Journal of Research in Weed Science

2021, Volume 4, Issue 4

Original Article: Nigeria Pesticide Use Profile

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Citation Hughes Ibrahim Usman. 2021. Nigeria Pesticide Use Profile, 4(4), 257-263.

http://dx.doi.org/10.26655/JRWEEDSCI.2021.4.1

Article info

Received: **20 June 2021**
Accepted: 13 December 2021
Available Online: 15 December 2021

Checked for Plagiarism:
Yes.

Peer reviewers approved by:
Dr. Mohammad Mehdizadeh

Editor who approved publication:
Dr. Amin Baghizadeh

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Keywords:
Herbicide, Insecticide, Fungicide, Soil fumigant, Net weight.

ABSTRACT

Data were obtained from the National Bureau of Statistics (NBS) Abuja in February 2021 on pesticides imports into Nigeria to ascertain costs and quantity of pesticides that were used in agricultural and sundry activities in Nigeria from 2010 to 2020 to make an empirical analysis based on pesticide use in Nigeria, Africa and globally. The annual net weight of pesticides used in Nigeria was 23,412.5 Mt, thus ranking Nigeria as the second largest pesticide user after South Africa. The total quantities of each of pesticide types; herbicides, insecticides, fungicides, soil fumigants and mosquito repellants over the 11years periods were 965, 558.98, 188, 132.37, 66, 129.62, 67, 243.97 and 623.56 metric tons respectively, while the mean annual tonnage of each of the pesticide types for the same periods were 87,778.08, 17,102.9, 6,011.8, 6,113.1 and 56.7 metric tons in that order. The quantities of pesticide types used over the periods represent 74.98%, 14.61%, 5.14%, 5.22% and 0.5% herbicides, insecticides, fungicides, soil fumigants and mosquito repellant coils respectively. Nigeria spent about 244 million US Dollars annually on pesticides, out of which 74%, 16.6%, 4.7%, 5.0% and 0.06% were on herbicides, insecticides, fungicides, soil fumigants and mosquito repellant coils respectively. Therefore, it could be concluded that the essence of pesticide use in Nigeria is in agriculture.

Introduction

Nigeria is the most populous country in Africa, with about 206.1 million people (World Bank, 2020). It has a total geographical area of 923,768 square kilometers and lies wholly within the tropics along the Gulf of Guinea extending from Latitude 04. 030 N to 14.000 N and Longitude 02.050 E to nearly 15.000 E. Out of its total area of 92.4 million hectares, only 70.8 million hectares have the potential for agricultural production, while 34 million hectares are arable (World Bank, 2020). It has a highly varied agro-ecological situation, which makes producing a wide range of agricultural products feasible. Therefore, agriculture constitutes one of the most critical areas of the economy. The agricultural area is significant in its employment creation, gross domestic product (GDP), and export revenue earnings.

However, despite rich agricultural potentials, the sector has grown shallowly (Manyong *et al.* 2005). Less than 50 % of the country's arable land is under cultivation (Manyong *et al.* 2005) because the more significant proportion of the farmers are smallholder and traditional farmers who use rudimentary production techniques, with resultant low yields. These smallholder farmers are constrained by many problems, including poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, and

land and environmental degradation. The poor access to insufficient inputs such as pesticides makes pest problems a limiting factor to agricultural expansion because farmers obviously would cultivate an area of land they could manage.

Currently, approximately 2 million metric tons of pesticides are utilized globally, out of which 47.5% are herbicides, 29.5% insecticides, 17.5% fungicides, and 5.5% other pesticides (De *et al.* (2014). Also, of 2 million metric tons of pesticides, 45% are being used in Europe, 25% in the United States, 4% in India, and 26% in the rest of the world (De *et al*., 2014) at a total expenditure of about US$40 billion per year (Popp *et al.* 2013). Moreover, it has been estimated that by the year 2020, global pesticide usage will increase up to 3.5 million metric tons (Zhang, 2018). The top ten pesticide-consuming countries globally are China, USA, Brazil, Argentina, Canada, Ukraine, France, Malaysia, Australia, and Spain (World Atlas, (2018), FAOSTAT, 2019; World Bank, 2019). Among the twenty countries listed in order of pesticide use, only South Africa is in Africa (FAOSTAT, 2019 and World Bank, 2019) (Table1), indicating the low level of pesticide application in African agriculture. Ecuador, China, South Korea, Japan, and Guatemala had the highest pesticide applications per hectare of cropped fields globally (FAOSTAT, 2019; World Bank, 2019).

