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Short-Lived Atmospheric Pollutant: An Emerging Threat to Agriculture and Livelihood

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Abstract

Short lived atmospheric pollutants are greenhouse pollutants with a high global warming potential and include hydrofluorocarbons (HFCs), black carbon, methane and nitrous oxide. Shakti is supporting efforts to reduce emissions of HFCs and black carbon from multiple sources. Anthropogenic climate change is a result of both global emissions of long-lived greenhouse gases (LLGHGs) and other short-lived climate pollutants. Exposure to air pollutants can also impact the health of livestock, reducing their productivity and potentially leading to respiratory problems. It is important to monitor and reduce emissions of short-lived atmospheric pollutants to protect agricultural productivity and food security. Strategies to reduce emissions can include using cleaner energy sources, implementing more efficient farming practices, and reducing transportation-related emissions. Additionally, promoting sustainable agriculture practices, such as crop rotation and reduced tillage, can help to mitigate the impacts of air pollution on agriculture.

Keyword- Climate Change, Global warning, Livelihood, Green house

Introduction

Short lived atmospheric pollutants are greenhouse pollutants with a high global warming potential and include hydrofluorocarbons (HFCs), black carbon, methane and nitrous oxide. Shakti is supporting efforts to reduce emissions of HFCs and black carbon from multiple sources. These include national and state level activities to inform policies through research studies, convening and capacity building of stakeholders, and enhancing access to finance and technology solutions. rowing season temperature trends have been positive for major wheat- and rice- producing Indian states (precipitation trends are mixed). Studies have shown that these climate trends have had a negative impact on Indian agriculture, reducing relative yields by several percent (DB Lobell *et al.,* 2011 and M Auffhammer *et al.,* 2012). Short-lived climate pollutants (SLCPs) are potent climate forcers that have a much shorter atmospheric lifetime compared to carbon dioxide (CO2), but their warming potential can be much greater. While CO2 remains the primary contributor to anthropogenic climate disruption, SLCPs, such as black carbon, methane, tropospheric ozone, and hydrofluorocarbons, also significantly contribute to the radiative forcing that drives climate change. In fact, they are responsible for up to 45% of current global warming, and if left unchecked, they could account for half of the warming caused by human activity in the coming decades. Reducing emissions of SLCPs presents a crucial opportunity to address climate change as they contribute to up to 45% of global warming, making them the second largest contributor after CO2. Targeted efforts to decrease SLCP emissions could slow the pace of global warming by 0.6 degrees Celsius by 2050. Additionally, many SLCPs are also air pollutants, with harmful effects on human and plant health. Specific reductions in methane and black carbon emitting activities, for example, could save 2.4 million lives in the year 2030 alone, according to estimates by the United Nations Environment Program and the World Meteorological Organization. It is important to note that some SLCPs are emitted alongside gases and aerosols that have a cooling effect. Therefore, careful consideration of actions to decrease SLCP emissions must be taken to reduce climate warming while improving public health, along with aggressive reductions in CO2 emissions to reduce the chances of increased warming while phasing out SLCP emissions.

