CLIMATIC CHANGE AND PESTICIDES USAGE: A BRIEF REVIEW OF THEIR IMPLICATIVE RELATIONSHIP

K.E. Ukhurebor[a]., U.O. Aigbe[b]., A.S. Olayinka[a]., W. Nwankwo[a]., & J.O. Emegha[c]

[a]Faculty of Science, Edo University Iyamho, Edo State, Nigeria
[b]Department of Physics, University of South Africa, Pretoria, South Africa
[c]Department of Physics, University of Benin, Benin City, Nigeria

Corresponding Author's Email: ukeghonghon@gmail.com

Abstract: Pesticides is very important for the prevention, mitigation, destruction of pests and diseases for the improvement of agricultural efficiency due to their contributions to agricultural yields and improving the standard of living. Considering the dynamicity and influence of weather in our everyday lives, it is obvious that the effects of pesticides might also be a contributing factor and vice versa. Climate change could have an influence on both pesticides' usage, as well as the losses of pesticides to the environment. Presently, the issue of climate change is one of the furthermost intellectual challenging issues facing the entire human race. Therefore, we must continue to protect our environment from these unfavourable effects of climate change by extremely dipping the emissions of greenhouse gases especially via the use of chemical substances such as pesticides. In this review study we will briefly attempt to give an insight and try to bridge the uncertainty surrounding the effects of the use of pesticides and its relationship to climate change effects on the environment.

Keywords: Agriculture; Environment; Pesticides, Climate Change; Living organism

1. INTRODUCTION

Weather has always been a universal concern that plays a major role in our everyday lives (Donald, 2009; Devaraju *et al.*, 2015; Ukhurebor *et al.*, 2017a-b; Ukhurebor and Odesanya, 2019). Meteorological studies are becoming more relevant mainly as a result of weather-related environmental hazards that have greatly affected agricultural activities and caused a lot of harms to living organisms and their environment as a result of the changes in the climate (Ukhurebor and Abiodun, 2018). These meteorological processes are described and their values are known by the meteorological conditions/parameters of the earth's atmosphere, as well as their variations and interactions over time.

These meteorological conditions/parameters that made up the universe have great influence on living organisms and their environment (Ukhurebor and Umukoro, 2018; Ukhurebor *et al.*, 2019). Nonetheless, it is worthy to note that the variations in these meteorological conditions/parameters are caused by most human activities. These human activities are actually the ones affecting these meteorological conditions/parameters that made up the atmosphere, which in turn have environmental influences (Ukhurebor and Azi, 2018; Ukhurebor *et al.*, 2018; Nwankwo and Ukhurebor, 2019). Sanchez-Lorenzo *et al.,* (2012) reported in their study, that there is a snowballing compromise about the anthropogenic influence on the present variations of the earth's climate. Accordingly, this is been confirmed in the tremendous increase in the universal average close surface air temperature with a warming rate over the last few years which have no standard in the instrumental records. This trend according to their study is expected to linger in the future. However, climate prognoses are still exaggerated by some other significant uncertainties,

specifically its relationship with the role of chemical substances like pesticides and clouds in the climate scheme.

Conversely, from existing literatures within our disposal, little or no much attention has been given to the relationship between climate variability and the use of pesticides. However, several researchers have concentrated their attention on the toxicity impacts of pesticides on living organisms and their environment. This review study will briefly attempt to give an insight and would try to bridge the uncertainty surrounding the effects of the use of pesticides as it relates to the impacts of the changes in climate on the environment. The implications and rationale of this research is that it will again bring to the consciousness of individuals about the existence of changes in the climate system, its influence on agriculture and other parts of human lives so as to take the necessary mitigation measures as well as the adaptation options.

2. CLIMATE CHANGE/VARIABILITY

According to the definition by the Intergovernmental Panel on Climate Change (IPCC), climate change is a statistically substantial discrepancy in either the mean condition of the climate or in the inconsistency of the mean state of climate, occurring over a long time. It has to do with an alteration of climate that is caused either by natural internal processes or external factors that are as a result of anthropological activities. These changes are constituent of the atmosphere, coupled with the natural climate unpredictability detected over longer period (IPCC, 2007). Climate variability on the other hand is the discrepancies in the average state as well as some additional statistics of the climate on all chronological and altitudinal scales, outside the distinct weather measures. It is mostly used to represent the nonconformities of climatic statistics done over a given short duration, when likened to long-standing statistics for the same duration. Climate variability is measured by these nonconformities, which are frequently called anomalies. These inconsistencies might be as a result of internal inconsistency that are caused by natural internal processes within the climate scheme or external inconsistency caused by the nonconformities in natural or anthropogenic external features (Ukhurebor and Abiodun, 2018).