Table 1. World Pesticide Use ranking by Countries in 2019

Country	Pesticides Net weight (Mt)	Kg of Pesticide per/ha of cropped land	Ranking
China	1,763,000.0	13.1	1
USA	407,779.0	2.5	2
Brazil	377,176.0	6.0	3
Argentina	196,009.0	4.9	4
Canada	90,139.0	2.4	5
Ukraine	78,201.0	2.3	6
France	70,589.0	3.6	7
Malaysia	67,288.0	8.1	8
Australia	63,416.0	2.0	9
Spain	60,896.0	3.6	10
Italy	56,641.0	6.1	11
Turkey	54,098.0	2.3	12
India	52,750.0	0.3	13
Japan	52,249.0	11.8	14
Germany	48,173.0	4.0	15
Mexico	47,128.0	1.8	16
Colombia	37,693.0	9.9	17
Thailand	35,287.0	1.7	18
Ecuador	34,252.0	13.9	19
S. Africa	26,857.0	2.2	20
Guatemala	20,489.0	10.0	23
S. Korea	20,043.0	12.4	24

Source (FAOSTAT, 2019; World Bank, 2019).

Apart from synthetic pesticides, other alternatives available to control crop loss due to pest attacks are applying various bio-pesticides and developing pest-resistant crop varieties using transgenic approaches. However, the application of chemical pesticides is still the most preferred to protect crops from yield loss (Sharma *et al*. 2019).

In a global checklist of data on pesticide use among 193 countries published by FAOSTAT (2019) and World Bank (2019), Nigeria was conspicuously not listed because of a shortage of such statistics. There is no published information on pesticide use data in Nigeria in agriculture or other activities. The essence of this study was to unfold the quantity and cost of pesticides used in agricultural and sundry activities in Nigeria from 2010 to 2020 to make an empirical analysis compared to other countries, particularly in Africa and globally (Table 2).

Table 2. Africa Pesticide Use Ranking by Countries

Country	Population (Million)	Total Arable Land (Million Ha)	Pesticides Net weight (Mt)	Kg of Pesticide per/ha of cropped land	Africa Ranking	World Ranking
Nigeria	206.1	34.0	**NA**	NA	NA	NA
Ethiopia	109.2	16.7	4,128	0.2	5	57
Egypt	101.3	2.8	8,044	2.2	3	44
Kenya	53.8	5.8	1,578	0.2	11	75
South. Africa	46.6	26.8	26,857	2.2	1	20
Algeria	43.0	8.0	5,983	0.7	4	48
Sudan	42.3	19.8	2,469	0.1	6	65
Morocco	36.5	8.1	13,697	1.7	2	32
Malawi	16.8	11.8	2,358	0.6	7	67
Zimbabwe	13.0	4.0	2,115	0.5	8	68
Rwanda	10.5	1,4	2,027	1.4	9	69

Source: (World Bank, 2020). NA = Not available.

Materials and Methods

In February 2021 from the Nigerian National Bureau of Statistics NBS), Abuja, on pesticides imports into Nigeria from 2010 to 2020. The data includes net weights in metric tons of pesticides such as herbicides, fungicides, insecticides, soil fumigants (Methyl bromide), mosquito repellants, and their Naira values. Aggregate and mean net weight of these pesticides in metric tons were determined for the pesticide types across each year and total study periods. The percentage of each pesticide type for each year and the entire period were also determined. The annual total cost per pesticide type and the mean cost for 2010-2020 were also evaluated. The mean net weights of the total pesticide types across the period were analyzed and used to rank Nigeria's pesticide use in Africa and globally. However, Kg of pesticides per/ha of cropped land could not be determined due to the non-availability of information on pesticides applied to cropped areas throughout the study. The monetary values in Naira and US Dollars were also determined considering the exchange rates at each specific period from 2010 – 2020.