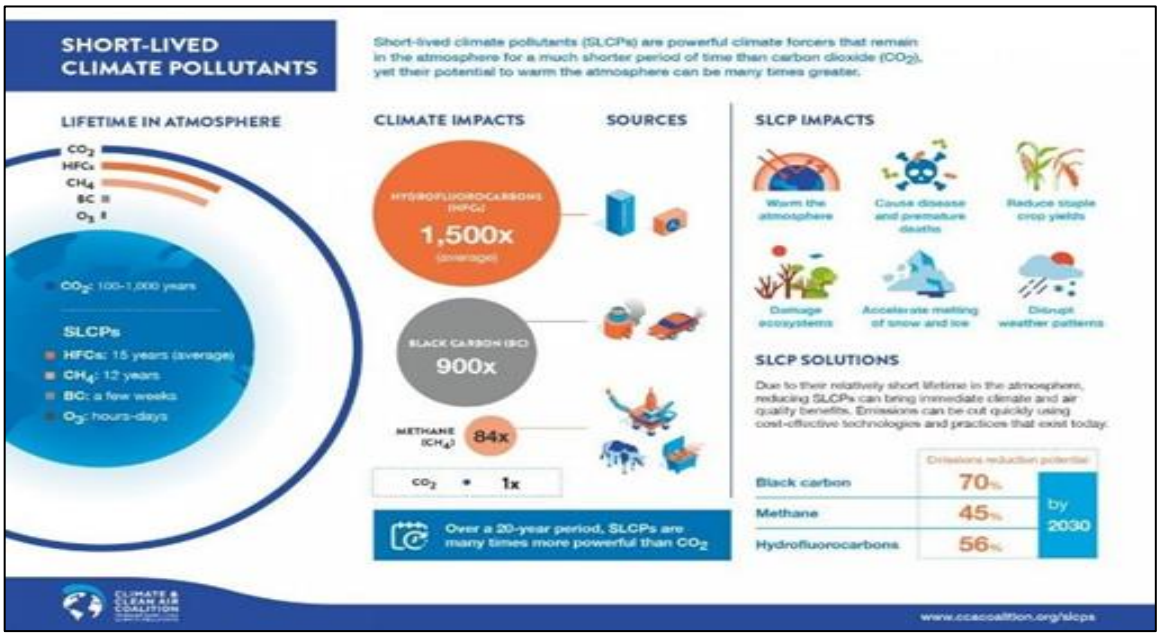

Fig 1- *Component of Short-Lived Atmospheric Pollutant*

Impact of Short-Lived Atmospheric Pollutant on Agriculture

The need to feed an ever-growing global population is a critical development challenge, and we cannot afford to lose millions of tons of crops each year to air pollution. Exposure to tropospheric ozone can cause significant relative yield losses, up to 12% for wheat, 16% for soybean, 4% for rice, and 5% for maize. To prevent the loss of over 50 million tons of crops annually, it is crucial to rapidly reduce the precursors to ozone formation. This can be achieved through measures such as the collection of landfill gas or the recovery of methane emissions from fossil fuel production and distribution. India has already been negatively affected by recent climate trends. However, anthropogenic climate change is a result of both global emissions of long-lived greenhouse gases (LLGHGs) and other short-lived climate pollutants (SLCPs) (Jennifer Burneya and V. Ramanathan, 2014).

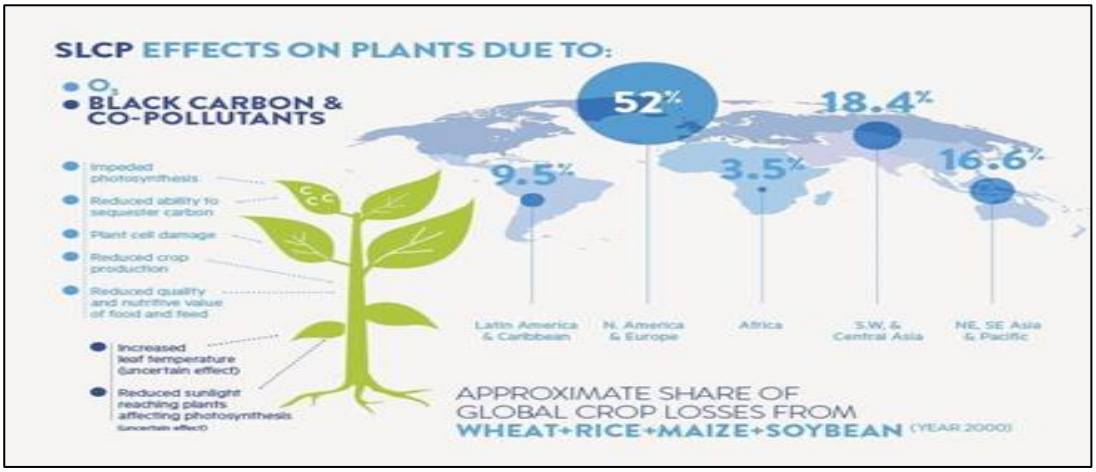

Fig 2*- Impact of Pollutant on Agriculture*

Impact of Short-Lived Atmospheric Pollutant on Climate

Short-lived climate pollutants present an opportunity for rapid action to address global warming. Due to their short atmospheric lifetimes, reducing their emissions can lead to quick reductions in their concentrations and benefits in the near future. Alongside efforts to decrease carbon dioxide emissions, targeting short-lived climate pollutants can be critical for achieving the Paris Agreement's goal of limiting global temperature rise to 2°C. Greenhouse gases (GHGs), air-pollution and short-lived climate pollutants (SLCPs), helps to take mitigation actions for achieving a 2 °C global temperature change limit above pre-industrial levels, so-called "2 °C target"(Tatsuya Hanaoka and Toshihiko Masui, 2020). By taking fast and widespread measures to reduce these emissions, we can

potentially limit global warming by up to 0.6°C in the next few decades. Such action can also prevent climate tipping points that could exacerbate the long-term effects of climate change and make adaptation more difficult, particularly for vulnerable populations.