The National Oceanic and Atmospheric Administration (NOAA, 2007) reported that the 20th century and the beginning of the 21st have been the warmest period ever in the world measurement of temperature records, and this commenced around the middle in the 19th century. In Nigeria and most parts of the world the release of greenhouse gasses has increased due to anthropological activities (IPCC, 2007). In the next coming decades or so, it is estimated that a great number of persons running up to billions, especially those of developing nations will encounter insufficiency of water and food with negative effect on their health as a result of climate inconsistency. Consequently, global actions are required to withstand these effects of climate variability which are occurring now and will continue imminently. However, because of global warming, the type, rate and extent of life-threatening environmental events, for example tropical cyclones, inundations, droughts, intense rainfall events and heat waves are expected to increase even with little increase in temperature (Ukhurebor and Abiodun, 2018). It is obvious that human activities have altered the atmospheric features, such as temperature, rainfall, levels of CO_2 and ground level ozone. IPCC (2007), highlighted countless uncertainties about climate change, that warming of the climate systems are now unambiguous and it is obvious that global warming is higher because of the man-made emissions of greenhouse gasses, particularly CO_2.

The current population pressure and means of survival has led to certain anthropological undertakings to increase the level of CO_2 on the atmosphere, which in turn increase global warming. Such anthropological undertakings include deforestation, bush burning and

pesticides usage (Ukhurebor and Abiodun, 2018). Recent studies have shown that the effects of climate inconsistency have certainly affected the development and have made the attainment of the Millennium Development Goals (MDGs) or Sustainable Development goals (SDGs) significantly more tedious in sub-Saharan Africa, Nigeria inclusive (Ukhurebor and Abiodun, 2018; Bakshi *et al.,* 2019). This again affirmed the report of the United State Agency for International Development (USAID, 2007), that the impacts of climate change have greater impacts on less privileged unindustrialized countries than those of more developed nations.

The significance of climate change cannot be over emphasized considering its impacts on water availability, quality and quantity, food security, agriculture, health, air quality, species migration and sea level rise. These pose great environmental challenges as well as economic losses. Extreme climatic variables like temperature and rainfall events have significant economic implications on agriculture and food security (Muluneh *et al.,* 2017; Ukhurebor and Abiodun, 2018). The United Nations Development Programme (UNDP, 2008), predicted that the impacts of climate inconsistency such as the rise of sea-level, floods, droughts, heat waves and changes in precipitation would possibly by 2080 drive more than 600 million persons into starvation and the quantity of persons that would be affected by water scarcities would be up to1.8 billion.

Specifically, Nigeria is vulnerable to climate variability because of its dependence on rain-fed pest-controlled agriculture which relies directly or indirectly on climate variables; agricultural activities from planting to harvesting are dependant either directly or indirectly to climate variability as well as the use of pesticides.

3. PESTICIDE USAGE

Pesticide belongs to a family of heterogeneous compounds which are used basically in controlling different pest and disease carriers. Pesticides are mainly use in agriculture on the control for unwanted plants, insect infestation and diseases. They are accountable for several benefits in the various sectors of our endeavours, such sectors include health, agriculture and industry. Accordingly, Mostafalou and Abdollahi, (2017) reported that the harmfulness of pesticides to living creatures such as animals and plants as well as the environment have continuously remained a course of worry. However, our concern in this brief overview is mainly on the implicative relationship between climatic change and pesticides.

Pesticides are of different types, each of which is intended to be effective against specific pests. They include but not limited to the followings:

- Algaecides: are used for destroying and/or slowing growth rate of algae.
- Antimicrobials: are used in controlling germs and microbes like bacteria and viruses.
- Disinfectants: are used in controlling germs and microbes such as bacteria and viruses.
- Fungicides: are used in controlling fungal problems like moulds, mildew and rust.
- Herbicides: are used in destroying/slowing the growth of undesirable plants (weeds).
- Insecticides: are used in controlling insects.
- Insect Growth Regulators: are used to interrupt the development and reproduction of insects.

- Rodenticides: are used in destroying rodents like mice, rats, and gophers.

The success in agricultural productivity not only depends on the effort of the farmers but also depend significantly on the protection measures used and the climatic conditions of the environment. The use of pesticide assists in the protection, prevention, mitigation, destruction of pests and diseases. Pesticides are applied fundamentally for the increase in food production so as to increase the standard of living.

