BUSITEMA UNIVERSITY
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P.O. Box 236, Tororo, Uganda
Gen: +256 - 45 444 8838
Fax: +256 - 45 4436517
Email: info@adm.busitema.ac.ug
www.busitema.ac.ug

GROWTH AND YIELD PERFORMANCE OF SERENUT 2 GROUNDNUT VARIETY TREATED WITH LOCALLY MADE BIOINOCULANTS (*Jeevamritha and Biodynamic*) UNDER FIELD CONDITIONS IN EASTERN UGANDA.

BY

APIO LOYCE

BU/UP/2018/1970

Email: apioloyce2015@gmail.com

TEL: +256781955169

SUPERVISOR: Mr. OJUU DAVID

Mr. AMAYO ROBERT

A PROJECT RESEARCH REPORT SUBMITTED TO THE DEPARTMENT OF CROP PRODUCTION AND MANAGEMENT IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE IN BACHELOR OF SCIENCE IN AGRICULTURE OF BUSITEMA UNIVERSITY

MAY 2023

DECLARATION

I APIO LOYCE; declare that the work in this report is my own and has not been submitted for the award of a degree in any other University.

Signed

......Apio..................................

APIO LOYCE

26/10/2023

Date

APPROVAL

This report was written under my supervision and has been submitted to the Department of Crop production and management for examination with my approval as supervisor.

Signed

.... 26/10/2023

Mr. OJUU DAVID

Date

Lecturer Department of Crop Production and Management

Busitema University, Arapai campus

Signed

For 26/10/23

Mr. AMAYO ROBERT

Date

Lecturer Department of Crop Production and Management

Busitema University, Arapai campus

DEDICATION

With sincere appreciation, I do dedicate this work to the almighty God and my parents; Mr. Etoori Stanslaus and Mrs. Ariokot Eunice, for the financial support and guidance they have availed towards my future as far as education and discipline is concerned. My beloved Aunty Aanyu Rose Omuria, my sisters and friends who have always co-operated and worked together with me to see that this comes to success.

ACKNOWLEDGMENT

First and foremost, I would like to express my heartfelt thanks to the almighty Lord for His grace and mercy that has enabled me to come to this far in my academic life. I would like to extend my sincere appreciation and gratitude to my dedicated supervisors; Mr. Ojuu David and Mr. Amayo Robert for being there every time I needed their advice and assistance while doing my research project. I greatly appreciate their invaluable marvelous guidance, patience, encouragement, leadership and the conducive environment that they created for me to complete this study smoothly and in time. I am extremely thankful to all my beloved friends for their time, guidance and contribution as far as this research project was concerned. In the same spirit, my sincere appreciation goes to the staff of crop production and management especially Dr Opio Peter, the research coordinator for his guidance, suggestions during research period, Mr. Andiku Charles and Dr. Lubadde Geoffrey (Deputy Dean) for having equipped me with research method concept and finally to Mr. Turyasingura Geoffrey (Head of Department Crop Production and Management) for having given me the useful knowledge and skills of Agricultural science, some of which I have been able to exploit in this study

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LIST OF ABBREVIATIONS

ANOVA	= Analysis of Variance.
CV	= Coefficient of Variation
Ha	= Hectare.
Kg ha^{-1}	= Kilogram per hectare.
LSD	= Least Significant Differences.
FAO	= Food, Agricultural Organisation.
SSA	= Sub Saharan Africa.
RDI	=Recommended Daily Intake
BNF	=Biological Nitrogen Fixation
N	=Nitrogen
P	=Phosphorus
AMF	= arbuscular mycorrhizal fungi
PGPR	=Plant Growth Promoting Rhizobacteria
PSB	=Phosphate Solubilizing Bacteria
%	=Per cent
Cm	=Centimetres

ABSTRACT

Groundnut is an important food crop throughout the tropics. It is mainly grown for the kernels and the edible oil and meal derived from them, and the vegetative residue. The average on farm yield of groundnuts in Uganda is about 800kg/ ha as opposed to the yield potential of 3000kg/ha, this brings a yield gap of 2200kg/ha. This yield gap has been attributed mostly to poor soil fertility due to inadequate availability of essential nutrients in the soils.

