African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

FARMER'S PERCEPTION ON THE USE OF BENEFICIAL MICROORGANISM FERTILIZER FOR THE GROWTH OF CROPS IN THE NORTHWEST REGION OF CAMEROON

Muyang Rosaline Fosah*, Ndjouondo Gildas Parfait,

Mbouobda Hermann Desire and Modest Berinyuy Ngoran

Department of Biology, Higher Teacher Training College, The University of Bamenda, Bamenda, Cameroon

*Email: wanfosah3@yahoo.com

Cite this article:

Muyang R.F., Ndjouondo G.P., Mbouobda H.D., Modest B.N. (2023), Farmer's Perception on the Use of Beneficial Microorganism Fertilizer for the Growth of Crops in the Northwest Region of Cameroon. African Journal of Environment and Natural Science Research 6(3), 179-191. DOI: 10.52589/AJENSR-GPSWP2AC

Manuscript History

Received: 10 Sept 2023

Accepted: 30 Oct 2023

Published: 23 Nov 2023

ABSTRACT: *Agricultural production mainly depends on the nature of soil, which is a measure of a complex set of biological, chemical and physical interactions driven by microorganisms. Crop production has been declining due to low soil fertility, disease and pests. The main objective of this research was to investigate farmer's perception on the use of effective microorganism fertilizers for crop production in the North West region of Cameroon. The descriptive survey method was used. Farmers were randomly sampled at the main shop where one of such biofertilizers (Effective microorganism, EM) is obtained in the North West. The sample size was 100 farmers. Data were collected through the administration of questionnaires and visits to some fields. Results showed that 79% of the respondents used microorganism fertilizers. The significant factors influencing the adoption of microorganism fertilizers included age (54%), type of farmer (65%), cost and income from using organic fertilizers (66%), belonging to farmers based organization (54%) and the benefits of the microorganism where many respondents stated that microorganism fertilizer increased yield and also improve the fertility of the soil (40%). The most pressing constraint associated with the use of effective microorganisms fertilizer was offensive odor. There is the need for consumer sensitization on the potential benefits of growing and consuming organically grown crops. This could expand the demand for organically grown crops and the willingness of consumers to pay premium prices and hence increase organic production by farmers.*

KEYWORDS: Microorganism fertilizers, Soil fertility, Yield.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)

www.abjournals.org

INTRODUCTION

Plant nutrients are essential for the production of crops and healthy food for the world's ever increasing population. Soil management strategies today are mainly dependent on inorganic fertilizers, which cause a serious threat to human health and the environment. Biofertilizer has been identified as an alternative for increasing soil fertility and crop production in sustainable farming. The exploitation of beneficial microbes as biofertilizers have become of paramount importance in the agricultural sector due to their potential role in food safety and sustainable crop production (Itelima *et al*., 2018). One of such biofertilizers is the effective microorganism (EM) fertilizer.

Effective microorganisms (EM) are mixed cultures of beneficial naturally-occurring organisms that can be applied as inoculants to increase the microbial diversity of the soil ecosystem. They consist mainly of the photosynthesizing bacteria, lactic acid bacteria, yeasts, actinomycetes and fermenting fungi. These microorganisms are physiologically compatible with one another and can coexist in liquid culture (Towett, 2016).

However, the technology behind this concept and its practical application is significantly advanced in Japan (Higa, 1998). Soil degradation is a serious problem in most developing countries especially in Sub-Saharan Africa because of its negative effect on soil fertility and nutrient balance aggravated by soil erosion. Improper land management systems cause erosion, reduce soil fertility and often cause acidification. In the Cameroon Western Highlands, soils are often very vulnerable due to demographic pressure associated with environmental conditions like high rainfall and uneven topography (Azinwi *et al*., 2020).

Currently, there has been a declining trend in crop production and a steady increase in the price of locally produced crops in the Northwest region of Cameroon. This is due to a number of factors that include low soil fertility, diseases and pests. Farmers are continuously cultivating crops without fertilizing the soil. This is because most of them do not have enough knowledge, skills, finance and information about various alternative fertilizers which are organic and that can be prepared by them. Most farmers in both rural and urban areas of Northwest of Cameroon are not aware and versed with the use of microorganism fertilizers. Organic fertilizers work over time to create a healthy growing environment, while inorganic fertilizers provide rapid nutrition but inorganic are subject to leaching, a process that occurs when fertilizers are washed by rain or Adoption of a technology begins with awareness, and then goes through interest, evaluation, acceptance, trial and finally adoption. Adoption of a technology is the continuous use of the technology and the decision can be a dichotomous choice (Lavison, 2013). Hence this study is aimed at investigating the perception and challenges faced by some farmers on one of these microorganism fertilizers (EM) for crop production in the Northwest region of Cameroon.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

MATERIALS AND METHODS

Study Area

This study was carried out amongst some farmers in the Northwest region of Cameroon from October 2020 to May 2021. The region is situated in the western highlands of Cameroon and bordered in the southwest by the Southwest region, north by the Federal Republic of Nigeria, east by the Adamawa region and south by the Western region. The Northwest region of Cameroon is located at 6.33° longitude North and 10.5° latitude east of the Greenwich Meridian and has a surface area of 17.910km2 (Nji & Engwali, 2019). The Northwest region has a population of 2.26 million inhabitants and a population density of 99.12 inhabitants per square kilometer. Economically, the Northwest region is predominantly agricultural with 80% of the rural population depending solely on subsistence agriculture

Research Design

The descriptive survey method was used to observe, describe and document aspects of effective microorganism fertilizers.