4. Climatic Change and Pesticides

Despite the advantages of the use pesticides in agriculture and other aspects of lives, there have also been several consequences associated with their applications. At what time pesticides are applied, they could move from the location where they are applied to other locations (Palikhe, 2007). Their mobile nature makes them sometimes move through air, water and soil. One of the main issues with pesticide mobility is that during the movement, they could come in contact with some organisms which can cause impairment to both human and his environment. Exposure to pesticides has resulted in countless poisonings, the growth of cancer and the losses of over fifty thousand persons annually (Palikhe, 2007; Mostafalou and Abdollahi, 2017).

Another major problem that is associated with the use pesticide in bioaccumulation and biological magnification. The use of pesticides is now a major threat as a result of the objectionable side effects of these chemicals. According to Mostafalou and Abdollahi, (2017), these effects are noticeable in food quality, biodiversity, human health, changes in the climate and the environment as large.

Several other research studies have also shown that in some circumstances the application of pesticides disrupts the balance of the ecosystem. This ensues when the use of pesticide destroys or affects the non-intended target, in the process and this can significantly distort the regular balance of the ecosystem (Mostafalou and Abdollahi, 2017). By affecting the non-intended target, the environment could be altered in favour the targeted pest. Obviously, this disruption in the ecosystem as a result of the use of pesticides will lead to climate variability.

Recent findings have shown that human induced activities such as the use of pesticides and other chemicals are tremendously contributing to effects resulting from the changes in the climate scheme via the emission of greenhouse gasses from these chemical substances. According to the United Nations Framework Convention on Climate Change (UNFCCC), these greenhouse gasses which are in the form of Carbon (IV) Oxide (CO_2), Methane (CH_4) and Nitrous Oxide (N_2O) are consequents from the use of chemicals substances. These emissions allow solar radiation to pass through the atmosphere and do not permit the reflected heat from going back into space and this certainly will cause an upsurge in the temperature of the earth. Invariably, resulting in climate inconsistency and this may result to global warming (UNFCCC, 2007). Global warming is now a treat in most parts of the world, Nigeria inclusive. In Nigeria and most parts of the world the release of greenhouse gasses has amplified tremendously as a result of human activities (Ukhurebor and Abiodun, 2018).

On the other hand, studies have shown also that climate inconsistency would upsurge the risk of diffuse losses of pesticides occurring from agriculture to the environment (Palikhe, 2007). Evidently, the continuous deviation of the climate, would not only affect plant yields but also the use of pesticide is expected to be pretentious.

5. CONCLUSION

Recent research studies by Bakshi *et al.,* (2019) reveal that climate inconsistencies, which possibly arise as a result of global warming or additional issues like the use of pesticides has been revealed to have a great effect on mortality rates in most parts of sub-Saharan Africa. Precisely, in Nigeria, application of pesticides for the prevention, mitigation, destruction and the improvement of agricultural efficiency are increasing; notwithstanding its eminent toxicity benefits on organisms, human health and the environment in general. Their usage and mode of action furnishes a comparative benefit for agricultural produce by protecting them from weeds, pests and diseases. The effectiveness and usage of pesticides are influenced environmentally. Considering, these eminent environmental effects of changes in the climate scheme, there is an assentation that pesticides usage could/may also have influence on climate change effect in the environment.

According to Palikhe (2007), the causes and sources and of anthropogenic changes in the climate scheme are numerous. He reported that these causes and sources of changes in the climate scheme are often problematic to tackle. There are no specific ways in solving these menaces. However, there are countless opportunities its mitigation.

Conclusively, it is paramount to urgently sensitize the general public about the existence of these vicious impacts of the use of pesticides especially for agricultural activities and its relationship to climate change in order to put in place the required procedures and adaptation possibilities to mitigating and controlling of its impacts.

ACKNOWLEDGEMENT

Our gratitude goes to Prof. Augusto José Pereira Filho of the Institute of Astronomy, Geophysics &Atmospheric Sciences, University of Sao Paulo, Brazil as well as Dr. Seyni Salack and Dr. Inoussa Saley both of the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), Competence Center, Ouagadougou, Burkina Faso for giving Kingsley Eghonghon Ukhurebor the fundamental understanding in Climatic/Atmospheric Science.