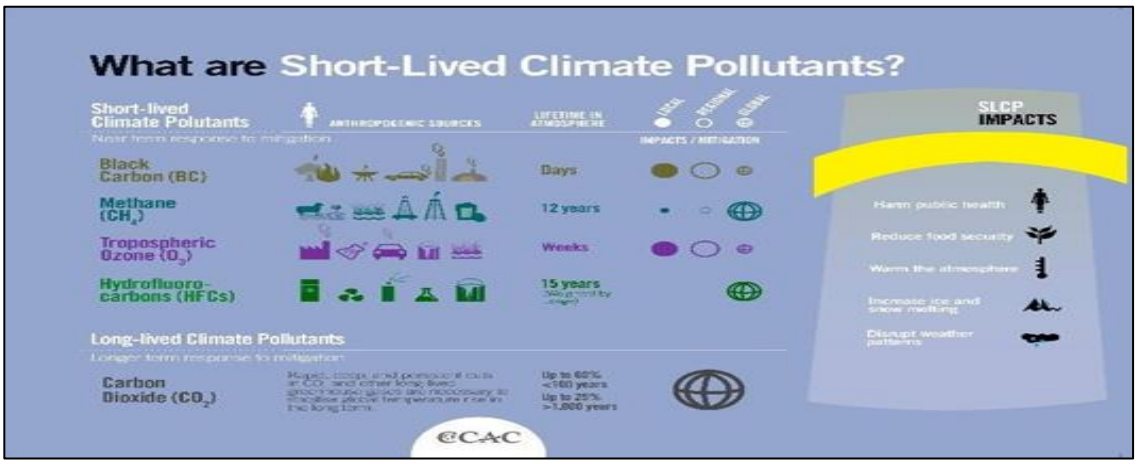

Fig: 3- *Impact of pollutant on Climate*

Impact of Short-Lived Atmospheric Pollutant on Human Health

Air pollution, especially short-lived climate pollutants, is responsible for the premature deaths of almost 7 million people annually, both indoors and outdoors. To address this pressing issue, we need to take fast action on critical sources of short-lived climate pollutant emissions, such as clean cooking and heating technologies and fuels. By doing so, we have the potential to prevent 2.4 million deaths each year. Ground-level ozone and black carbon are highly toxic air pollutants that have severe consequences for human health, ecosystems, and food security. Particulate matter (PM2.5), which consists of very tiny dust, smoke, soot, and liquid droplet particles, can penetrate the lungs and bloodstream, leading to lung disease, severe cardiovascular and neurological problems. Climate change and air pollution can interact to amplify risks to human health and crop production. This has significant implications for our ability to reach the Sustainable Development Goals and for the design of effective mitigation and adaptation policies and risk management (Jana Sillmann *et al.,* 2021). In highly polluted regions, ground-level ozone also contributes to asthma and chronic respiratory illnesses while negatively impacting crop production. For example, in India, ground-level ozone damage to critical crops could have fed an estimated 94 million people living in poverty. The United Nations Environment Programme (UNEP) estimates that by reducing black carbon emissions through measures such as eliminating high-emitting vehicles, introducing clean-burning stoves in low-income countries, and improving solid waste/wastewater management systems by 2030, we could prevent almost 2.4 million premature deaths annually. Similarly, fast action on methane can significantly reduce ground-level ozone, leading to an increase in global crop yields by 26 million tons per year. Reducing short-lived climate pollutants is critical for achieving both the United Nations Sustainable Development Goals and the Paris Climate Agreement.

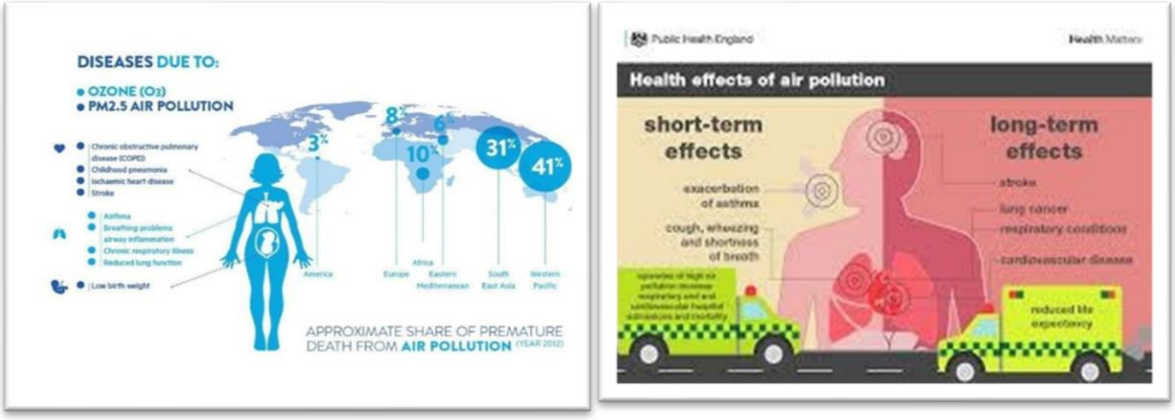

Fig 4: *Impact of Pollutant on Human Health*

Impact of Short-Lived Atmospheric Pollutant on Livelihood Security

Air pollution has a detrimental effect on crop growth by weakening the process of photosynthesis. The presence of tropospheric ozone alone is responsible for significant annual losses of major staple crops such as wheat, rice, maize, and soybean, which amounts to approximately 110 million tonnes per year globally. This represents about 4% of the total annual global crop production and up to 15% in some regions. Unfortunately, air pollution and its negative impact on crops directly affects those who are most vulnerable, including the 2.5 billion people worldwide who rely on agriculture for their livelihoods, many of whom are smallholder farmers living in the tropics. As such, even small changes in climate and crop growth can have an immediate and devastating impact on their productivity and well-being. Hunger and undernutrition affect 1 in 9 people globally, and to achieve the Sustainable Development Goals for 2030, we must address these linked crises and the inequities they cause.