Results and Discussion

Table 3 shows that the mean annual pesticide use of **23,412.5** Mt in Nigeria was less than that of South Africa (**26,857** Mt) (Table 2) despite the availability of more arable lands (34 million ha) coupled with a higher population of 206.1 million (World Bank, FAOSTAT. 2020). The African economy is mainly reliant on agriculture, and approximately 59% of the population earns their maintenance from agriculture (Abate *et al*. 2000). Notwithstanding that, the African region provides 2– 4% of the global market part of pesticides, which accounts for the lowest acceptance rate in the world. Pesticide usage in any country, be it developed or developing, is a function of agricultural development and not population and available arable land areas as observed in countries with a similar level of development (Tables 1 and 2). Countries in Europe with less population and arable land areas could afford higher pesticide uses because of their levels of agricultural development (FAOSTAT, 2019; World Bank, 2019). Five hundred million Kg of pesticides is used in the USA annually at the cost of $10 billion per year (Pimentel and Greiner, 1997). The primary use of pesticides in the USA is agriculture (Pimentel and Burgess, 2014).

The pesticide use showed South Africa's highest in Africa despite lower population and less available arable land compared to Nigeria. Nigeria with a better comparative advantage than South Africa in terms of agricultural productivity potentials. However, it has less than 50% of the country's arable land under cultivation (Manyong *et al.* 2005) because larger farmers are smallholder and traditional farmers who use rudimentary production techniques. With far higher arable land areas than other countries, Sudan and Ethiopia had lower net weights of pesticide use because of lack of resources,

vagaries of natural limiting factors such as drought, and political instability witnessed over the years. However, due to the increasing population, food demand has been projected to rise rapidly in the next three decades, warranting more pesticide application (Snyder *et al.*, 2015). Also, the widespread application of pesticides has been favored by the benefits they provide. In particular, they have increased crop and livestock yields and, in some circumstances, have improved human health and quality of life, for instance, by killing vectors of human pathogens (Cooper and Dobson, 2007).

In Table 4, the total quantities of herbicides, insecticides, fungicides, soil fumigants, and mosquito repellants in Nigeria over the periods of 2010-2020 were 965,558.98, 188,132.37, 66, 129.62, 67,243.97, and 623.56 metric tons, respectively, while the mean annual quantities of the pesticides for the same periods were 87,778.08, 17,102.9, 6,011.8, 6,113.1 and 56.7 metric tons in that order. These quantities of pesticides used over the periods represent 74.98%, 14.61%, 5.14%, 5.22%, and 0.5% of herbicides, insecticides, fungicides, soil fumigants, and mosquitos' repellant coils, respectively. The higher quantities of herbicides used in Nigeria corroborate De *et al.*'s report (2014) that of approximately 2 million metric tons of pesticides utilized globally, 47.5% were herbicides, 29.5% insecticides, 17.5% fungicides, and 5.5% other pesticides. Reasons for more herbicide use than other pesticides could be attributed to a more constant nature of weeds and marginal nature of most soils due to population pressure, unlike other pests that are sporadic and sometimes occasional in the absence of epidemics. Weed control is a significant challenge in the tropics, particularly in field crops where c4 plants are the predominant weeds (Usman *et al*. 2013; Ekeleme *et al*. 2016) and scarcity of labor at peaks of weeds interference, thus making herbicide application the only possible option. The magnitude of herbicide usage not only intensifies on croplands but also wildlands, industrial sites, and domestic levels.