REFERENCES

Bakshi, B., Nawrotzki, R.J., Donato, J.R., & Lelis, L.S. (2019): Exploring the Link between Climate Variability and Mortality in Sub-Saharan Africa. Int. J. Environment and Sustainable Development, 18(2), 206-237.

Devaraju, J.T., Suhas, K.R., Mohana, H.K., & Vijaykumar, A.P. (2015): Wireless Portable Microcontroller based Weather Monitoring Station. Measurement, 76, 189-200.

Donald, A.C. (2009): Meteorology Today; an Introduction to Weather, Climate and the Environment. Ninth Edition, Brooks/Cole, Cengage Learning, USA.

IPCC. (2007): Climate Change Impacts, Adaptation and Vulnerability, Contribution of the Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, United Kingdom.

Mostafalou, S., & Abdollahi, M. (2017): Pesticides: An Update of Human Exposure and Toxicity. Arch Toxicol., 91(2), 549-599.

Nwankwo, W., & Ukhurebor, K.E. (2019): Investigating the Performance of Point to Multipoint Microwave Connectivity across Undulating Landscape during Rainfall. In: Journal of the Nigerian Society of Physical Sciences, 1(3), 103-115.

NOAA. (2007): Observing Climate Variability and Change, National Oceanic and Atmospheric Administration. http://www.oar.noaa.gov/climate/observing.html.

Palikhe, B.R. (2007): Relationship between Pesticide use and Climate Change for Crops. Journal of Agriculture and Environment, 8, 83-91.
Sanchez-Lorenzo, A., Laux, P., Hendricks-Franssen, H., Calbo, J., Vogl, S., Georgoulias, A.K., & Quaas, J. (2012): Assessing Large-scale Weekly Cycles in Meteorological Variables: A Review. Journal of Atmospheric Chemistry and Physics, 12, 5755-5771.
Ukhurebor, K.E., & Abiodun I.C. (2018): Variation in Annual Rainfall Data of Forty Years (1978-2017) for South-South, Nigeria. Journal of Applied Sciences & Environmental Management, 22(4), 511-518.
Ukhurebor, K.E., Abiodun, I.C., Azi, S.O., Otete, I., & Obogai, L.E. (2017a): A Cost-Effective Weather Monitoring Device. Archives of Current Research International, 7(4), 1-9.
Ukhurebor, K.E., & Azi, S.O. (2019): Review of Methodology to Obtain Parameters for Radio Wave Propagation at Low Altitudes from Meteorological Data: New Results for Auchi Area in Edo State, Nigeria. Journal of King Saud University – Science, 31(4), 1445–1451.
Ukhurebor, K.E., Azi, S.O., Abiodun, I.C., & Ojiemudia, S.E. (2018): The Influence of Weather Variables on Atmospheric Refractivity over Auchi, South-South, Nigeria. Journal for Applied Science and Environmental Management, 22(4), 471-475.
Ukhurebor, K.E., Batubo, T.B., Abiodun, I.C., & Enoyoze E. (2017b): The Influence of Air Temperature on the Dew Point Temperature in Benin City, Nigeria. In: Journal for Applied Science and Environmental Management, 21(4), 657-660.
Ukhurebor, K.E., & Odesanya, I. (2019): Relationship between Meteorological Variables and Effective Earth Radius Factor over Auchi, Edo State, South-South, Nigeria. Covenant Journal of Physical & Life Sciences, SE, 7(1), 1-10.
Ukhurebor, K.E., Olayinka, S.A., Nwankwo, W., & Alhasan C. (2019): Evaluation of the Effects of some Weather Variables on UHF and VHF Receivers within Benin City, South-South Region of Nigeria. In: Journal of Physics: IOP Conference Series. 1299, 012052.
Ukhurebor, K.E., & Umukoro, O.J. (2018): Influence of Meteorological Variables on UHF Radio Signal: Recent Findings for EBS, Benin City, South-South, Nigeria. IOP Conference Series: Earth & Environment Science, 173, 012017.
UNDP. (2008): Fighting Climate Change, Human Solidarity in a Divided World, Human Development Report, United Nations Development Programme. 1 UN Plaza, New Work, 10017, U.S.A.
UNFCCC. (2007): Climate Change Impact, Vulnerabilities and Adaptation in Developing Countries, United Nations Framework Convention on Climate Change. Information Services of UNFCCC Secretariat, Germany.
USAID. (2007): Adapting to Climate Variability and Change, a Guide Manual for Development Planning, U.S Agency for International Development. 1300 Pennsylvania Avenue, NW Washington DC.