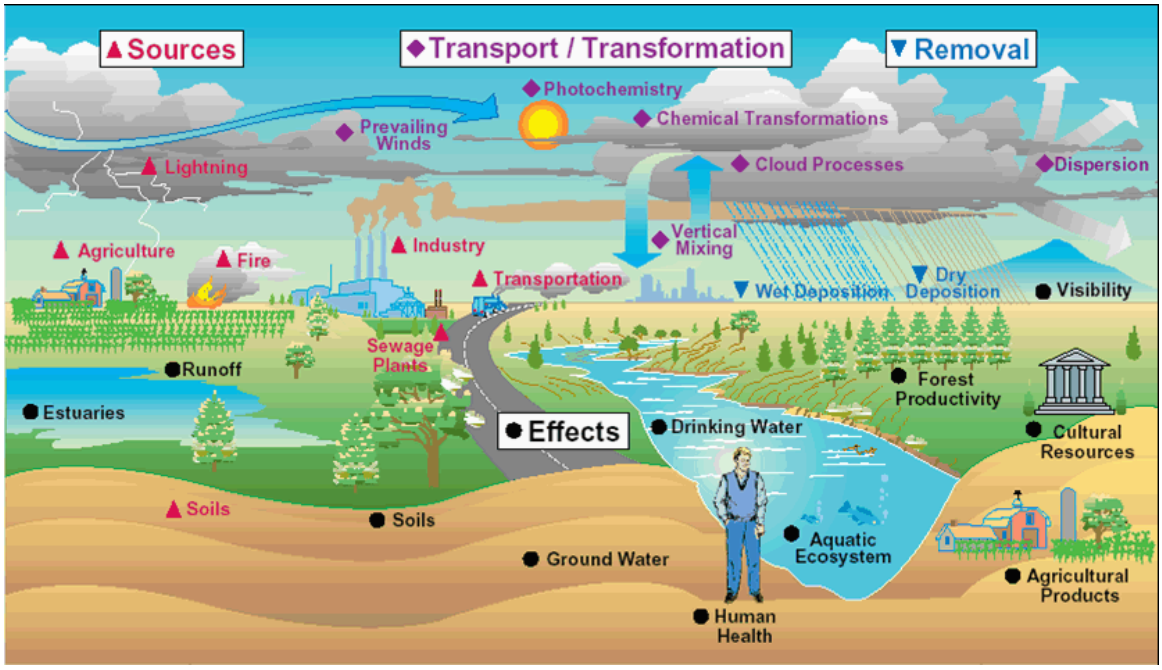

Fig 5: *Impact of Pollutant on Livelihood Security*

Conclusion

In conclusion, a short-lived atmospheric pollutant is a type of air pollutant that has a relatively short lifespan in the atmosphere, typically less than a few days to weeks. Examples of short-lived atmospheric pollutants include volatile organic compounds (VOCs), nitrogen oxides (NOx), sulphur dioxide (SO_2), and particulate matter (PM). While these pollutants may not persist in the atmosphere for very long, they can still have significant impacts on human health and the environment, including contributing to respiratory illnesses, acid rain, and climate change. Therefore, it is important to monitor and reduce emissions of short-lived atmospheric pollutants to protect human health and the environment. Short-lived atmospheric pollutants can have significant impacts on agriculture. These pollutants can affect the quality and productivity of crops, as well as the health of livestock. For example, high levels of nitrogen oxides (NOx) and sulphur dioxide (SO_2) can lead to acid rain, which can damage crops and soil, and reduce their ability to absorb nutrients. Additionally, particulate matter (PM) can reduce the amount of sunlight that reaches crops, which can impact their growth and yield. Exposure to air pollutants can also impact the health of livestock, reducing their productivity and potentially leading to respiratory problems. It is important to monitor and reduce emissions of short-lived atmospheric pollutants to protect agricultural productivity and food security. Strategies to reduce emissions can include using cleaner energy sources, implementing more efficient farming practices, and reducing transportation-related emissions. Additionally, promoting sustainable agriculture practices, such as crop rotation and reduced tillage, can help to mitigate the impacts of air pollution on agriculture.

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