This has been attributed to production constraints such as reducing soil fertility, pests and diseases, drought and water logging. Soil infertility is a major constraint in groundnut production, capable of causing low on farm yields among smallholder farmers. The continuous cultivation of the same small piece of land every season with no replenishment has limited the ability of the soils to regenerate resulting in soil biodiversity loss and soil exhaustion. This has created a need to explore new avenues to rebuild the soil health. One of the ways to address these challenges is the use of indigenous microorganisms (IMO) that are effective in rejuvenation of soil health. Therefore, this study was carried out to assess the effects of bio-inoculants, (Jeevamritha and Biodynamic) on growth and yield of Serenut 2 variety of groundnuts. Study consisted of four treatments which include; jeevamritha, biodynamic, jeevamritha+biodynamic and control. The bioinoculant treatments were applied in respective plots. Each treatment was replicated four times in randomized complete block design. The data was collected from branches, leaf area, days to first flowering, days to50% flowering, days to 75% flowering, stem length, nodules, roots, pods, shelling%, 100 grain weight, gynosphere and haulm weight. Results showed that most of the bio-inoculants significantly increased the observed parameters. Maximum plot yield was recorded in jeevamritha +biodynamic 26.20 kg which was significantly higher than control 20.60kg. Similarly, significantly higher yield was recorded in jeevamritha and biodynamic. Combined application of bio-inoculants gave better results than single inoculation which suggested that bio-inoculants used under the study worked synergistically with each other. Hence, it may be concluded that combination application of jeevamritha +biodynamic can be used to enhance the yield of groundnuts in Uganda.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Groundnut (*Arachis hypogea*) also known as peanut belongs to the family Leguminasae. It originated in South America, probably in Brazil, and has been cultivated since ancient times by Native Americans (Hammons, 1994). It is an annual grain legume crop widely cultivated in tropics and subtropics regions of sub–Saharan Africa (SSA) and a subsistence crop commonly intercropped with cereals (maize, sorghum and millet) and grains (sesame, and beans). Groundnut is currently grown on about 21.8 million hectares worldwide and the global production totals 38.6 million tons of which 95 percent occurs in developing countries (Growth et al., 2021**)**. Presently in Uganda the area under groundnut cultivation is estimated at 260,000ha representing 24.6% of total arable land (Okello et al., 2014).

Groundnut is an important subsistence food crop throughout the tropics. It is mainly grown for the kernels and the edible oil and meal derived from them, and the vegetative residue. Groundnut kernels typically contain 47-53% oil and 25-36% protein; they also contain about 10-15% carbohydrate and are rich in P; they are also a good source of vitamins B and E (Morton et al., 2008).

According to Okello et al. (2010), groundnuts thrive under low rainfall and as a legume; groundnuts improve soil fertility by fixing nitrogen. Therefore, the crop generally requires few inputs, making it appropriate for cultivation in low-input agriculture by smallholding farmers

Inoculation of legumes with bio inoculant generally triggers plant growth, development and yield and it is normally used as a substitute for mineral nitrogen fertilizer which is often costly. The rhizobia (bacteria) that have the potential to infect the root, form nodules and symbiotically fix N_2 in leguminous plants including groundnuts. However, the rhizobium activity and N2 fixation ability are reduced when the soil system lacks phosphorus (P) which is energy source for the rhizobia and also stimulates early root growth and enhances the formation of lateral and fibrous root systems which are essential for nodule formation (Asante *et al.,* 2020).

The average yield of groundnuts in Uganda is about 800kg/ ha as opposed to the yield potential of 3000kg/ha, this brings a yield gap of 2200kg/ha (Scheurer & Schlegel, 2013). This yield gap the meantime the world is moving from inorganic to organic farming due to the adverse effects of synthetic fertilizers on the ecosystems,

- There is necessity to carry out additional research on the nodule occupancy, locally available sugar sources which can stand in for molasses because depending on the molasses which may not be contained by the farmer may deject farmers from adopting the usage of bioinoculants.

REFERENCES

Abdulameer, A. S. (2010). *Impact of Rhizobial strains Mixture , Phosphorus and Zinc Applications in Nodulation and Yield of Bean (Phaseolus vulgaris L .) Abstract : Introduction : Materials and Methods : 8*, 357–365.