Target Population

The reference population were farmers using effective microorganism fertilizers to grow crops in the Northwest region of Cameroon. Most of the farmers were targeted at the main EM shop in Cameroon, located in Small Mankon, Bamenda in the Northwest region of Cameroon.

Sample and Sampling Techniques

It consisted of farmers using effective microorganism fertilizers to grow crops at the time of the study. Inclusion criteria which stated that the respondents must be farmers and using EM to grow crops (Burns & Grove, 2001).

Data Collection Instruments and Field Evaluation

Research instruments used were questionnaires and personal interview schedules. Structured questionnaires consisting of both closed ended and open ended questions were used to elicit responses from the respondents. Personal interviews were done using a structured questionnaire for participants who could not read. Farmers were asked to state how much they know about EM fertilizers. During the administration of questionnaires, field visits were made to some farms of the respondents to see what types of crops were grown. Established true facts about EM were used to rate farmer's knowledge on EM fertilizers.

Layout of the Questionnaire

The questionnaire comprised of the following sections;

Section 1: Biographical Data

This section comprised questions on biographical data (age, gender, religion, marital status, resident, level of education, occupation).

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

Section 2: Knowledge and Practice on EM Fertilizers

This section contained questions which ascertained the level of knowledge, understanding and practice on the use of EM fertilizers by farmers. Included also in this section were questions on the type of crops they cultivate using EM fertilizers. Multiple choice and open ended questions were used to access the knowledge and practice of EM fertilizer**.**

Data Analysis

Data from the survey was statistically analyzed using Microsoft Excel 2010. Findings were presented using frequency distribution tables and charts.

RESULTS

Socio-economic and Demographic Characteristics of Respondents

Out of the 100 farmers sampled, 60% were females and 40% males (fig. 1a). They were 33 between the ages of 10-40 (33%), 54 from 41-60 (54%) and 14 from 61 and above (14%) (fig. 1b). Majority of the respondents were married (50), 40 were single, 7 were widowed while 3 were divorced (fig. 1c). From the survey it showed that 5% of the respondents had no formal education, 20% did the primary education, 36% secondary education and 39% went to higher institutions (fig. 1d). The majority of the correspondents lived in town (64%) while 36% lived in the villages (fig. 1e). Most of the respondents (65%) had farming as their main occupation, 16 had a fixed salary based job, 7 had trading as main profession and 12 had other professions (fig. 1f).

