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# Impact of Malaria on Agricultural Productivity

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Abstract
This study examined the impact of malaria on agricultural productivity using farmers in Araga farm settlement and Agric-YES in Poka, Epe, Lagos state as its target population. Eighty farmers were randomly selected and structured questionnaire were administered to collect data. The data was analyzed using Simple percentages and Standard Deviation. The data was further subjected to Chi-square to test the formulated hypothesis at 5% level of significance. The result shows that 54 (67.5%) of the respondents were males while 26 (32.5%) were females. All the farmers were found to be educated with a minimum of NCE or OND qualification. Most of the respondents figure (53.8%) were between 31-40 years. About 77 (97.7%) of the respondents of this study perceived that if agricultural and health support systems are available to them, it will reduce the adverse effect of malaria on agricultural productivity in their area. While only 3 (3.8%) respondents disagreed that agricultural and health support systems if available to farmers can reduce the impact of malaria on agricultural productivity. The mean response and the standard deviation are 1.96 and 0.191 respectively. The hypothesis tested ($p \leq 0.05$) gave 0.166 which indicates that there was no significance differences in the perception of male and female respondents on the effect of malaria on agricultural productivity. It was also deduced that the impacts of malaria can be reduced if there are agricultural and health support systems available for farmers; such as the use of prophylactic drugs and indoor residual spraying of insecticides. The study therefore concluded that malaria has negative impacts on farmers and such impacts impede agricultural production which is due reduces household income.

Keywords: Malaria, Agricultural, Productivity.

## Background to the Study

Malaria is a mosquito borne infectious disease of humans and other animals caused by protist (a type of microorganism) of the genus plasmodium. It begins with a bite from an infected female Anopheles Mosquito, which introduces the protist through saliva into the circulatory system. In the blood, the protist travel to the liver to mature and reproduce. Malaria causes symptoms that typically includes fever and headache, which in severe cases can progress to coma or death. The disease is widespread in tropical and subtropical regions in a broadband around the equator, including much of sub-saharan Africa, Asia, and America (en.wikipedia.org/wiki/malaria 2013).

Malaria, is not only a health problem, it is also an economic problem as the success of agricultural livelihoods depend on the heath of its work force (Oladepo*et al*, 2010). Malaria at the household level affects productivity of the people and their assets acquisition capacity. Households also frequently spend substantial share of their income and time on malaria prevention and treatment as well as an effort to control mosquitoes (Coluzzi, 1999).

Globally, an estimated 3.2 billion people in 97 countries and territories are at risk of being infected with malaria and 1.2 billion are at high risk. According to the latest estimates, 198million cases of malaria occurred globally in 2013 and the disease led to 584,000 deaths. The burden is heaviest in the WHO African region, where an estimated 90% of all malaria deaths occur and in children aged under 5years who account for 78% of all deaths (WHO, 2014).

In Nigeria, Malaria impacts on development of the country as it causes death, reduces human work capacity or productivity in all sectors including the agricultural sector. Malaria reduces Nigeria's GNP by 1.0% annually ($348 Million), and 25.0% of household income is expected on malaria control and treatment. Chloroquine, the cheapest drug for malaria treatment, has lost its potency, thus implying more cost for malaria control and reduction of income among agricultural workers (SIMA,2002). According to Oladepo (2010) malaria-afflicted farmers harvest only 40.0% of their crops compared with the healthy ones who could harvest almost 100.0% of their harvest. Malaria thus constitutes a great burden on the already depressed Nigerian economy through its severe impact on the agricultural sector.

Effective methods for reducing malaria infection exist but the challenge is their deployment in the context of weak health systems and the poverty situation in many parts of Africa, Asia and South America. A recent effort has been directed at the use of anti-malarial drugs, and the promotion of insecticide treated bed nets (ITN) (SIMA 2002). A new approach proposed by System-wide Initiative on Malaria and Agriculture (SIMA) which involves investment in Malaria focused agricultural research has been reported (Klinkenberg and Boelee, 2002). The initiative entails providing health education to farmers, with the aim of reducing malaria at its source, in many high-risk regions. The approach involves management of land, water and farming practices in ways that discourage mosquitoes from breeding and to reduce human-mosquito contact. This is based on the fact that malaria is a disease that can be controlled by good management of the environment where the vector breeds. The burden of malaria varies across different region of the world and even within a country. The disease carries with it two

categories of costs; morbidity and mortality costs. Malaria morbidity affects agricultural productivity through its effects on house holds' welfare (through families' allocation to treatment and prevention of the disease), and decline in agricultural productivity through loss of time. In case of mortality, losses to agricultural productivity include loss of future income and cumulative investment on the dead due to malaria.

Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs. Its measures are subdivided into partial, multifactor and total. Partial factor productivity is the amount of output per unit of a particular input. It only considers a single input in the ratio. For example, it uses yields of crops to determine the productivity of field crops. Literature indicates that it is easy to compute as it requires limited data, but it can be hard to identify factors that cause productivity of field crops to change.

Agricultural productivity measures the performance and provides a guide to the efficiency of the sector (Thirtle*et a*l (1993); Thirtle*et al* (2005); Kirsten *et al* (2003) and Conradie*et al* (2009)). Even United States Department of Agriculture (1980) stated that agricultural productivity statistics are important to identify the source of economic growth, justify the appropriation of agricultural research funds, serve as an indicator of technical changes and justify price changes.