Table 3. Pesticides Consumption in Nigeria from 2010 – 2020 in Net weight (Mt) and % per year

Year	Herbicides	Insecticides	Fungicides	Fumigants	Mosquito Repellant coils	Total annual net weight
	Net weight Mt	Net weight Mt	Net weight Mt	Net weight Mt	Net weight Mt	
2010	24,935.78	15,015.61	30,378.26	0.00	215.22	70,544.87
2011	52,617.38	24,462.93	4,745.44	0.00	72.42	81,898.17
2012	71,915.20	18,136.37	6,853.78	0.00	0.20	96,905.55
2013	59,895.81	35,581.41	5,992.02	0.00	90.17	101,559.41
2014	128,337.69	72,713.91	2,543.52	0.00	202.98	203,798.10
2015	83,331.49	9,005.78	3,203.37	219.51	2.41	95,762.56
2016	47,606.47	2,394.86	2,305.46	6,206.51	0.00	58,513.30
2017	98,642.85	2,032.93	1,965.18	16,215.61	7.68	118,864.25
2018	114,669.91	1,538.69	2,457.60	10,975.58	1.21	129,642.99
2019	107,630.91	2,180.20	1,808.55	9,941.54	8.74	121,569.94
2020	175,975.49	5,069.68	3,876.43	23,685.22	22.53	208,629.35
Total	965,558.98	188,132.37	66,129.61	67,243.97	623.56	1,287,688.49
Mean net Weight	87,778.08	17,102.9	6,011.8	6,113.1	56.7	

Table 4. Total pesticides use in Nigeria by types in net weight (Mt), annual mean weight and percentage (%) from 2010 -2020

Pesticides Types	Net weight (Mt) (2010-2020)	Annual mean net weight (Mt)	Net weight (Mt) (%)
Herbicides	965,558.98	87,778.08	74.98
Insecticides	188,132.37	17,102.9	14.61
Fungicides	66,129.61	6,011.8	5.14
Soil Fumigants	67,243.97	6,113.1	5.22
Mosquito repellant coils	623.56	56.7	0.05

On the other hand, insecticides are predominantly used in Nigeria to control insects like mosquitoes, which vectors malaria parasites and other avalanches of insect pests on legumes, citrus, cereals, and other horticultural crops.

Nigeria spent about 63.4 billion Naira annually on pesticides, an equivalent of about 244 million US Dollars (Tables 5 and 6.), out of which 74%, 16.6%, 4.7%, 5.0%, and 0.06% went to herbicides, insecticides, fungicides, soil fumigants, and mosquito repellant coils, respectively (Table 7). In the USA, pesticide expenditure accounts for approximately 16–18% of the entire world (Atwood and Paisley-Jones, 2017). In the agriculture sector, herbicides (59%) accounted for significant pesticide expenditure, followed by insecticides (14%) and fungicides (10%) (Atwood and Paisley-Jones, 2017).

Conclusions

The profile of pesticide use in Nigeria indicates that about 23,412.5 metric tons of pesticides were utilized annually in agriculture and other sundry activities, amounting to an average cost of 244 million US Dollars annually. And out of this amount, about 74% and 17% of the total expenditure were on herbicides and insecticides respectively, while the remaining 9% went to fungicides and others. Therefore, it could be concluded that the essence of pesticide use in Nigeria is in agriculture.

Table 5. Pesticides use values (Naira) in Nigeria from 2010-2020

Year	Herbicides	Insecticides	Fungicides	Soil Fumigants	Mosquito Repellant coils	Total Annual Cost
	Naira (#)					
2010	8,866,193,020.00	8,571,677,710.00	1,063,816,607.00	0.00	29,629,904.00	18,531,317,241
2011	19,327,625,900.00	10,716,987,710.00	1,336,969,510.00	0.00	8,655,332,00	31,390,238,452
2012	27,600,862,196.00	9,170,731,277.00	2,236,943,746.00	0.00	15,821.00	39,008,553,040
2013	25,435,305,955.00	17,650,800,560.00	2,154,025,534.00	0.00	35,232,947.00	45,275,364,996
2014	53,571,520,971.00	15,985,623,190.00	1,592,749,911.00	0.00	81,064,811.00	71,230,958,883
2015	42,245,257,505.00	4,374,936,915.00	2,744,233,798.00	217,785,768.00	5,712,951.00	49,587,926,937
2016	21,520,707,316.00	1,653,300,993.00	2,442,138,315.00	3,766,799,788.00	0.00	29,382,946,412
2017	59,529,425,330.00	1,247,981,564.00	2,603,457,329.00	10,918,107,491.00	9,530,143.39	74,308,501,857
2018	87,720,842,541.00	1,027,075,299,00	4,041,526,713.00	7,122,048,760.00	365,853.00	99,911,859,166
2019	76,939,717,569.00	1, 311,094,284.00	2,864,065,876.00	6,982,802,199.00	23,470,599.00	88,121,150,527
2020	125,569,237,376.00	3,184,939,162.00	6,715,306,740.00	14,909,613,831.00	29,002,435.00	150,408,000,000
Total	548,327,000,000.00	74,895,148,664.00	29,795,234,079.00	43,917,157,837.00	222,680,796.00	697,157,000,000.00
Mean Annual Cost	49,847,909,090.00	6,808, 649,879.00	2,708,657,643.00	3,992,468,894.00	20,243,708.73	63,377,909,090.00