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

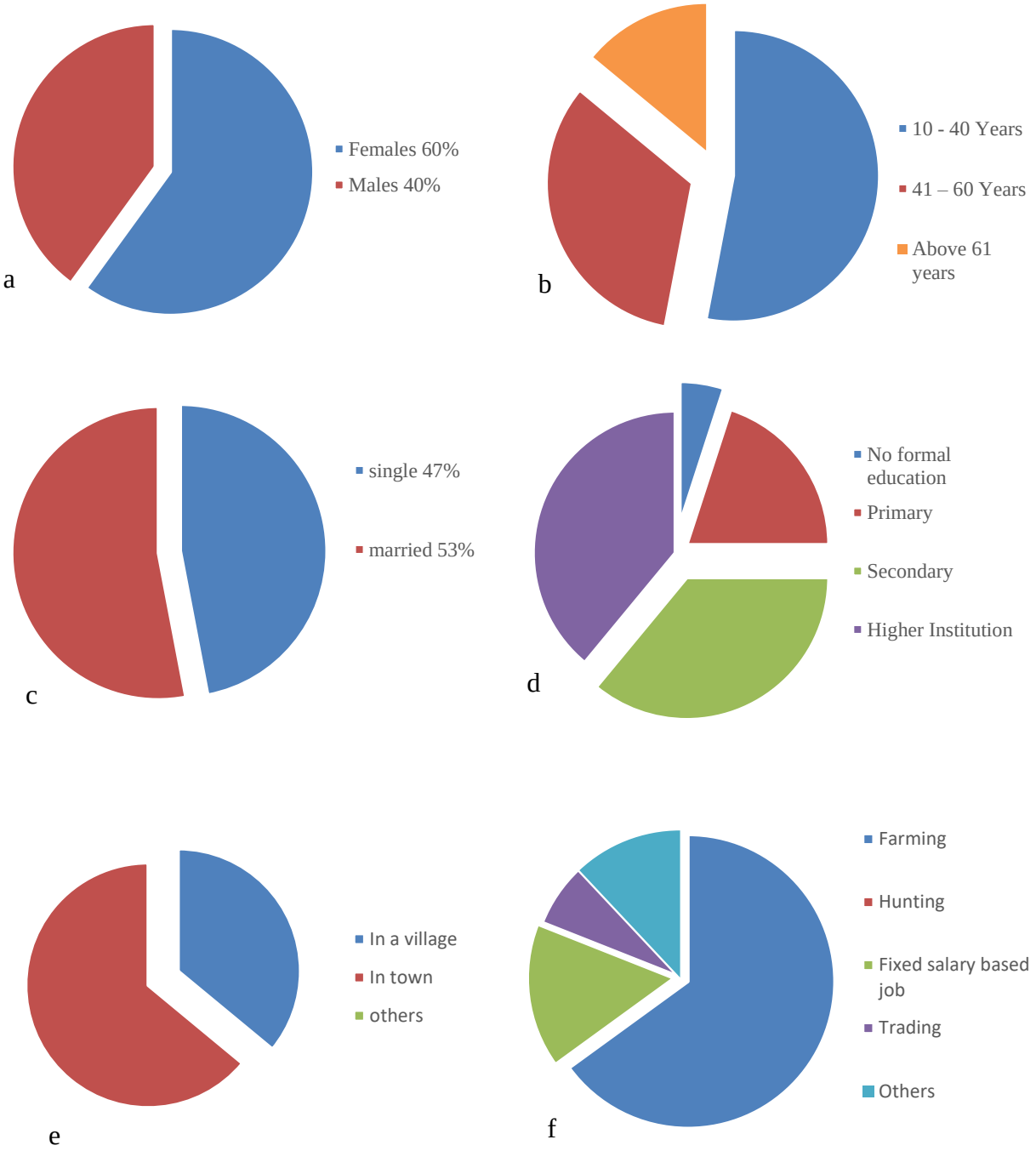


Figure 1: Distribution of samples according to: (a) sex, (b) age, (c) marital status, (d) level of education, (e) residential status (f) occupation.

Information on the Knowledge of Microorganism Fertilizers and Organic Manures

Almost all of the respondents were aware of microorganism fertilizers (93%) (fig. 2a) and organic fertilizers (92%) (fig. 2b). The majority of the respondents (40%) got their information about EM fertilizers from the suppliers, 15% from friends, 19% from neighboring farmers,

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

24% from the media and 2 from other sources (fig. 2c). Also 54% of the respondents belong to a farmer based organization and 46% do not belong to any farmer based organization (fig. 2d). The results showed that 11 respondents belonged to an NGO, 42 to a farming group and 1 belonged to other farmers based organizations (fig. 2e).

