



## EFFECT OF ACID RAIN ON SEED GERMINATION

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### Abstract

Acid rain is an umbrella term, which is used to cover a number of different pollution processes. The pH of acid rain is ten, fold difference between numbers. India illustrates the drastic effect of acid rain on agricultural productivity researchers there found that wheat growing near a coal fired power plant where SO<sub>2</sub> deposition was almost five times greater than the critical load (the amount of the soil can safely absorb without harm) suffered a 49% reduction in yield. In the present investigation to assess the effect of acid rain on the plant growth, the plant of *Triticum aestivum* and *Raphanus sativus* were grown in different wooden boxes and three different plastic boxes. The different pH (2.0, 4.0, 5.0) of simulated rain does were sprayed on the plant and after last dose the specific visual difference was seen in seed germination.

**Keywords:** Critical laod, Stimulus, Sprayed etc.,

### Introduction:

Rain or snow falling from the atmosphere contains acids like H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub> then we say there is acid rain. The term acid rain is not new. It was first coined in Manchester, England over a century ago. Sulphur dioxide and nitrogen oxide are the gases pollutants and the fossil fuels contain compounds of sulphur or nitrogen in addition to carbon. These waste gases are released by combustion of fuels by automobiles, electric power plants and smelting and refining facilities. Each year the global atmosphere receiving, 20 billion tone of CO<sub>2</sub>, 130 million tons of SO<sub>2</sub>, 97 million tons of hydrocarbons and 53 million tons of nitrogen oxides **Katelyn**

**monsoon, (2003-04).** In the United State total Sulpher dioxide emission measured between 1960 to 1970 pollution control led to decrease in urban sulpher dioxide concentration **Atschuller, (1980).** In Europe and North America man-made nitrogen oxide outweighs natural nitrogen oxide by 5-10 times **Galloway & Dillon, (1982).** The proportion of nitrogen oxide in the atmosphere in Europe has grown by 40-50% during the 1970's but rates vary **Heagle, (1982).** At night under foggy conditions, rainy or high humidity conditions, oxidation of sulpher dioxide to sulphate ions is accelerated by ammonia ions **Gupta Neeraj (2004).** The oxidation of sulphur dioxide is much slower than that of nitrogen oxides, so that sulphur dioxide may remain airborne for three to four days compared with nitrogen oxide which may persist for only half a day. India illustrates the drastic effect of acid rain on agricultural productivity, researchers there found that wheat growing near a coal fired power plant where SO<sub>2</sub> deposition was almost five times greater than the critical load (the amount of the soil can safely absorb without harm) suffered a 49% reduction in yield compared with wheat growing 22 km. away. **Eurekalert (2007).**

India meteorological department (IMD) has found increasing acidity in rain samples from Pune and Nagpur. IMD maintains a network of global atmospheric watch stations that follow world meteorological organization norms. It has been analyzing rainwater samples from 10 locations for almost three decades. The monitoring areas Pune, Nagpur, Allahabad, Jodhpur, Kodaikanal, Minicoy, Mohanbari, Port Blair, Shrinagar and Vishakhapatnam. A 2004 paper in the journal environment science and engineering by IMD scientist says pH value in rainwater has been dropping in India. All station

except Kodaikanal has shown a two - fold rise in sulphate concentration in the rain. Northern India where oil refineries, fertilizer factories, thermal power plant and oil gases installation release sulphate and nitrate compounds into atmosphere raising acid content in the rain. There are other reasons too. In most part of the India the alkaline dust in the atmosphere neutralizes the acid content in rain. But rain water at Mohanbari Assam is the more acidic in nature because the area lacks the neutralizing agents. The clean air acts were and attempting to reduced acid rain and other harmful pollutants in the air. The most recent is the clear skies act of 2002: according to Christie Todd, Whitman, administrators, USEPA "The clear skies at of 2002 is the most aggressive plane to reduced the air pollution in this country in more than decade clear skies will protect public health and environment and dramatically improve American's air quality" to reduced pollution and improve the environmental entails that for examples power plant will use new methods of production.

#### Experimental Methods and Materials:

For the preparation of field in the laboratory seeds were sowing in the plastic pots. Pots were field with the 3 kg of soil for radish seeds and the wooden trays were filled with 9 kg of soil for the wheat grains. 15 seeds of radish and 85 seeds of wheat were sowing in the plastic

pot and in wooden trays and it labeled as 2 pH, 4 pH, 5pH, and control. After 12 days of sowing, the plants of wheat were grown upto 17 cm and radish was 9 cm.

The initial doses of acid rain vary in pH like (2, 4 & 5) were sprayed. Each dose was supplied after 5 days of intervals. The result were recorded in the form of seed germination and compared with each pH and control.

