. Such old model buses, trucks, three wheelers are the main contributors in the degradation of our atmosphere, water bodies, road side agricultural lands, and human health who are be exposed to such exhausts of incomplete combustion of the fuel. Pollutant emissions from the gasoline powered automobiles are volatile organic compounds, carbon monoxides, oxides of Nitrogen while heavy duty diesel vehicles releases Nox, fine particulate matter etc. are of the great concern (Sawyer, 2010). The pollutants and dust particles released to these vehicles finally settle to the nearby fields and causes degradation in the important nutrients and changes in the pH, organic matters and deposition of heavy metals in the soil. These chemicals enter our food chain and they are thus biologically magnified.

Agricultural fields adjacent to the road side where there is heavy traffic of automobiles as found to be contaminated as a result of vehicular emission and have been found to constitute one of the major causes of soil degradation. Borush and Nath (1992); Basumatary and Bordoloi (1992); Singh *et al*; (1995); Yuan *et al*; (2000) distribution of heavy metal; Lee *et al*; (2005); Kimura *et al*; (2009); Sharma and Prasad (2010); Ghiri *et al*; (2011); Ramachandra and Shwetmala (2011). Olukani and Adebiyi (2012); Sood (2012); Akan *et al*; (2013); Chaudhary *et al*; (2013); Goel *et al*; (2013). Srivastva *et al*; (2013); All the agricultural lands which are on road side where there are heavy traffic and occasion traffic jams are prime target of contamination which different pollutants released from the heavy duty vehicles in general and the old and ill maintained heavy duty vehicles in particular (Devi *et al*; 2015). Analysis of pH and organic carbon from the road side soil has been done by Singh *et al*; (2017). Keeping these ideas in mind the present research was done to assess the effects of vehicular exhaust on road side soil.

II. METHODS AND MATERIAL

Present experiments were done at Chapra head quarter in the area where there is maximum vehicular transport and cases of traffic jams are frequent. Town distinct sites SITE-1 and SITE-2 were selected. At each site four locations such as L1, L2, L3 & L4 which are situated 10M, 20M, 30M and 500 M away from the road were used for the collection of the soil.

In three different seasons soil was collected from all locations. Samples were collected from 5-25 cm randomly. All were mixed thoroughly and gravels were removed. Soil samples were placed in a well cleaned poly bags and air dried in shade. Finally soil was ground n a mortar and pestle. They were filtered or sieved through 2 mm mesh size sieve. Powdered soil samples from different locations at site1 and site 2 were packed in separate poly bags with tags of locations and date of collection.

Determination of pH and organic carbon:

Soil suspension 1:2 soils and water was prepared. With the help of digital electric pH meter, range of pH was noted in all the samples collected from different locations. Organic carbon was determined by titrimetric method as proposed by Jackson (1958). Estimation of available nitrogen, available phosphorous and available potassium was done by the methodology proposed by Asija (1956) and Jackson

(1973). All the experiments were done in triplicates and data have been presented in table 1, 2 and 3 and represented by the graph 1, 2, 3 etc.

III. RESULTS AND DISCUSSION

RESULTS

Data obtained during the studies with respect to pH and organic carbons with respect to different locations from the main road passing through the Chapra towns are presented in table-1 and table-2. From the table, it may be noted that pH ranged between 7.90 to 7.65 at locations L1 to L4 in springs at Site-1. At site 2 in the same season the pH range was between 7.96 to 7.72 respectively from L1 to L4. Similarly, in summer the pH ranged between 8.20 to 7.62 and mean ranged between 7.98 to 7.72 and the mean ranged between 7.98 to 7.68. At site -2 during summer it ranged between 8.15 to 7.81, during winter 7.89 to 7.72 and the mean ranged between 8.0 to 7.75 respectively.

With respect to organic carbon during spring at site 1 from distance 10 to 500 M the value ranged between 0.42 mg/kg to 0.31 mg/kg of soil. During summer, at this site the organic carbon ranged between 0.55 mg/kg to 0.42 mg/kg from 10M to 500 M distance from the main road in the field. At site 2 the organic carbon during spring ranged between 60mg/kg to 0.45, during summer, it ranged between 0.68 mg/kg to 0.53 and during winter from 0.55 mg/kg to 0.42 mg/kg from the distance 10M to 500 M away from the main road.