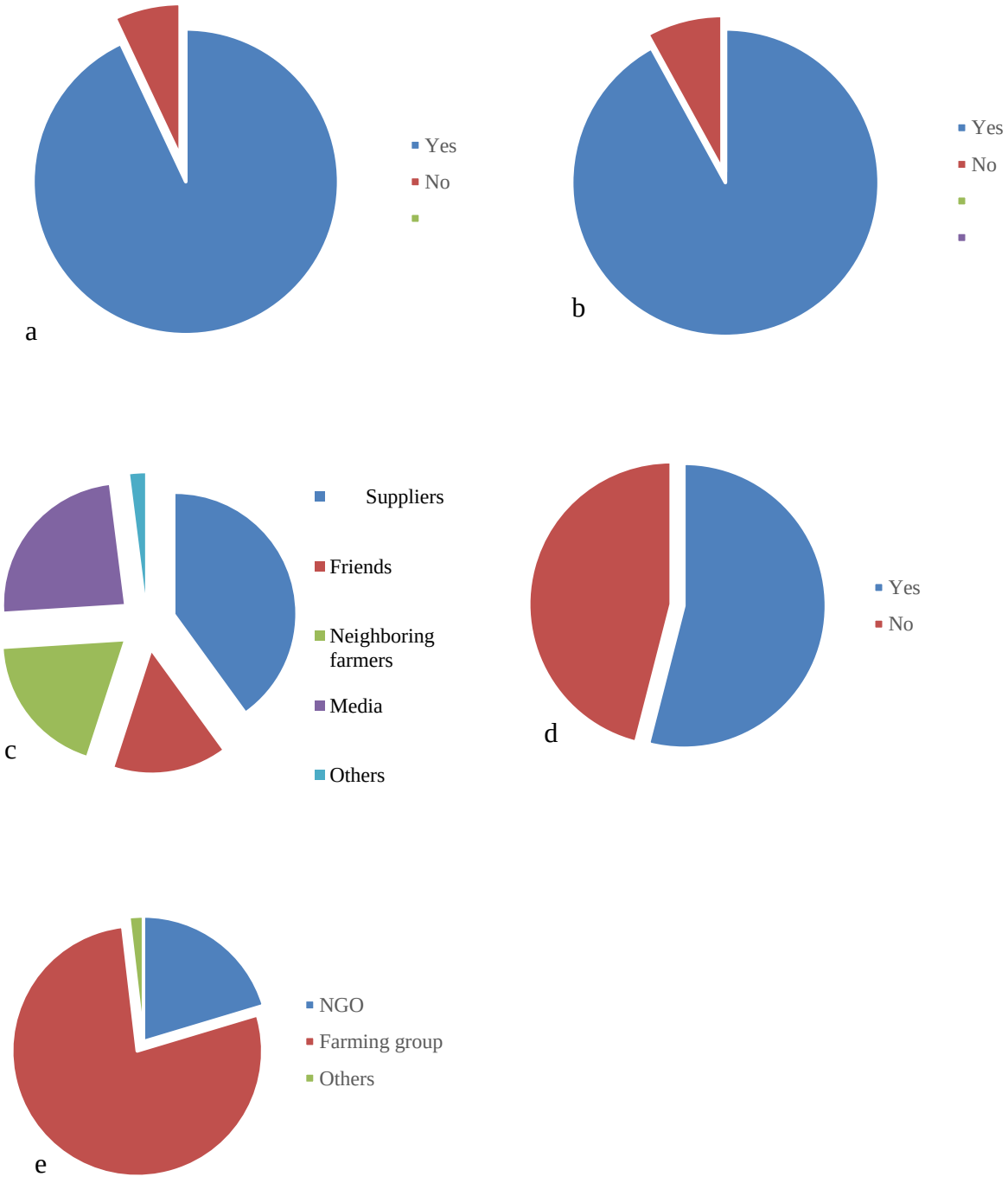


Figure 2: Distribution of samples according to: (a) knowledge about microorganism fertilizers; (b) knowledge of organic fertilizers; (c) source of information; (d) membership in any farmers based organization; (e) choice of farmers based organization.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

Information about the Usage of EM Fertilizers

From the results obtained, 71% of farmers had been trained on usage of EM fertilizers, while 29% had not undergone any training (fig. 3a). Based on the choice of crops, 54 % of respondents applied EM fertilizers on vegetables, 6% applied on fruits, 20% applied on tubers and 20% applied to other crops (fig. 3b). With regards to the rate of application of EM fertilizers, 22% applied once, 55% applied twice, 12% thrice and 11% applied as many times as possible (fig. 3c). Different methods were being used to apply EM; 25% by spotting, 10% by the ring method, 61% by spraying, 2% by side placement and 2% by broadcasting (fig. 3d).

