

EFFECTS OF AIR POLLUTION ON AGRICULTURE

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ABSTRACT

In addition to the increase in the temperature of the world due to climate change, air pollution is increasing as a result of human activities. Air pollution is increasing as a result of industrial activities, heating, and motor vehicles. This situation causes disorders in the respiratory, circulatory, and nervous systems in humans. In addition, air pollution does a great deal of harm to the ecosystem. In recent years, it has been observed that air pollution caused by industry and traffic also harms agriculture and deteriorates the quality of the products grown. It has been observed that air pollution causes developmental disorders and decreased photosynthesis in many plant species. Studies shown that grains, which are the main food source all over the world, are greatly affected by air pollution and can harm human health by mixing with the food chain.

Keywords: Agriculture, air pollution, climate change, grains, plants

INTRODUCTION

In recent years, the temperature of the world has increased, especially with the increase in anthropogenic activities. Global climate change still continues with the increase in greenhouse gas emissions (Akalın, 2014). According to Stern, the temperature will continue to rise between 0.5 and 1.0 degrees every decade in the coming years. Again, according to Stern's report, it is estimated that the world will increase by 1.4 to 5.8 degrees in the next century if no action is taken in this regard (Stern, 2007). Industrial facilities, traffic and domestic heating are shown as the 3 main sources of air pollutants in urban areas. Especially industrial facilities are significant sources of pollutants such as VOC (Volatile Organic Compound), PM, SO₂ and NO₂.

The air quality index (AQI) scale has been developed for outdoor air quality. The AQI scale is divided into 6 categories with different colors. This scale has been developed for pollutants such as particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen dioxide (NO₂) and ground-level ozone (O₃) (Kara , 2016). The contribution of motor vehicles, which has increased considerably in recent years, to existing air pollution has reached significant dimensions. Air pollution can be observed more in some cities than in others. The reason for this can be shown as the change in the direction of the surface winds as a result of meteorological conditions, topography and urbanization (Çiftçi et al, 2013).

Table 1. Sources of air pollutants and their effects on human health (Republic of Turkey Ministry of Environment, Urbanism and Climate Change).

Pollutant	Source	Negative Effects on Health
SO ₂	fossil fuel combustion	respiratory diseases
NO _x	traffic and industry	respiratory diseases
O ₃	traffic	respiratory diseases
CO	incomplete combustion product and traffic	circulatory system diseases
PM	industrial and agricultural activities	circulatory and respiratory diseases
Heavy Metals	traffic and industry	circulatory, respiratory and neurological diseases

Increasing air pollution as a result of human activities adversely affects not only human health, but also the whole ecosystem, including clean water resources, vegetation, and biodiversity (Akalm, 2014).

According to the research conducted by Tolunay (Tolunay, 2003), changes occur in the form of a decrease in annual ring widths when trees are exposed to air pollution in forest areas. Due to the industrial facilities concentrated in the Aliğa region of İzmir, 13 red pine and 20 black pine trees were examined. In the northern region of İzmir, annual ring widths of trees exposed to air pollution have decreased, and these widths have increased during periods when air pollution has decreased. (Gheorghe et al., 2011), examined the effects of air pollutants on plant species and evaluated the susceptibility or resistance status of plants. In the research of (Yücedağ et al, 2016), the negative effects of air pollution caused by industrial, urban and agricultural activities on plants were investigated. It was concluded that when the roots, stems and leaves of plants are exposed to these pollutants for a long time, deformations occur and growth and photosynthesis are inhibited. In another study, the effects of air pollution caused by the combustion of fossil fuels on plants were investigated in the literature and it was concluded that pollutants adversely affected the growth and development mechanisms of plants. Suggestions that can reduce these negativities have been presented (Elkoca, 2003).

Table 2. Plant species affected by air pollutants originating from vehicles and their effects summary table.

Pollutant	Affected Types	Effects
SO ₂	Cucumbers, apples, radishes, barley, wheat, oats and cotton (Elkoca, 2003)	It prevents the stomata from closing and causes water loss (Elkoca, 2003).
NO _x	Young seedlings, conifers (Gheorghe et al., 2011)	Root growth can cause serious reductions in respiration and photosynthesis (Elkoca, 2003; Yücedağ et al., 2016).
O ₃	Wheat, soybean, tobacco, potato and tomato species (Elkoca, 2003)	It negatively affects photosynthesis and plant growth and causes a decrease in yield (Elkoca, 2003).
PM	Fruits and leaves (apple leaves), oak, beech (Gheorghe et al., 2011)	It can prevent pollination and light absorption with problems such as bud burst (Yücedağ et al., 2016). Accumulation of cement dusts in vegetation can inhibit respiration and photosynthesis in leaves (Gheorghe et al., 2011).
CO	There is no clear information about which species it directly affects.	Causes leaves to change from horizontal to vertical (epinastia), shedding of leaves and fruits (abscess), and chlorosis (Gheorghe et al., 2011; Yücedağ et al., 2016).
Heavy Metals	In general, it has toxic effects on many plant species.	However, overdose inhibits the growth of plants. They cause disruptions in photosynthesis and enzyme mechanisms and inhibit chlorophyll synthesis and germination. (Yücedağ et al., 2016).

RESULTS AND CONCLUSIONS

- Along with global climate change, air pollution makes the lives of people who earn their living from the soil difficult, and also puts food security at risk. Food security is defined by the World Agriculture Organization as the physical and economic access of all people to healthy, safe and nutritious food so that they can lead an active and healthy life (Akalin, 2014). A possible food crisis and endangerment of food security are expected to cause bigger problems in the economic, social and political fields on a global scale (Kurukulasuriya and Rosenthal, 2003).
- Grain is an important staple food for humans. Some countries have developed a number of strategies to secure their own citizens and economies in the fields of grain production and consumption. Worldwide, Turkey ranks first in wheat production, flour production and pasta exports. There has been an increase in wheat imports in Turkey, especially in recent years (Karaca, 2022). Wheat has a very important place in human nutrition and therefore it is considered a strategic product throughout the world. Flour obtained from wheat, pasta, bulgur, starch, etc. While the products are used in human nutrition, the stems of the wheat plant are used in the cardboard and paper industries, and in the field of livestock. Bread wheat (*Triticum aestivum* L.), in particular, is among the three most important basic crops with approximately 700 million metric tons produced annually (Bektaş, 2015). According to different climatic conditions, the production of some of these wheat varieties can come to the fore in some regions. As climatic conditions are effective on wheat species, factors such as production quantities and quality are also affected (Karaca, 2022). If climate change becomes more effective on agriculture in the coming years, it is inevitable that more than one billion people in the world will not be able to reach basic food sources easily and steadily (FAO, 2009). It is estimated that countries located in northern latitudes such as Canada and Russia may have the opportunity to engage in agricultural activities in larger areas due to air pollution (Akalin, 2014).
- Global estimates are that grain production will decrease by 20% to 30% in the future due to air pollution (Darwin, 1995). In developing countries, it is expected that there may be a decrease in agricultural products in 2050 compared to 2000, and that the highest product loss in these countries will be in rice and wheat grown with irrigation systems. Agricultural product losses due to climate change in South East Asian countries such as Indonesia, Philippines, Singapore, Vietnam, Cambodia and Thailand are expected to decrease in productivity and product quality of all product groups (Akalin, 2014).
- For all these reasons, the damage caused by traffic and industrial air pollution to agriculture should not be ignored. In the light of this information, it is a fact that the negative effects of climate change and air pollution on plants will not only be limited to plants, but also enter the food chain through agriculture. For this reason, studies should be carried out to ensure food safety all over the world.

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