



Perception of the Environmental Impact of Chemical Fertilizer Application by Vegetable Farmers along River Ngadda of Maiduguri, Borno State, Nigeria

*¹MUSA, A; ¹ZANNA, FM; ¹WAKIL; NA; ²GUJJA, AA

¹Department of Basic Science and Technology, Mohamet Lawan College of Agriculture, P.M.B. 1427, Maiduguri, Borno State, Nigeria.

²Department of Forestry Technology, Yobe State College of Agriculture, Science and Technology Gujba, P.M.B. 1104, Damaturu, Yobe State, Nigeria.

*Corresponding Author Email: abbakmusa@gmail.com; Tel: 07084303444

ABSTRACT: There is an increasing global concern on the current agricultural practices that are not sustainable owing to adverse impact of chemical fertilizer application on environment. This study identifies types of fertilizer applied, examined farmers knowledge on fertilizer application and assessed farmers perception of the impact of fertilizer on environment along river Ngadda in Maiduguri, Borno State, Nigeria. Data were collected from both primary and secondary sources. Primary data were generated through field observation and anonymous structured interview questionnaire were used, while the secondary data was obtained from relevant literature. Through purposeful sample, 120 farmers were selected for the study. Findings revealed that farmers applied NPK fertilizer were 31.9%, Urea fertilizer 27.1%, Phosphorus 19.4% and those applied combined Urea and NPK were 21.5%. The study revealed farmers knowledge on fertilizer application, 50.8% have no formal training, 28.3% trained by extension workers and 20.8% were trained by World Food Program. Findings also revealed that 6.0% of the respondents perceived fertilizer pollute air, contribute to climate change were 2.7%, contaminate soil 25.7% while 3.8% perceived fertilizer build-up heavy metals in soil. Those perceived pollute groundwater were 12.0% and causes eutrophication 21.9%. The study concluded that chemical fertilizer increases plant growth and vigor, hence meets the food security of the world, but its continuous use degrades the soil and environmental pollutions. We recommended that opting organic farming and bio-fertilizers will create a healthy natural environment for the present as well as future generation.

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As global population and environmental threat increases of insuring safety and food security is in critical situation (Tayoh *et al.*, 2016). However, the use of chemical fertilizer has become imperative to modern agriculture to feed the growing population but it apparent that they have much negative consequences and have become beyond the reach of ordinary farmers (Hussain *et al.*, 2017). In most countries of sub-Saharan Africa, about 60% of the economically active populations work in the agricultural sector. Over 85% of the rural populations of sub-Saharan African countries rely on agriculture for their survival (Mahmoud *et al.*, 2009). The use of chemical fertilizers have risen about 150 kg/ha in Asia and Europe (Druilhe *et al.*, 2012; Jama *et al.*, 2013).

Modern chemical dependent farming methods deprived the soil of nutrients, destroy soil microbes, contribute to salinization and climate change and saturates farmlands with toxic fertilizers and pesticides that leaches into groundwater, river and lake (Suresh and Himanshu, 2015). Intensive application causes serious environmental problems for instance, eutrophication of water, loss of biodiversity, global warming and ozone depletion (Omidiri *et al.*, 2015). Some chemical fertilizer contains heavy metals excess use may result in a toxic buildup in the soil. The can eventually make their way into fruits and vegetables posing an adverse health risk to humans and animals that consume the contaminated products (Atikur and Dunfu, 2018). Despite the harmful effects of chemical fertilizers, farmers in Nigeria rely heavily on the use of chemical fertilizers to increase crop yield because

*Corresponding Author Email: abbakmusa@gmail.com; Tel: 07084303444

soil nutrients have been depleted due to incessant tillage. The objectives of this study were to identify types of chemical fertilizers applied, examined farmers knowledge on fertilizer application and assess farmer perception of the impact of chemical fertilizer application on environment along river Ngadda in Maiduguri, Borno State, Nigeria.

MATERIALS AND METHODS

Study Area: The river Ngadda flows through Maiduguri, which is located between latitude 11° 40' N and 12° 05' N and longitude 13° 05' E and 13° 20' E. It is also located in the Sudano-Sahelian belt of Borno State and is part of the Chad formation. The source of the river is from Sambisa Swamp sources by the flood spill of Gambole and river Yezaram and length up to 82.2 km (Abdullahi *et al.*, 2015). The river provides socio-economic benefits for Maiduguri and settlements located along the river channel.

Data Collection: The study was conducted in November 2020 to March 2021 both primary and secondary sources of data were used. Primary source data generated through field observation and anonymous structured interview questionnaire were used. The secondary data were obtained from relevant literature. Purposeful sample of 120 vegetable farmers were selected and interviewed for the study.

Data Analysis: Data was presented as simple percentage using descriptive statistics.