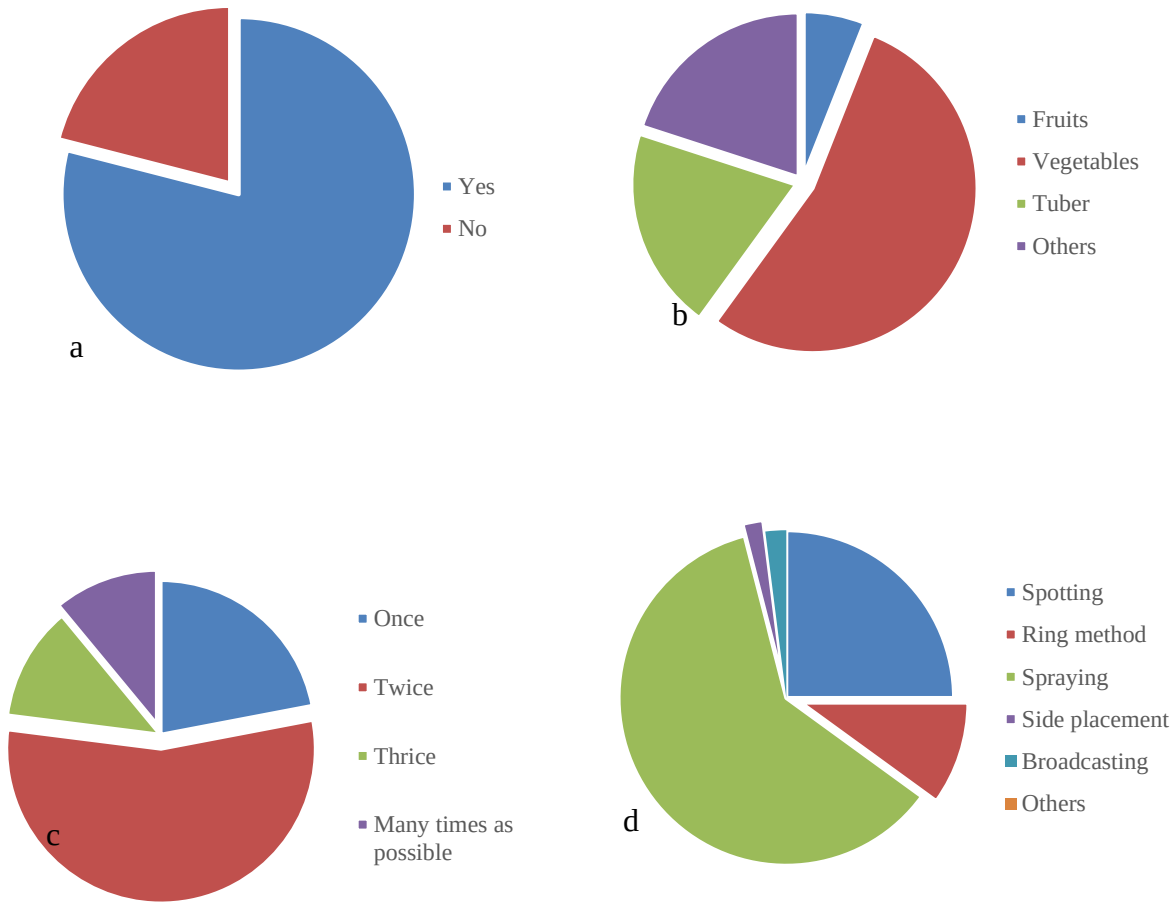


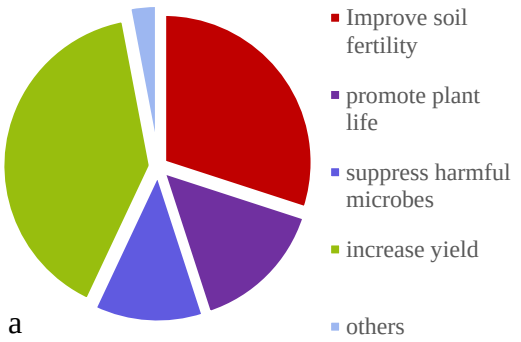
Figure 3: The usage of EM fertilizers: (a) training on usage of EM; (b) choice of crops for application of EM fertilizer; (c); number of times EM is applied; (d) method by which EM fertilizer is applied to crops

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

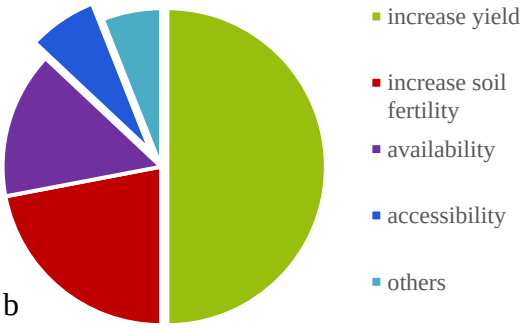
African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

The Advantages and Disadvantages of EM Fertilizers

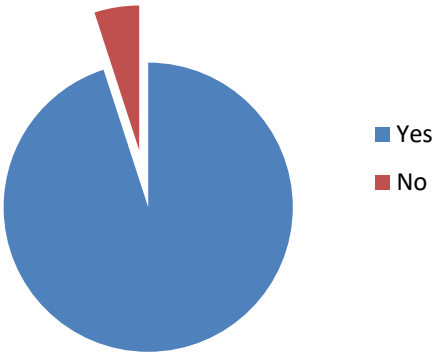
The majority of the respondents (40%) were of the opinion that it increased yield, 30% were for the fact that it increases soil fertility, 15% were of the opinion that it promotes plant life, 12% were of the opinion that it suppresses harmful microbes and 3% were for other benefits (fig. 4a). Regarding the reason for using EM fertilizer, 50% used EM fertilizers because of its increase in yield, 22% used because it increases soil fertility, 15% used because of the availability, 7% used because of accessibility and 6% had other reasons (fig. 4b). Almost all (95%) of the population preferred EM fertilizers, while 5% preferred inorganic fertilizers (fig. 4c). Also 26% of the respondents preferred EM fertilizers because it is cheaper, some (41%) because it increases yield, 22% because it increases soil fertility and is easy to use (6%) (fig. 4d). Most of them (66%) were satisfied with the cost of EM fertilizers (fig. 4e). Majority of the respondents (69%) stated that EM fertilizers have an offensive odor, 13% that it's bulky and thus difficult to transport, 8% that it acts slowly, and 6% were doubtful (fig. 4f).