Table 6. Pesticides use values (US Dollars) in Nigeria from 2010-2020

Year	Herbicides	Insecticides	Fungicides	Soil Fumigants	Mosquito Repellant coils	Total Annual Cost (US$)	Naira/US$ Exchange Rates
	USD Dollars (US$)						
2010	56,907,529.00	55,017,186.84	6,828,091.19	0.00	190,179.10	118,942,986.10	#155.8/$
2011	125,618,262.70	69,654,151.24	8,689,519.76	0.00	562,559.03	204,524,492.70	#153.86/$
2012	175,243,569.50	58,226,865.25	14,202,817.43	0.00	100.45	247,673,352.60	#157.50/$
2013	161,689,059.50	112,203,932.10	13,692,870.98	0.00	223,971.44	287,809,834.00	#157.31/$
2014	337,884,080.50	100,823,861.20	10,045,726.34	0.00	511,288.62	449,264,956.70	#158.55/$
2015	219,524,306.30	22,734,030.94	14,260,204.73	1,131,707.38	29,686.92	257,679,936.20	#192.44/$
2016	84,897,657.94	6,522,154.70	9,634,061.76	14,859,756.95	0.00	115,913,631.30	#253.47/$
2017	194,674,205.60	4,081,171.93	8,513,873.34	35,704,592.99	31,165.65	243,005,009.50	#305.79/$
2018	286,594,493.40	3,355,577.95	13,204,151.57	23,268,585.85	1,195.29	326,424,004.10	#306.08/$
2019	25,080,513.25	4,270,665.42	9,329,204.80	22,745,284.04	76,451.46	61,502,118.97	#307.00/$
2020	311,586,196.80	7,903,074.84	16,663,292.16	36,996,560.37	71,966.34	373,221,090.51	#403.00/$
Total	1,979,699,874.49	444,792,672.41	125,063,814.06	134,706,487.58	1,698,564.30	2,685,961,412.84	

Mean Annual Cost	179,972,715.8	40,435,697.49	11,369,437.64	12,246,044.32	154,414.94	244,178,310.3

Table 7. Nigeria annual pesticides use by types and mean cost in Naira (#) and US Dollars from 2010 - 2020

Pesticides	Mean Annual Cost (#)	Cost (%)	Mean Annual Cost (US$)	Cost %
Herbicides	49,847,909,090.00	78.65	179,972,715.80	73.70
Insecticides	6,808,649,879.00	10.74	40,435,697.49	16.56
Fungicides	2,708,657,643.00	4.27	11,369,437.64	4.66
Soil Fumigants	3,992,468,894.00	6.30	12,246,044.32	5.02
Mosquito repellants	20,243,708.73	0.03	154,414.94	0.06
Total annual cost	63,377,909,090.00	100	244,178,310.30	100
Pesticides	Mean Annual Cost (#)	Cost (%)	Mean Annual Cost (US$)	Cost %

Acknowledgements.

I sincerely wish to extend my profound appreciation to the National Bureau of Statistics (NBS), Abuja, Nigeria, for allowing and providing me with all the necessary data for this study. My immense gratitude goes to Profs. For their guidance and proofreading of the manuscript, S. Idoga and M. O Adeyemo of the Federal University of Agriculture, Makurdi.

Conflict of interest

No conflicts of interest have been declared.

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