RESULTS AND DISCUSSION

One hundred and twenty (120) interviewed questionnaires were completely filled, given a response rate of 100%. Socio-demographic characteristics of the respondents (table 1) shows 84.2% of the farmers were male and 15.8% were female. Male were more actively engaged in farming than their female counterparts in the study area inconsistent with Tayoh *et al.*, (2016). The respondents age were categorised into three as presented in table 1, results show highest proportion (70.8%) of the respondents were middle aged as compared to young aged (23.3%) and old aged (5.8%) respectively. Therefore, findings indicate that middle to young aged farmers were more involved in vegetable farming in the study area consistent with Hussain *et al.*, (2017). Based on educational level, the respondents were grouped into four categories as presented in table 1. Higher proportion (39.2%) of the respondents acquired secondary level, followed by non-formal (33.3%), those with primary level (17.5%) and tertiary level (10.0%) respectively. Results in table 1 also revealed farm size used among the farmers

(37.5%) cultivate half hectare of land, 1 hectare of land farmers (29.2%), some farmers (20.8%) used 1 and half hectares of land and others (12.5%) cultivate 2 hectares of land respectively. Land ownership is a problem in the study area, each year most farmers rented land for one year farming period, it was consistent with the study by Maianguwa *et al.*, (2007).

Table 1: Socio-demographic characteristics of respondents

Variable	Frequency	Percentage
Gender		
Male	101	84.2
Female	19	15.8
Total	120	100
Age		
Young age<35	28	23.3
Middle age 35-50	85	70.8
Old age>50	7	5.8
Total	120	100
Educational level		
Non-formal education	40	33.3
Primary education	21	17.5
Secondary education	47	39.2
Tertiary education	12	10.0
Total	120	100
Farm Size		
½ hectare	45	37.5
1 hectare	35	29.2
1 and ½ hectares	25	20.8
2 hectares	15	12.5
Total	120	100

Field survey 2021

Table 2: Types of fertilizer applied in the study area (n-120)

Variable	Frequency	Percentage
NPK fertilizer	46	31.9
Urea fertilizer	39	27.1
Phosphorus fertilizer	28	19.4
Combine Urea and NPK	31	21.5
Total	144	100

Field survey 2021

The study has identified types of fertilizer applied by the farmers in the study area (table 2), findings revealed (31.9%) of the respondents applied NPK. Those applied Urea fertilizer (27.1%), some farmers (19.4%) applied Phosphorus fertilizer and others (21.5%) said they applied combined Urea and NPK. The respondents claimed that NPK fertilizer is more potent in adding nutrient to the soil than any other chemical fertilizers consistent with Bokhtier and Sakurai (2007). These farmers have limited options and prioritized excessive fertilizer use in pursuit of bumper harvest.

Table 3: Farmer's knowledge of fertilizer application

Variable	Frequency	Percentage
No formal training	61	50.8
Trained by extension worker	34	28.3
Trained by world food program	25	20.8
Total	120	100

Field survey 2021

Findings revealed farmers knowledge on fertilizer application in the study area (table 3), they have limited access to efficient technologies on fertilizer application techniques and little formal training from government extension workers. Farmers not received formal training (50.8%), those trained by extension worker (28.3%) and trained by World Food Program (20.8) respectively.

The untrained farmers are associated with excessive fertilization less likely to the trained-up farmers consistent with Martey *et al.*, (2007); Raut and Sittelula (2012).

Table 4: Farmer's perception of the impact of chemical fertilizer on environment (n=120)

Variable	Frequency	Percentage
Fertilizer pollute air	11	6.0
Climate change	5	2.7
Contaminate soil	47	25.7
Build-up heavy metals in soil	7	3.8
Long term soil degradation	35	19.1
Reduce soil humus	16	8.7
Pollute groundwater	22	12.0
Causes water eutrophication	40	21.9
Total	180	100

Field survey 2021

Findings further revealed (table 4) farmer's perception of the environmental impact from usage of chemical fertilizers could not be negligible. Respondents (6.0%) perceived that fertilizer pollute air, contribute to climate change (2.7%) consistent with Savci (2017), Cherry *et al.*, (2017) and inconsistent with Hussain *et al.*, (2017), some (25.7%) respondents perceived contaminates soil, build-up heavy metals in soil were (3.8%) consistent with Usman and Dosumu (2011). Respondents (19.1%) perceived that fertilizer causes long-term soil degradation and others (8.7%) perceived reduces soil humus consistent with Iqbal *et al.*, (2015).

Those (12.0%) perceived that pollute groundwater 12.0% and causes eutrophication were (21.9%) consistent with Day (2008). Farmers in the study area moderately perceived impacts of chemical fertilizer on environment, but incessantly applied fertilizers environmentally unconscious.