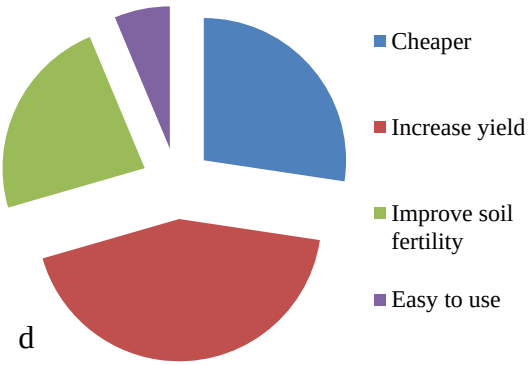
a



b



c



d

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

African Journal of Environment and Natural Science Research
ISSN: 2689-9434
Volume 6, Issue 3, 2023 (pp. 179-191)
www.abjournals.org

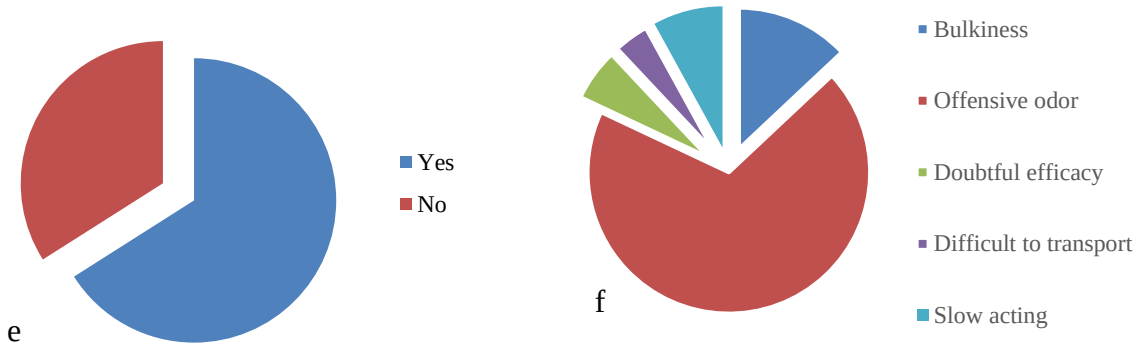


Figure 4: Advantages and disadvantages of EM fertilizers; (a) benefits of EM fertilizer; (b) reasons for using EM fertilizer; (c) Fertilizer preference; (d), choice of EM Fertilizers over inorganic fertilizers; (e) cost of EM fertilizers; (f) negative effects of EM Fertilizers

DISCUSSION

Results indicated that more women in the Northwest region engaged in subsistence agriculture compared to the men. It could also mean that the population of women in this area is more than the male population. In analyzing the impact of gender on technology adoption, Mwangi and Kariuki (2015) had found no association between gender and probability to adopt improved maize in Ghana. They concluded that technology adoption decisions depend primarily on access to resources, rather than on gender and if adoption of improved maize depends on access to land, labor, or other resources, and if in a particular context men tend to have better access to these resources than women, then in that context the technologies will not benefit men and women equally which is not in line. On the other hand, gender may have a significant influence on some technologies. Gender affects technology adoption since the head of the household is the primary decision maker and men have more access to and control over vital production resources than women due to socio-cultural values and norms (Mesfin, 2005; Omonona *et al*., 2006; Mignouna *et al*., 2011). For instance, a study by Obisesan (2014) on adoption of technology showed that gender had a significant and positive influence on adoption of improved cassava production in Nigeria. The majority of the respondents (54%) were between the age range from 41-60 years. This indicates that the vibrant population involved in agriculture and the use of farm inputs like EM fertilizers are mostly the old people between the ages 41-60. This is similar to Mignouna *et al*. (2011) where age was also assumed to be a determinant of adoption of new technology. Older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate technology information than younger farmers (Kariyasa & Dewi, 2011). According to Obisesan (2014), more years of farming experience helped farmers to evaluate the advantage of agricultural technology and be the early adopters of new technology. More experienced farmers seem to have better information and knowledge accumulated over time. Akpan *et al*. (2012) claimed that farming experience improves farmer's behavior of coping with problems of soil infertility and reduces likelihood of chemical fertilizer adoption while in support of this, Ketema and Bauer (2011) noted that lower use of chemical fertilizer could possibly result in more use of organic fertilizer.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

The majority of the respondents (50) were married. Respondents who are household heads as a result of being married are more likely to adopt innovations for the simple reason that they want to improve output (quantity and quality) at the minimal possible cost because of limited resources and competing uses of those resources (BonabanaWabbi, 2002).

Most of the respondents had attended the level of a higher institution. This indicates that people of every level of education are involved in subsistence agriculture in the Northwest region of Cameroon. They might have discovered agriculture as one of the most important activities which serves the entire population worldwide, unlike in those days when farming was seen not to be an important occupation by some scholars. This study correlates with Kassie *et al*. (2013) who saw that education of the farmer positively influences the farmer's likelihood of adopting a new technology or practice because those with better education have more exposure to new ideas and information, and thus have better knowledge to effectively analyze and use available information.

The highest number of respondents were full time farmers. This study agrees with Lavison (2013) who showed that the type of farmer influences adoption of organic fertilizers positively, full time farmers are more likely to adopt microorganism fertilizers than part-time farmers.