It may be noted form the table, that at site1 from L1 to L4 the pH values were less than the Site-2 for all the locations, in the spring seasons. Similar trends were noted in summer and winter season were the pH range at Site-1 was less than the Site-2. It may also be noted from the table, that the pH range at both the Site-1 and Site-2, was higher in summer than that of the spring and winter. Here at Site-1 the value ranged between 8.20 to 7.76 while at Site-2 the value ranged from 8.15 to 7.81. This was followed by spring where it ranged from 7.90 to 7.65 at Site-1 and 7.96 to 7.72 respectively the lowest values of pH were noted in winter at both the Site-1 an Site-2 and it ranged between 7.84 to 7.62 at Site-1 and 7.89 to 7.72 at Site-2. In mean values also Site-2 had higher pH range than that of the Site-1.

Here maximum percentage of organic carbon was observed at Site-2 which was 0.68% during summer located at 10M distance from the main road side. In the same season at 20M the value of organic carbon was 0.64% at 30 M 0.61% and at 00M it was 0.53%. This was followed at 10M in spring which was 0.60%, 0.58 at 20M, and 0.54 at 30M, 0.45 at 500M. During winter the percentage value ranged between 0.55 to 0.42% respectively at Site-2. At Site-1 the maximum value of organic carbon at 10 M in summer was 0.55% at 20M 0.52. Here again the value was lowest I spring at all the distances. So at all the seasons the value of organic carbon was hither at Site-2 than that of Site-1. Similarly, among seasons in summer at all the distances at both Site-1 and Site-2, the values of organic carbon were higher than rest of the seasons. Above values were followed in winter and the lowest value in spring itself.

Because Site-2 was near a cross road in Chapra town where traffic jams are frequent. Naturally, the vehicular emissions are higher. Site-1 was near the road from where vehicles were passing but no traffic jams was observed. During summer the frequency of traffic becomes double and so emission is also high. Here distance 500 M and L4 is used as control. Here decrease in pH and organic carbon may be due to production of organic acid during minerlization that includes ammonization and ammonification, because the soil is less disturbed by the pollutants at this distance. Similar findings have been reported by Patnayak *et al*; (2001); and Shilpkar *et al*; (2011); which authenticate the above findings.

Data related to available nitrogen, available phosphorous and available potassium have been presented in table-3 and represented by graph 1,2 and 3. From the table, it may be noted that available nitrogen, available phosphorous and available potassium were highest in summer such as nitrogen 238.8 mg/kg, 25.16 mg/kg and 112.74 mg/kg of soil respectively. The values of these nutrients were lower in winter such as nitrogen 179.5 mg/kg, phosphorous 15.87 mg/kg potassium 83.56 mg/kg of the soil. Factor mean of location L1 from both the sites of study revealed the lower values for available nitrogen, available phosphorous, and available potassium (167.31, 14.38 and 78.25 mg/kg respectively). From the table, it appears clearly that at location 4 (L4) the highest value (2000.85, 19.47 and 95.48 mg/kg respectively) were obtained. Further, it is evident from the table, that at Site-2 (2001.25, 20.27 and 96.48 mg/kg) as compared Site-1 (200.45, 18.67 and 94.47 mg/kg). These values were found to be significantly different.

DISCUSSION:

The data obtained for the availability of nitrogen, phosphorous, and potassium in the road side soil of Chapra where heavy traffics are found are presented in table-1. The field away from the road side are less disturbed, due to which higher available nitrogen was found there, that is control as L4, than the nearest field or disturbed one of Site-1 and Site-2, respectively. Higher nitrogen at L4, which is undisturbed field may be due to higher organic matter. So degraded soil has less nitrogen. Present findings corroborate with the findings of Verma *et al*; (2005); Zarger *et al*; (2005) and Suge *et al*; (2011).

Phosphorous contents were also present in higher concentration in L4 which was used as control and the distance is away from the road side. However, lowest concentration was found in L1 which is more adjacent to the road where maximum traffic jams are found. Present findings are therefore, in agreement with that of the findings of Tisdale *et al*; (1997); Sing (2004); Chaudhary (2013) and Rasool (2014) respectively.