Conclusion: The study concludes that fertilizers application is vital for today's agricultural crop production as it restores the soil nutrient and promotes crop growth and yield. Therefore, to ensure both enhanced and sustainable agricultural production and to safeguard the environment, integrated use of different types of nutrient such as organic manures and bio-fertilizers, and comprehensive national policies for quality control of fertilizers should be adopted.

REFERENCES

- Abdullahi, J; Odihi, JO; Wanah. BB (2015). Assessment of the Impact of Human Activities along River Ngadda Channel, Maiduguri, Borno State, Nigeria. *Journal of Geography, Environment and Earth Science International*. 2 (4): 207-217.
- Atiku, R; Dunfu, Z (2018). Effects of Fertilizers Broadcasting on the Excessive Use of Inorganic Fertilizers and Environment Sustainability. *Sustainability*. 3: 759: 1-15
- Bokhtiar, SM; Sakurai, K (2005). Effects of organic manure and chemical fertilizer on soil fertility and productivity of plant and ratoon crops of sugarcane. *Archiv. Agron. Soil Sci*. 325-334
- Cherry, ML; Akane, N; Seiji, H (2017). Eco-Efficiency Assessment of Material Use: The Case of Phosphorus Fertilizer Usage in Japans Rice Sector. *Sustainability*. 9, 1563: 1-13
- Day, J (2008). The debate over organic VS chemical fertilizers. *Renew. Sust. Energ. Rev*. 31: 846-859
- Druilhe, Z; Barreiro-Hurle, J (2012). Fertilizer subsidies in sub-Saharan Africa. ESA Working paper No. 29-04. Agricultural Development Economic Division, FAO, July 2012.
- Ghosh, MK; Hassan SS (2013). Farmers Attitude Towards Sustainable Agricultural Practices. *Bangladesh Res. Pub. J*. 8 (4): 227-235.
- Hassain, A; Hossain, Z; Islam, Matiul, I (2017). Farmers Perception Regarding Effect of Chemical Fertilizer Application on Soil Health. *Bangladesh J. Soil Sci*. 39 (1): 35-41.
- Iqbal, SMA; Sattar, MA; Islam, N; Islam, GM; Mollah, MRA (2015). Assessment of Farmers Perception on the Application of Chemical Fertilizers and Organic Manures Chuadanga Region. *J. Environ. Sci. Nat. Resour*. 7 (2): 69-72.
- Jama, B; Harawa, R; Kiwia, A; Ratieya, M; Kimani, D (2013). Improving Soil Health in Africa: Challenges and Promising Solutions. AGRA Jason Scarpone, AFAP.
- Mahmoud, E; El-Kader, NA; Robin, P; Akkal-Corfini, N; El-Rahman, LA (2009). Effects of Different Inorganic Fertilizers on Cucumber Yield and Some Soil Properties. *World Journal of Agricultural Science*. 5 (4): 408-414.

- Maiangwa, MG; Ogunbible, AO; Olukosi, JO; Atala, TK (2007). Adoption of chemical fertilizer for land management in the North-West. Zone of Nigeria. *Tropic Agric. Res. Exten.* 10: 33-46
- Martey, E; Wiredu, AN; Etwire, PM; Fosu, M; Buss, SSJ (2014). Fertilizer adoption and use intensity among smallholder farmers in Northern Ghana: A case study of the AGRA Soil health project. *Sustain. Agric. Res.* 3 (1): 24-36.
- Omidire, NS; Raymon, S; Victor, K; Russell, B; Jewel, B (2015). Assessing the impact of inorganic and organic fertilizer on crop performance under a microirrigation-plastic mulch regime. *Professional Agricultural Workers Journal.* 3 (1): 1-9.
- Raut, N; Sitaula, B (2012). Assessment of fertilizer policy. Farmers perceptions and implications for future agricultural development in Nepal. *Sustainable Agriculture Research.* 1 (2): 188-200.
- Savci, S (2012). An agricultural pollutant: Chemical fertilizer. *International Journal of Environmental Science and Development.* 3 (1): 77-80.
- Suresh, P; Himanshu, P (2015). A Study of Perception of Farmers towards Organic Farming. *Inter. J. Appl. Innov. Eng. Manage.* 4 (3): 269-277.
- Tayoh, LN; Kiyoye, LMI; Nkemnyi, MF (2016). Chemical fertilizer application and farmers perception on food safety in Buea, Cameroon. *Agricultural Science Research Journal.* 6 (12): 287-295.
- Usmam, OAS; Dosumu, OO (2007). Cadmium analysis in fertilizers and groundwater samples in Dass Local Government Area of Bauchi State, Nigeria. *Centerpoint (Science Edition).* 208-213