Most of the respondents in this area got information about microorganism fertilizers from the suppliers. EM fertilizers are being supplied to the farmers who use them in their farms. The reason could be that they were sensitized on the importance of this particular fertilizer. Also, the reason behind their awareness could be that some of the farmers must have seen how the fertilizer works from friends or neighboring farmers which makes them interested. This is consistent with Naboth (2015) and Mwangi and Kariuki (2015) who saw that knowledge about the technology is often influenced by farmers' access to information and social networks within which the farmers interact. Access to information increases farmers' awareness. This in turn influences farmers' views about the practices' perceptions based on their felt needs and prior experience. Acquisition of information about a new technology is another factor that determines adoption of technology. It enables farmers to learn the existence as well as the effective use of technology and this facilitates its adoption.

Most of the farmers belonged to a farmer based organization and it gives access to innovative technologies in agriculture. This agrees with Mignouna *et al.* (2011) who stated that belonging to a social group enhances social capital, allowing trust, idea and information exchange. Social network effects are important for individual decisions, and that, in the particular context of agricultural innovations, farmers share information and learn from each other. Farmers-based-organizations in rural areas help transfer information among farmers through discussions (Berhe, 2014). The majority of the respondents were satisfied with the cost of EM fertilizer., probably they had compared prices with other types of fertilizers. This study is not in line with Ibrahim *et al*. (2014) where their study showed that organic fertilizers are more expensive than inorganic fertilizers.

EM fertilizers were mostly applied to vegetables compared to other crops. This could be as a result of the method of application by spraying on the leaves which in turn suppress harmful microbes. This study goes in line with that of Olle and Williams (2013) where spraying EM on the leaves of plants could serve as a prophylactic treatment for disease and insect control.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

EM fertilizer had many beneficial effects, which include increased yields and improved soil fertility. This result is similar to that of Ncube (2008) who showed that effective microorganisms enhance soil fertility and promote growth, flowering and fruit development in crops. Farmers had varied reasons why they use EM fertilizers but the most important reasons were the availability and the fact that it increases soil fertility and yield. This study is in line with Lin *et al.* (2019) who showed that organic fertilizers can enhance crop yield and soil properties while restraining pests and diseases.

Ninety-five percent of the population preferred EM fertilizers to inorganic fertilizers because it is cheaper and increases yield. This is similar to the study carried out by Nosheen *et al.* (2021) who showed that biofertilizers play an important role in improving soil fertility and enhancing crop yield. When applied to the soil, they participate in nutrient cycling and improve the soil structure and crop productivity. According to Itelima *et al.* (2018), biofertilizers are environmental friendly and do not cause pollution unlike inorganic fertilizers which often 'run off' into water bodies.

The negative impact of EM fertilizers includes the offensive odor, bulkiness, difficulties in transporting, slow in action, and doubtful efficacy. This is in accordance with Lavison (2013) who stated that some health risks posed by organic fertilizers include nausea, blocked sinuses and offensive odor making handling difficult.

CONCLUSION

The type of farmer influences adoption of organic fertilizers positively, full time farmers are more likely to adopt microorganism fertilizers than part-time farmers. The cost of the microorganism fertilizer and income from using this fertilizer also influences the adoption of effective microorganism fertilizers positively, implying that the more income a farmer gets from previous use of organic fertilizers, the greater the likelihood of adoption of microorganism fertilizers.

During the period the research was carried out, 93% of those interviewed were aware and had knowledge about microorganism fertilizers. This was because many of the respondents belonged to many farmers-based-organizations where useful information and ideas were transmitted to farmers about new agricultural technologies.

The most pressing constraint associated with the use of organic fertilizers is the offensive odor of the fertilizer, followed by bulkiness, slow acting, and difficulties in transporting and doubtful efficacy.

Acknowledgement

Special thanks to all the management and staff of EM Cameroon shop in Bamenda for giving us the opportunity to carry out this study. Also to the farmers who cooperated by giving us valuable information.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

REFERENCES

Akpan, S. B., Nkanta, V. S. & Essien, U. A. (2012). A Double-Hurdle Model of Fertilizer Adoption and Optimum Use among Farmers in Southern Nigeria. *Tropicultura*, 30(4): 249-253.

Azinwi, T. P., Asafor, H. C., Katte, V. Y., Achantap, R. A., Magha, A. M., Moundjeu, S. E., Tabi, O. F. & Bitom, D. (2020). Land characteristics and agricultural suitability status along a toposequence in Santa Bamenda highlands, Cameroon. *J Atmos Earth Sci* 4:022

Berhe, Y. (2014). The Impact of Row Planting of Teff Crop on Rural Household Income: A Case of Tahtay Maychew Wereda, Tigrai, Ethiopia. M.Sc. Thesis. Mekelle University, Ethiopia 87p.