Abraha, N. W. (2019). *Evaluation of Biocontrol Agent and Wheat Straw Mulch on Yield and Yield Components of Groundnut (Arachis hypogaea L .) Genotypes in Central Tigray , Northern Ethiopia*. *3208*, 40–50. https://doi.org/10.7176/JBAH

Adebisi, Y. A., Ibrahim, K., Lucero-Prisno, D. E., Ekpenyong, A., Micheal, A. I., Chinemelum, I. G., & Sina-Odunsi, A. B. (2019). Prevalence and Socio-economic Impacts of Malnutrition Among Children in Uganda. *Nutrition and Metabolic Insights*, *12*, 117863881988739. https://doi.org/10.1177/1178638819887398

Asante, M., Ahiabor, B. D. K., & Atakora, W. K. (2020). Growth, Nodulation, and Yield Responses of Groundnut (Arachis hypogaea L.) as Influenced by Combined Application of Rhizobium Inoculant and Phosphorus in the Guinea Savanna Zone of Ghana. *International Journal of Agronomy*, *2020*. https://doi.org/10.1155/2020/8691757

Aziz, A., Ahiabor, B., Opoku, A., & Abaidoo, R. (2016). Contributions of Rhizobium Inoculants and Phosphorus Fertilizer to Biological Nitrogen Fixation, Growth and Grain Yield of Three Soybean Varieties on a Fluvic Luvisol. *American Journal of Experimental Agriculture*, *10*(2), 1–11. https://doi.org/10.9734/ajea/2016/20072

Badar, R., Nisa, Z., & Ibrahim, S. (2015). *Supplementation of P with rhizobial inoculants to improve growth of Peanut plants*. *1*, 19–23.

Behera, S. S., & Ray, R. C. (2021). *Current Research in Microbial Sciences Bioprospecting of* *cowdung microflora for sustainable agricultural , biotechnological and environmental applications*. *2*(November 2020).

Bonabana-wabbi, J., Kirinya, J., Kasenge, V., Semalulu, O., & Mugonola, B. (2015). *Smallholder farmers ' access to improved groundnut production and value addition technologies in Eastern Uganda*. *7*(8), 247–256. https://doi.org/10.5897/JAERD14.

Boraiah, B., Devakumar, N., Shubha, S., & Palanna, K. B. (2017). Effect of Panchagavya, Jeevamrutha and Cow Urine on Beneficial Microorganisms and Yield of Capsicum (Capsicum annuum L. var. grossum). *International Journal of Current Microbiology and Applied Sciences*, *6*(8), 3226–3234. https://doi.org/10.20546/ijcmas.2017.609.397

Chaudhary, T., Dixit, M., Gera, R., Shukla, A. K., Prakash, A., Gupta, G., & Shukla, P. (2020). Techniques for improving formulations of bioinoculants. *3 Biotech*, *10*(5), 1–9. https://doi.org/10.1007/s13205-020-02182-9

Dash, S., & Gupta, N. (2011). *Microbial bioinoculants and their role in plant growth and development*. *2*(13), 232–251. https://doi.org/10.5897/IJBMBRX11.005

Daudi, H., Shimelis, H., Laing, M., Okori, P., Mponda, O., Daudi, H., Shimelis, H., Laing, M., Okori, P., & Mponda, O. (2018). *Groundnut production constraints , farming systems , and farmer-preferred traits in Tanzania*. *7528*. https://doi.org/10.1080/15427528.2018.1531801

Devakumar, N., Shubha, S., Gounder, S. B., & Rao, G. G. (2014). Microbial analytical studies of traditional organic preparations beejamrutha and jeevamrutha. *Proceedings of the 4th ISOFAR Scientific Conference. Istanbul, Turkey*, 13–15.

Glycine, S., & Merril, L. (2014). *Effect of Rhizobium Inoculants and Reproductive Growth Stages on Shoot Effect of Rhizobium Inoculants and Reproductive Growth Stages on Shoot Biomass and Yield of Soybean (Glycine max (L .) Merril). April*. https://doi.org/10.5539/jas.v6n5p44

Gore, N. S., & Sreenivasa, M. N. (2011). Influence of liquid organic manures on growth, nutrient content and yield of tomato (Lycopersicon esculentum Mill.) in the sterilized soil. *Karnataka Journal of Agricultural Sciences*, *24*(2), 153–156. http://web.inflibnet.ac.in/ojs/index.php/KJAS/article/view/782

Growth, A., Perspectives, F., & Investment, U. D. (2021). *Promising Agriculture Technologies : Groundnut Promising Agriculture Technologies : Groundnut AND SEX-DISAGGREGATED FUTURE PERSPECTIVES UNDER DIFFERENT INVESTMENT welfare gains Webinar : Climate resilience and job prospects for young people in Promising A*. 10–11.

