Volume-5, Issue-4, April - 2016 • ISSN No 2277 - 8160

Research Paper | Chemistry

Effect of Heavy Metals on Seed Germination on Soil Samples From Industrially Polluted and Heavy Traffic Areas

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ABSTRACT

The increasing pressure of providing food to feed the geometrically growing population throughout the world is a challenge for farmers, scientists and policy makers alike. It can be met through the intensification of agriculture, which requires high yielding varieties, with high input of water and fertilizer and of late through biotechnology. The present paper deals with analysis of soil collected from three industrial areas and areas of heavy traffic regions in the city of Hyderabad. The heavy metals were estimated by DTPA extraction method. The results have revealed a very high levels of presence of toxic metals like Zn,Cu and Cd in the soil samples of the industrial areas. Their effect was further studied by carrying out the germination of seeds by applying chemical fertilizer, urea and a bio-fertilizer, vermicompost. Environment ethics suggest use of natural manures and organic farming may be a viable solution. The moot point is industrialization at what cost? Should there not be a focus on environmental ethics.

KEYWORDS : Heavy metals, Vermicompost, Urea, DAP, Soil pollution

Humans historically depended on hunting and gathering of food to sustain life. As populations grew, organized agricultural systems were needed to ensure food security. But agricultural systems have not developed at the same rate. As a result famine has become reality in underdeveloped regions that exhibit the highest population growth rates and rely on inefficient and unproductive farming methods. In contrast, developed countries utilize modern agricultural technologies are generally self sufficient in food production and provide the majority of food exports to underdeveloped and developed nations.

The incidence of famine or risk of death due to the food shortage has decreased over the last few years. Crop yields have increased greatly over the last half century. This remarkable achievement is directly related to the development and adoption of agricultural technology over the last 60 years. The principle factor that contributing to higher crop yields includes development of improved varieties and hybrids, nutrient and pest management, soil and water conservation and cultural practices.develpoment and use of fertilizer and pesticides is directly related to the crop productivity. The yield is good but people are severely under nourished or exhibiting various levels of nutrient deficiencies which is found in 600 million people. But in due course it is observed that the rich biodiversity of rice is fast depleting and herbicide-tolerant GE soyabean and corn have not increased yields any more than conventional methods that rely on commonly available herbicides. Insect-resistant BT varieties have provided an average yield advantage of just 3-4% compared to conventional practices. Excess usage of fertilizers, herbicides and insecticides in the long run are depleting the soil quality and it is causing the water and soil pollution.

Taking that factor into consideration, the present paper study deals with the effect of biological and chemical fertilizers on industrially polluted soil samples and traffic area samples in Hyderabad. It deals with the impact of vermicompost, DPA, urea on germination of seeds.

Methods and materials:
Soil sampling

Rapid advancement in industrialization caused environment degradation and contamination. Indiscriminate usage and disposal of wastes generated by the industries is becoming a great problem in the present situation .soil pollution and its impacts and remedial measures have been less studied with less focus compared to air and soil. So careful soil sampling is essential for soil analysis sample must reflect the complete picture of soil in that region. The various samples of soils are collected from the industrial sites and traffic regions, mixed thorough to obtain a composite sample of test region. The samples are collected in polyethylene bags and they are transported to the laboratory. The samples are collected from industrial areas of **Jeedimetla, bolloram** and **patencheru** areas. The soil samples are also collected from traffic zones of sitaphalmandi, mettuguda.

Micronutrients such as zinc, copper, iron, manganese and lead are essential to crop growth. The soils are extracted using the appropriate hallow cathode lamps using atomic absorption spectrometer.DTPA extraction method is used to determine zinc, copper, iron, manganese and lead.

Materials used for germination of seeds

Manufactured fertilizers are the most important sources of nitrogen to plants. In the present study, the fertilizers used are vermicompost, urea, and diphenyl amine.

Seeds used for germination

20 mustard seeds are counted and selected for germination. These seeds are selected on the basis of floatation method. The seeds are dropped into water and seeds which have floated are taken out from the water, and the seeds which are sinking in the water are selected for germination.

Experimental setup for the germination of seeds

Soil samples from three industrial areas and three traffic areas are taken in three earthen pots. These pots are named according to their areas. In these pots 20 mustard seeds are introduced. In another set of six pots the industrial area and traffic area soil samples are taken and vermicompost is introduced. In another set of six pots the industrial area and traffic area soil samples are taken and urea is introduced. In another set of six pots the industrial area and traffic area soil samples are taken and DAP or DPA is introduced. Germination and growth of germination is studied.