Bonabana-Wabbi, J. (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, M.Sc. Thesis. University of Virginia, Blacksburg Eastern Uganda 146p.

Burns, N. A. & Grove, S .K. (2001). The practice of nursing research.conduct,critique and utilization 4th edition Philadelphia:WB Saunder 66-90.

Higa, T. (1998). Effective microorganisms,concept and recent advances in technology Proceedings of the 4th International Conference on Kyusei Nature Farming in Bellingham U.S. Department of Agriculture, Washington, D.C., USA. 247-282.

Ibrahim, M., Tasi'u, Y. R., Umma, M. & Dangora, I. I. (2014) .The effects of inorganic fertilizer on soil characteristics and production of Egg Plant (*Solanum melongena L.)* in Warawa area of Kano State. *Standard Research Journal of Agricultural Sciences* 2(8): 129-135.

Itelima, J. U., Bang, W. J. & Onyimba I. A. (2018). A review: Biofertilizer; a key player in enhancing soil fertility and crop productivity. *J Microbiol Biotechnol Rep*. 2(1): 22-28.

Kariyasa, K. & Dewi, A. (2011). Analysis of Factors Affecting Adoption of Integrated Crop Management Farmer Field School (Icm-Ffs) in Swampy Areas. *International Journal of Food and Agricultural Economics* 1(2): 29-38.

Kassie, M., Jaleta M., Shiferaw, B., Mmbando, F. & Mekuria, M. (2013). Adoption of interrelate,ed sustainable agricultural practices in smallholder systems: Evidence from rural Tanzania. Technological forecasting and social change.80 (3): 525-540

Ketema, M. & Bauer, S. (2011). Determinants of Manure and Fertilizer Applications in Eastern Highlands of Ethiopia. *Quarterly Journal of International Agriculture*, 50(3): 237-252.

Lavison, R. (2013). Factors Influencing the Adoption of Organic Fertilizers in Vegetable Production in Accra, Gahna. M.Sc. Thesis. University of Ghana, Legon, Ghana. 131pp.

Lin, W., Lin, M., Zhou, H., Wu, h. & Li, Z. (2019).The effect of chemical and organic fertilizer usage on rhizosphere soil in tea orchards. PLOS/ONE 14(5): 1-16.

Mesfin, A. (2005). Analysis of factors Influencing Adoption of Triticale and its Impact. The Case Farta Wereda Msc. Thesis (Unpublished) Presented to School of Graduate Studies of Alemaya University 112p.

Mignouna, B., Manyong, M., Rusike, J., Mutabazi, S. & Senkondo, M. (2011). Determinants of Adopting Imazapyr-Resistant Maize Technology and its Impact on Household Income in Western Kenya: *AgBioforum*, 14(3): 158-163.

Mwangi, M. & Kariuki, S. (2015). Factors Determining Adoption of New Agricultural Technology by Small Scale Farmers in Developing Countries, *Journal of Economics and Sustainable Development* 6(5): 208-216.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC

Naboth, B. (2015)."Farmers' Knowledge, Perceptions, and Socioeconomic Factors Influencing Decision Making For Integrated Soil Fertility Management Practices in Masaka and Rakai Districts, Central Uganda" (2015).Graduate Theses and Dissertations. P 5-6.

Ncube, L. (2008). Evaluation of Effective Microorganisms (EM) on Soil Chemical Properties and Yield of Selected Vegetables in the Eastern Cape, South Africa. M.Sc. Thesis. Department of Agronomy, School of Agriculture and Agribusiness, Faculty of Science and Agriculture, University of Fort Hare, Alice, South Africa.156 p.

Nji, M. P. & Engwali, F. D. (2019). Farmer Organisation In The Northwest Region Of Cameroon: Actual State Of Affairs .*International Journal of Agricultural Extension and Rural Development Studies* 6(2): 13-26.

Nosheen, S., Ajmal, I. & Yuanda, S. (2021). Microbes as Biofertilizers, a Potential Approach for Sustainable Crop Production. *Open Access Journal* 13, 1868: 1- 20.

Obisesan, A. (2014). Gender Differences in Technology Adoption and Welfare Impact among Nigerian Farming Households, MPRA Paper No. 58920

Olle, M. & Williams, H. I. (2013). Effective microorganisms and their influence on vegetable production. *Journal of Horticultural Science and Biotechnology 8(4)*: 380-386.

Omonona, B., Oni, O. & Uwagboe, O. (2006). Adoption of improved Cassava varieties and its impact on Rural Farming Households in Edo State, Nigeria. *Journal of Agriculture and Food Information* 7(1): 40-45.

Towett, G. (2016). What are effective microorganisms? Permaculture research institute 10pp.

Article DOI: 10.52589/AJENSR-GPSWP2AC
DOI URL: https://doi.org/10.52589/AJENSR-GPSWP2AC