#### Results:

The rapid industrialization and urbanization leads to emission of SO<sub>2</sub> and NO<sub>2</sub>. These pollutants combine with rain water to formation of sulphuric acid and nitric acid and resulted into acid rain. This is one of the problems of agricultural sector in the world. The concentration of SO<sub>2</sub> and NO<sub>2</sub> was responsible for decrease in the pH of rain water . The more acidic water directly affects the seed germination and indirectly reduced the agricultural productivity

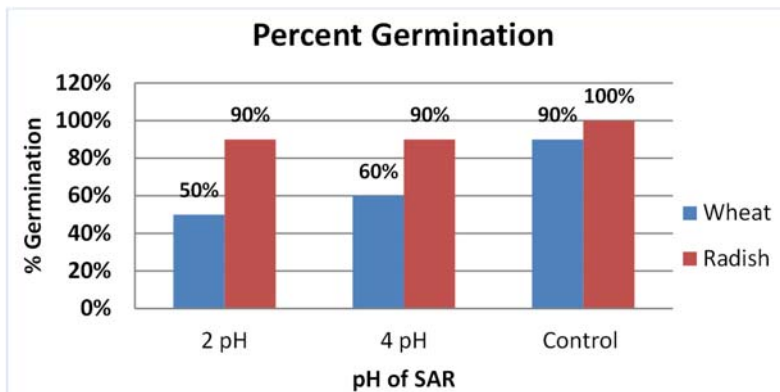
In the present investigation to assess the effect of acid rain on the plant growth, the plant of *Triticum aestivum* and *Raphanus sativus* were grown in different wooden boxes and three different plastic boxes. The different pH (2.0, 4.0, 5.0) of simulated rain does were sprayed on the plant and after last dose the specific visual difference was seen in plant growth, which is as follows,

**Table No. 1: Effect of Acid rain on seed germination of Wheat**

pH	Number of seed Germinated in Percentage (%)	Mean shoot length of seedlings (cm)	Mean root length of seedlings (cm)
2	50	2.27	2.67
4	60	3.2	4.42
Control	90	3.7	6.1

**Table No. 2: Effect of Acid rain on seed germination of Radish**

pH	Number of seed Germinated in Percentage (%)	Mean shoot length of seedlings (cm)	Mean root length of seedlings (cm)
2	90	3.1	2.8
4	90	4.0	3.2
Control	100	4.7	4.1

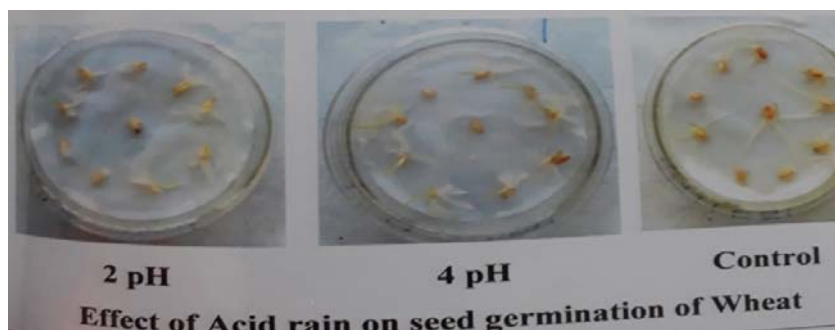


**Fig: 1**

The germination rate of wheat was reduced 10 % and 40% in controlled water and at pH treatment respectively, but at pH 2 it had the insignificant effect. **John G Mccoll and Robert Johnson (1983)**; had observed same result in their study. Germination rate in radish at pH 2 treatments reduced to 50% and at pH 4 and in control it was reduced to only 10% and at control radish shown 100% germination rate. The some reasons were

responsible to show the effect on seed germination.

According to **Lihon Wang, Xiaohua Huang et. al. (2008)** observed the effect of acid rain on the activity of enzymes like peroxides (POD) and catalase (CAT). In the seed germination of wheat the activity of peroxides and catalase inhibited at acid rain treatment. The activity of CAT and POD was mostly affected at pH 4 treatment



**Steven Seefeldt and Staff (1999)**; had put forth that, the cell division is important for seed germination and at low pH of rain the cell division was affected.

According to **Lce and Weber et.al. (1979)**; The acid rain at pH 2.0 treatment had affected the germination for all species were least affected like of American plant species, so the acid rain did not affect radish as compared to wheat. **Mccoll and Johnson et.al. (1983)**; had

recorded, the potential effects of the extremely low pH on germination for several species.

#### **Discussion:**

Acid rain is the combination of two acids like sulphuric acid and Nitric acid along with rain. Those acids responsible for decrease in pH of rain water. These acids are harmful to plants and animal. Acid rain shows various effects on plants. From the present study, it is revealed that

increased acidic level (pH 2.0) of the rain water affects the seed germination by the rate of 40% as compared to that of lower level of acidity (pH 4.0 and 5.0). At lower acidity (pH 5.0) the negligible effects on seed germination and plant growth was observed, but its continuous exposure in environment affected the plant growth and its development.

From the study it is also revealed that the continuous exposure of highly acidic rain not only increased the acidic level of soil but also reduced the agriculture productivity, by leaching of Nitrogen (N), Phosphorous (P), Pottassium (K) and other essential micronutrients. It leads to washing upper surface of soil, which are essential for plant growth and made unavailable for plants.

Also some plants showed chlorosis i.e. yellowish spotted levels due to death of cell in the respective area, affecting the rate of photosynthesis which is reduced the plant growth. This is major problem of acid rain in the agriculture zone and hence is of prime concern in developing countries like India which is supposed to be an Agriculture based country.

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