Gupta, Chinmay, M. K. Y., Meena1, V., , Ambuj Singh1, H. B. S., Sarma2, B. K., & S.P. Singh2 and Amitava Rakshit. (2020). Bio-inoculants as Prospective Inputs for Achieving Sustainability: Indian Story. *Economic Affairs*, *65*(1), 31–41. https://doi.org/10.30954/0424-2513.1.2020.5

Hammons, R. O. (1994). *The origin and history of the groundnut*. 1–2.

Jadav, N. B. (2022). *Constraints Experienced by Farmers in Adoption of Recommended Groundnut Crop Production Technology*. *10*(2), 50–53.

Jayappa, S., Jogattappa, V., Jaime, N., & Teixeira, A. (2010). *Influence of Jeevamrutha (Biodynamic Formulation) on Agro-Industrial Waste Vermicomposting*.

Jayappa Veeresh, S., Narayana, J., & Teixeira da Silva, J. A. (2009). Influence of Jeevamrutha (Biodynamic Formulation) on Agro-Industrial Waste Vermicomposting. *Dynamic Soil, Dynamic Plant*, *June*.

Kaur, A. (2020). *JEEVAMRUTHAM : An effective activator of soil microorganisms*. *1*(1).

Kevin Naik. (2005). *Importance of Floriculture in Indian Economy*. 1–8. https://www.ukessays.com/essays/economics/current-status-of-indian-floriculture-industry-economics-essay.php

Kulkarni, S. S., & Gargelwar, A. P. (2019). *Production and microbial analysis of Jeevamrutham for Nitrogen fixers and Phosphate solubilizers in the rural area from*. *12*(8), 85–88. https://doi.org/10.9790/2380-1208018592

Lal, R. (2015). *Restoring Soil Quality to Mitigate Soil Degradation*. 5875–5895. https://doi.org/10.3390/su7055875

Maitra, S., Brestic, M., Bhadra, P., Shankar, T., Praharaj, S., Palai, J. B., Shah, M. M. R., Barek, V., Ondrisik, P., Skalick, M., & Hossain, A. (2022). *Bioinoculants — Natural Biological Resources for Sustainable Plant Production*. 1–35.

Maurya, D., Adhikari, C., Kumar, T., & Bishwas, A. J. (2021). *Biological Interactions of Plants, Soils, and Microbes*. *December*.

Merrill, L. (2020). *Effect of fungicide and different Rhizobium inoculants on growth and yield of Effect of fungicide and different Rhizobium inoculants on growth and yield of soybean (Glycine max (L .) Merrill)*. *March*, 8–14. https://doi.org/10.22271/chemi.2020.v8.i2ao.9159

Mintah, F., Mohammed, Y. Z., Lamptey, S., & Ahiabor, B. D. K. (2020). Growth and Yield Responses of Cowpea and Groundnut to Five Rhizobial Inoculant Strains in the Guinea Savanna Zone of Ghana. *Advances in Agriculture*, *2020*. https://doi.org/10.1155/2020/8848823

Mishra, D., Rajvir, S., Mishra, U., & Kumar, S. (2013). Role of Bio-Fertilizer in Organic Agriculture: A Review. *Research Journal of Recent …*, *2*(2013), 39–41. http://isca.in/rjrs/archive/special_issue2012/8.ISCA-ISC-2012-1AFS-32.pdf

Morton, B. R., Tillman, B. L., Gorbet, D. W., Boote, K. J., Hammons, R. O., Prasad, P. V. V., Cilliers, A. J., Rao, R., & Smith, E. V. (2008). *The origin and history of the groundnut*. *289*, 1–26.

Munshi, S. K., Roy, J., & Noor, R. (2019). Microbiological investigation and determination of the antimicrobial potential of cow dung samples. *Stamford Journal of Microbiology*, *8*(1), 34–37. https://doi.org/10.3329/sjm.v8i1.42437

Mweetwa, A. M., Mulenga, M., Mulilo, X., Ngulube, M., Banda, J. S. K., Kapulu, N., & N, S. H. (2014). *Response of Cowpea , Soya Beans and Groundnuts to Non-Indigenous Legume Inoculants*. *3*(4), 84–95. https://doi.org/10.5539/sar.v3n4p84

Nigam, S. N., Giri, D. Y., & Reddy, A. G. S. (2013). Groundnut seed production manual. *Journal of Chemical Information and Modeling*, *53*(9), 1689–1699.