Potassium is a macronutrient, taken by the plats form soil. In the present work control L4 at each Site-1 and Site-2, had higher contents in comparison to L1 at both Site-1 and Site-2. As L1 is more closure to the road side, so due to degraded soil concentration of potassium was less than the soil which was not disturbed by the vehicular pollutants. Basumatary and Bordoloi(1992) and Baruah and Nath (1992) reported that layer of organic matter significantly improves the retention of potassium in the soil. Whereas degraded soil promotes leaching of potassium and due to this there may be decrease n the content of potassium in the above region of soil. This may be reason that L4 which was undisturbed area had higher concentration of potassium in comparison to the L1 site at Site-1 and Site-2. Above findings are supported by the findings of Singh (2004), Zarger *et al*; (2005); Chaudhari (2011); Shah and Jeelani (2015) and Ghirie *et al*; (2011) respectively. So due to deposition of vehicular exhaust in the soil near to the road the chemical properties might have disturbed, causing leaching of the mineral nutrients.

IV. CONCLUSION

Due to heavy load on roads by large numbers of different kinds of vehicles, on narrow road heavy jams are noted. This increases the release of vehicular exhaust containing different pollutants. These pollutants finally are deposited in nearest soil as well as water bodies, causing soil and water pollution. The change in pH, organic carbon, the amount of nitrogen, phosphorous and potassium contents may be correlated with such motor vehicular emission. In addition these toxic pollutants coming out form the vehicular emissions are also deposited in soil and water bodies near to the road side. They enter I our food chain and finally damage and health too. So it is essential to monitor such cases where ever there are heavy traffic on the narrow roads which causes the problems of jam frequently.

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TABLE-1

Showing pH level at two sites of soil taken from different distance of the roadside.

Season	Site-1					Site-2				
	L1	L2	L3	L4	Mean	L1	L2	L3	L4	Mean
Spring	7.90	7.88	7.81	7.65	7.81	7.96	7.92	7.86	7.72	7.87
Summer	8.20	7.94	7.85	7.76	7.94	8.15	8.00	7.92	7.81	7.97
Winter	7.84	7.78	7.70	7.62	7.74	7.89	7.86	7.80	7.72	7.82
Mean	7.98	7.87	7.79	7.68	7.83	8.00	7.93	7.83	7.75	7.88

TABLE-2

Showing organic carbon percentage in different soil depth (15 cm) at two sites adjacent to the main road.

Distance \ Season	Site-1			Site-2		
	Spring	Summer	Winter	Spring	Summer	Winter
10 M	0.42	0.55	0.46	0.60	0.68	0.53
20M	0.40	0.52	0.43	0.58	0.64	0.51
30M	0.36	0.48	0.39	0.54	0.61	0.48
500M Control	0.31	0.42	0.33	0.45	0.53	0.42

TABLE-3

		Site-1					Site-2						
	Season	L1	L2	L3	L4	Mean	L1	L2	L3	L4	Mean	SM	FM
Average Nitrogen	Spring	140.50	146.70	177.30	179.50	161.00	142.70	148.84	179.78	182.64	163.49	162.25	
	Summer	196.20	209.80	214.40	235.70	214.03	198.90	211.30	216.32	238.00	216.13	215.08	
	Autumn	173.80	178.30	185.60	206.40	186.03	177.30	180.46	186.40	209.60	188.44	187.23	
	Winter	151.60	158.40	162.80	183.20	164.00	157.50	162.80	164.74	186.20	167.81	165.91	
	Mean	165.53	173.30	185.03	201.20	181.26	169.10	175.85	186.81	204.11	183.97	182.62	
Average Phosphorous	Spring	9.68	10.24	11.75	14.76	11.61	11.20	12.46	14.22	15.87	13.44	12.52	
	Summer	19.76	21.38	22.54	23.87	21.89	21.15	23.55	25.16	26.42	24.07	22.98	
	Autumn	14.24	17.34	18.85	19.68	17.53	15.76	18.36	20.28	21.52	18.98	18.25	
	Winter	10.84	12.46	14.24	16.38	13.48	12.36	13.85	15.60	17.25	14.77	14.12	
	Mean	13.63	15.36	16.85	18.67	16.13	15.12	17.06	18.82	20.27	17.81	16.97	
Average Potassium	Spring	61.72	64.25	69.66	80.16	68.95	62.84	6.40	71.22	83.56	56.01	62.48	
	Summer	89.35	94.65	99.72	109.36	98.27	90.76	97.35	102.84	112.74	100.92	99.60	
	Autumn	76.22	80.30	84.22	93.78	83.63	81.30	82.45	86.56	95.20	86.38	85.00	
	Winter	68.43	73.16	79.40	90.60	77.90	72.24	74.56	80.76	94.44	80.50	79.20	
	Mean	73.93	78.09	83.25	93.48	82.19	76.79	65.19	85.35	96.49	80.95	81.57	