Table 1
Germination of seeds in Jeedimetla soil

s. no	DAYS	With-out Ferti-lizer	50g vermi-compost + 2kgs of soil	50gms of urea + 2kgs of soil	50gms of DAP + 2kgs of soil
1.	1st DAY	-	-	-	
2.	2nd DAY	0 cm	-	-	
3.	3rd DAY	1 cm	1.3 cm	-	1 cm
4.	4th DAY	1 cm	1.3 cm	-	1.3 cm
5.	5th DAY	1.5 cm	1.6 cm	-	1.5 cm
6.	6th DAY	2.5 cm	2.8 cm	-	3.0 cm

7.	7th DAY	3.2 cm	3.0 cm	-	3.2 cm
8.	8th DAY	3.5 cm	4.0 cm	-	3.6 cm
9.	9th DAY	3.9 cm	5.0 cm	-	
10.	10th DAY	4.5 cm	6.5 cm	-	
11	11th DAY	5.1 cm	7.0 cm	-	
12.	12th DAY	6.0 cm	9.0 cm	-	
13	13th DAY	6.4 cm	11 cm	-	
14.	14th DAY	7.5 cm	12 cm	-	
15	15th DAY	8.2 cm	12.6 cm	-	
16.	16th DAY	9 cm	14 cm	-	

Table 2
Germination of seeds in bolloram area

S. no	DAYS	Bollo-ram	Bolloram + 50gver-micom-post	50gms of urea + 2kgs of soil	Bolloram + 50gms of DAP
1.	1st DAY	-	-	-	-
2.	2nd DAY	-	-	-	-
3.	3rd DAY	1 cm	1 cm	-	-
4.	4th DAY	1 cm	1.1 cm	-	-
5.	5th DAY	2.3 cm	3.2 cm	-	-
6.	6th DAY	2.4 cm	3.2 cm	-	-
7.	7th DAY	2.5 cm	3.6 cm	-	-
8.	8th DAY	2.9 cm	4.0 cm	-	-
9.	9th DAY	3.3 cm	4.6 cm	-	-
10.	10th DAY	3.9 cm	5.1 cm	-	-
11.	11th DAY	4.5 cm	5.7 cm	-	-
12.	12th DAY	5.2 cm	5.7 cm	-	-
13.	13th DAY	5.6 cm	6.4 cm	-	-
14.	14th DAY	6.0 cm	6.9 cm	-	-
15.	15th DAY	6.8 cm	7.4 cm	-	-
16.	16th DAY	7.9 cm	8.6 cm	-	-

Table 3
Germination of seeds in patencheru area

s. no	DAY	Soil Without Fertilizer	Patencheru + vermicompost	Patencheru + urea
1	1st DAY	-		-
2.	2nd DAY	-		-
3.	3rd DAY	0.5 cm	0.9 cm	-
4.	4th DAY	1 cm	1.4 cm	-
5.	5th DAY	1.2 cm	2.5 cm	-
6.	6th DAY	2.5 cm	3.0 cm	-
7.	7th DAY	2.8 cm	3.7 cm	-
8.	8th DAY	3.5 cm	4.1 cm	-
9.	9th DAY	3.9 cm	5.0 cm	-
10.	10thDAY	4.8 cm	5.6 cm	-
11.	11thDAY	5.2 cm	6.2 cm	-
12.	12thDAY	5.7 cm	6.7 cm	-
13.	13thDAY	6.2 cm	7.5 cm	-
14.	14thDAY	7.0 cm	7.6 cm	-
15.	15thDAY	7.3 cm	9.0 cm	-
16.	16thDAY	8 cm	9.2 cm	-

TABLE 4
Germination of seeds in Sitaphal Mandi area

s no	DAYS	Sprouted after 60 days(sitaphal)	vermicompost	Urea	DAP
1.	1stDAY	1.5 cm	1.3 cm	-	1.5 cm
2.	2ndDAY	1.7 cm	1.5 cm	-	1.7 cm
3.	3rdDAY	2.2 cm	1.8 cm	-	2.2 cm
4.	4thDAY	2.8 cm	2.3 cm	-	2.8 cm
5.	5thDAY	3.1 cm	2.6 cm	-	3.1 cm
6.	6thDAY	3.8 cm	3.4 cm	-	3.8 cm
7.	7thDAY	4.3 cm	4.0 cm	-	4.3 cm
8.	8thDAY	4.6 cm	4.3 cm	-	4.6 cm
9.	9thDAY	5.0 cm	4.7 cm	-	5.0 cm
10.	10thDAY	5.3 cm	4.9 cm	-	5.3 cm
11.	11thDAY	6.0 cm	5.6 cm	-	6.0 cm
12.	12thDAY	6.8 cm		-	6.3 cm
13.	13thDAY	7.1 cm		-	6.8 cm
14.	14thDAY	7.2 cm		-	7.0 cm
15.	15thDAY	7.5 cm		-	7.2 cm
16.	16thDAY	7.6 cm		-	7.4 cm