Okello, D. K., Biruma, M., & Deom, C. M. (2010). Overview of groundnuts research in Uganda: Past, present and future. *African Journal of Biotechnology*, *9*(39), 6448–6459.

https://doi.org/10.5897/AJB09.013

Okello, D. K., Okori, P., Puppala, N., Bravo-Ureta, B., Deom, C. M., Ininda, J., Anguria, P., Biruma, M., & Asekenye, C. (2014). *Groundnut seed production manual for Uganda*. https://www.researchgate.net/publication/277558622_Groundnut_Seed_Production_Manual_for_Uganda_2015

Owen, D., Williams, A. P., Grif, G. W., & Withers, P. J. A. (2014). Use of commercial bio-inoculants to increase agricultural production through improved phosphrous acquisition Use of commercial bio-inoculants to increase agricultural production through improved phosphorus acquisition. *Applied Soil Ecology*, *86*(August), 41–54. https://doi.org/10.1016/j.apsoil.2014.09.012

Palanisingh, V., Vijayalakshmi, R., Sathishkumar, R., & Palanichamy, V. (2020). *Groundnut Exports Of India-Direction And Trends*. *9*(July), 4–7.

Ragimekula, N., Pv, K., & Gowda, M. (2012). *STUDY OF GENETIC VARIABILITY AND CORRELATIONS IN SELECTED*. *March*.

Rajendran, K., Nithya, A., & Mohan, E. (2016). *Effect of Bio-inoculants on Growth and Quality Seedling Production of Coriander (Coriandrum sativum L .) in Nursery Condition*. *1*(1), 50–61.

Road, I. (2014). *Biofertilizers for enhancing groundnut productivity*. *5*.

Sailaja, V., Naga Ragini, A., & Narasimha Murthy, C. V. (2013). Influence of biodynamic compost BD 500 on growth and development of leafy vegetable Amaranthus viridis. *Asian Journal of Microbiology, Biotechnology and Environmental Sciences*, *15*(1), 93–98.

Scheurer, C., & Schlegel, C. (2013). ["How can I help you?"]. *Krankenpflege. Soins Infirmiers*, *106*(11), 89. https://doi.org/10.4324/9780429446962-1

Student, G. A. (2019). *Production and microbial analysis of Jeevamrutham for Nitrogen fixers and Phosphate solubilizers in the rural area from Maharashtra*. *12*(8), 85–92. https://doi.org/10.9790/2380-1208018592

Suyal, D. C., Soni, R., & Sai, S. (2016). *as Biofertilizer*. 311–318. https://doi.org/10.1007/978-

81-322-2647-5

Trivedi, A., & Rajpoot, S. K. (2018). *Bio-inoculants and their importance in improving nutrient acquisition and crop productivity under ICM concept* (Issue September 2020).

Tulu, D., Endalkachew, W., Zikie, A., Asnake, F., Tilahun, A., & Chris, O. (2018). Groundnut (Arachis hypogaea L.) and cowpea (Vigna unguiculata L. Walp) growing in Ethiopia are nodulated by diverse rhizobia. *African Journal of Microbiology Research*, *12*(9), 200–217. https://doi.org/10.5897/ajmr2017.8756

Turuko, M., & Mohammed, A. (2015). *Effect of Different Phosphorus Fertilizer Rates on Growth , Dry Matter Yield and Yield Components of Common Bean (Phaseolus vulgaris L .). January 2014*, 2–7. https://doi.org/10.12691/wjar-2-3-1

Veeraiah, A., Shilpakala, V., Devi, S. R., & Kumar, K. A. (2019). *Constraint Analysis of Groundnut Cultivation in YSR District of Andhra Pradesh , India*. *8*(07), 1488–1493.

Vessey, J. K. (2003). Plant growth promoting rhizobacteria as biofertilizers. *Plant and Soil*, *255*(2), 571–586.

Vishnu, A., Reddy, V., & Menon, S. (2021). *a Study on Role of Jeevamruth in Natural Farming: a Replacement for Synthetic Fertilizers*. *8*(5), 89–93. https://www.researchgate.net/publication/351450351

Zoundji, C. C., Houngnandan, P., Amidou, M. H., Kouelo, F. A., & Toukourou, F. (2015). *INOCULATION AND PHOSPHORUS APPLICATION EFFECTS ON SOYBEAN [Glycine max (L .) Merrill] PRODUCTIVITY GR OWN IN FARMERS ' FIELDS OF BENIN*. *25*(5), 1384–1392.