Table 5
Germination of seeds in mettuguda region

s. no	DAYS	Mettuguda + DAP	Vermicompost + mettuguda	Urea + mettuguda	mettuguda
1.	1stDAY	1.5 cm	1.3 cm	-	1.5 cm
2.	2ndDAY	1.75 cm	1.5 cm	-	1.7 cm
3.	3rdDAY	2.0 cm	1.8 cm	-	2.2 cm
4.	4thDAY	2.5 cm	2.3 cm	-	2.8 cm
5.	5thDAY	3.2 cm	2.6 cm	-	3.1 cm
6.	6thDAY	4.0 cm	3.4 cm	-	3.8 cm
7.	7thDAY	4.6 cm	4.0 cm	-	4.3 cm
8.	8thDAY	5.1 cm	4.3 cm	-	4.6 cm
9.	9thDAY	5.3 cm	4.7 cm	-	5.0 cm
10.	10thDAY	5.5 cm	4.9 cm	-	5.3 cm
11.	11thDAY	6.2 cm	5.6 cm	-	6.0 cm
12.	12thDAY	6.9 cm	6.0 cm	-	6.8 cm
13.	13thDAY	7.2 cm	6.3 cm	-	7.1 cm
14.	14thDAY	7.4 cm	6.8 cm	-	7.2 cm
15.	15thDAY	7.5 cm	7.0 cm	-	7.5 cm
16.	16thDAY	7.7 cm	7.2 cm		7.6 cm

RESULTS AND DISCUSSIONS

The germination of seeds was carried in a period of 16 days and results were given in table 1, 2,3,4,5 and 6.

It was observed that in all the industrial and traffic zones urea fertilizers had adverse effect on germination of seeds. Numerous investigations have shown that urea fertilizers can have adverse effect on seed germination, seedling growth, and early plant growth. The adverse effect of urea in germination of seeds is due to ammonia formed through hydrolysis of urea by soil urease or due to NO_3^- produced through nitrification of urea nitrogen by soil microorganisms.

It was observed from all tables, the germination of seeds in untreated sample and treated sample has started after two days.

The growth rate was more in all DAP samples compared to vermicompost.

It is observed that the germination of seeds in untreated sample and treated samplewith vermicompost of jeedimetla soil samples started after 2 days. Similarly in patenchervu area the germination has started on third day in untreated sample and treated sample the germination was observed on fourth day.similar results were observed in bolloram soil samples. In the industrial area the growth of seedlings was highest in jeedimetla in comparison to bolloram and patenchervu area. DAP has great impact on germination of seeds. In all the cases DAP increased the growth rate and germination. The traffic areas of sitaphal mandi and mettuguda DAP effect is more compared to vermicompost.

As available nitrogen content in all the traffic and industrial samples was less so by addition of vermicompost or earth worm casting increased mineral nitrogen ion the soil which may have helped in germination or plant growth. These results attributed the rate of micro and macronutrients provided by vermicompost as well as improved soil conditions due to vermicompost applications which was conducted to stimulate growth ,synthesis, and accumulation of more metabolites in plant tissues .vermicompost had five times available nitrogen and seven times available potassium and 1.5 times more calcium was found in 15cm top soil.

The high organic matter content and biological activity made vermicompost effective in variety of application including soil erosion, revegetation, biofiltration and bioremediation. In DAP added soil samples Nitrogen percentage is 18-21%, P_2O_5- 46-54%, Sulphur percentage-1-2%.

Meeting food security needs for a growing population (estimated to be 9.5 billion in 50 yrs) will require a 30-40%increase in food production on approximately the same agricultural land area used today. Land managers must adopt economically viable technologies that maintain, enhance, or protect the productive capacity of our soil resources to ensure future food and fiber supplies. While organic nutrient sources are important to meet the nutritional needs of higher-yielding cropping systems, inorganic fertilizer nutrients will remain the predominant nutrient source. The challenge to the agricultural community is to ensure maximum recovery of applied nutrients, regardless of source, through use of diverse soil, crop, water, and other input management technologies to maximize plant productivity. Accomplishing this will significantly reduce nutrient losses to the environment. Protecting water and air quality is essential to the health of diverse ecosystems on earth, which directly impact our quality of life.

The study of soil fertility and nutrient management is a large and critical component of our agricultural systems. Throughout the text, the relationships between nutrients and other essential inputs and management factors were presented. Sustaining the productivity of agricultural demands a thorough and functional understanding of the interactions between nutrients,water,plant growth, and many other factors that influence plant health and yield. Hopefully you will continue your search for new knowledge and experiences that will help secure a productive agriculture.

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