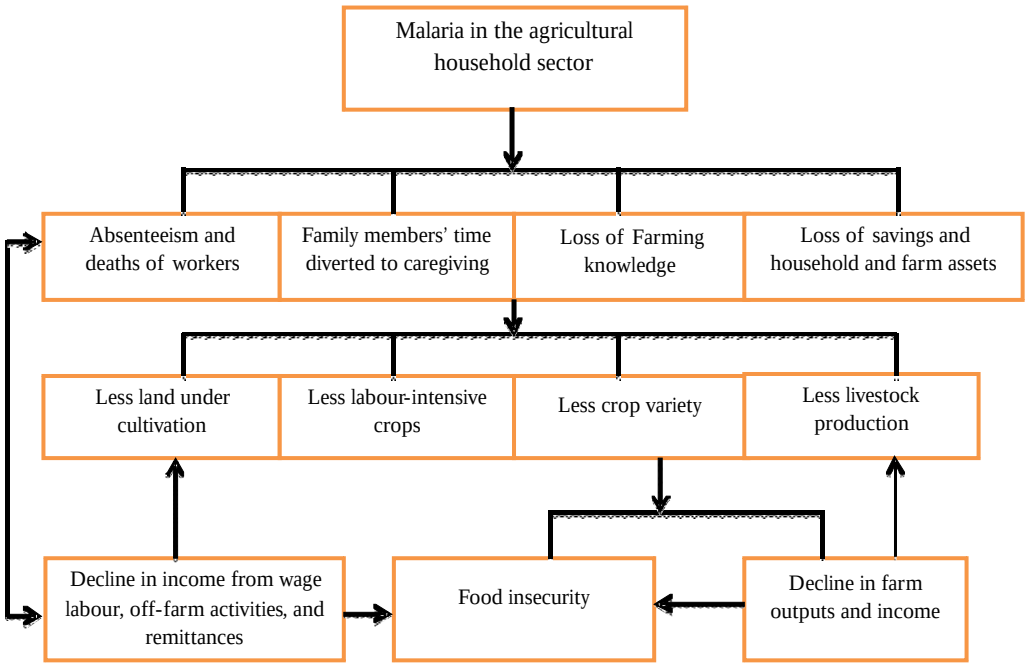
Although government's involvement was limited to creating policy instruments that improved productivity within the sector, its involvement on researching about the productivity was limited. Both Multifactor productivity (MFP) and Total factor productivity (TFP) are defined as the ratio of total agricultural output to a subset of agricultural inputs. They utilize more than a single factor. Their measures reflect the joint effects of many factors including new technologies, economies of scale, managerial skill, and changes in the organization of production to agricultural production.

The objectives of this study are therefore to assess:

i. Causes of malaria
ii. Effect of malaria on farm productivity
iii. Possible ways of preventing or controlling malaria to enhance productivity.

Conceptual Framework

Fig.1- Conceptual Framework for the impact of malaria on farm productivity




The figure above shows that the incidence of malaria leads to absenteeism of workers, family members' time are diverted due to caregiving, there will be loss of farming knowledge when older and highly experienced farmers die. Household, farm assets as well as savings are lost, less land would be put under cultivation, less crop variety and less livestock would be produced. These all would lead to decline in output and income from agriculture and generally food insecurity.

The nature of the respondents has been found to be a factor in the incidence of malaria in the study area. According to Service,1991; Martens & Hall, 2000, agricultural labourers and may not only place themselves at risk through increased contact with the malaria vector but also, through their migration, place others at greater risk by contributing to the spread of the disease.

The incidence of malaria on farm productivity could be linked to life expectancy and ultimately economic productivity, thus depleting the quality and quantity of countries labour force. Munongo (2013) employed ordinary least square and two stage instrumental variable estimation methods to estimate the impact of ill-health on productivity and labour supply in Uganda found that poor health on productivity force leads to productive loss and negatively impact on economic growth thorough reduced economic output due to work absenteeism. A similar approach was also employed to examine the wage and labour supply effects on the illness in Cote d'ivoire and Ghana and the results revealed that for one additional disable day,

the estimated impact on annual earning is about 65% reduction in Cote d'ivoire and 32% reduction in Ghana.

## Empirical Studies on the Impact of Malaria on Agricultural Productivity

The study of malaria and agricultural production has of recent attracted scholars' attention, especially the nexus or impact of malaria on household agricultural production. According to Mwabu and Fosu (2007), the effect of malaria on farm output, wage income and household expenditure was analyzed using household data. Their assessment was done using ordinary least squares (OLS) and Least Absolute Deviation (LAD) regression methods, they found out that the effect of malaria illness on crop production was negative and statistically significant and the negative production effect of malaria was more than twice of the effect of other diseases.

On other important determinants of crop production like gender, experience (proxies by age), land holding and house-hold size the study revealed that they were statistically significant. The study concluded that malaria impairs work ability more relative to other diseases since the ability to work is compromised by any disease and results strongly suggest that sick people have lower output than healthy people.

Wangombe and Mwabu (1993) in their study examined the extent to which malaria affected agricultural land use patterns in several districts in Kenya. The study related the total family size and the total number of malaria cases in households over a period of three months. They concluded that malaria had no statistically significant effect on cassava production nor the acreage cultivated. They suggested that this may be explained by coping strategies of households including household labor hiring practices aimed at cushioning the effects of malaria on income and increased efforts made by other household members at the time of the illness. This study totally contrasts with that of Mwabu and Fosu (2007) and given that Kenya is an agro-based country, one would expect malaria to have a negative effect on Cassava production. In more rigorous empirical study, Wangombe and Mwabu (1993) using econometric technique, examines the relationship between income, production and malaria. Using log linear functional forms, which set demand for malaria services as a control to determine how responsive the household is to malaria, household income, accessibility in year of schooling and preparedness to the disease were used as explanatory variables. The breakdown of the results shows no statistical significance to production or income as against previous studies. This however, does not mean that household. This result may be due to misspecification of the models as well as use of aggregated data on age – sex patterns of production and time allocations amidst household members.

The study by Ajani and Ashagidigbi (2008), however, maintain that malaria has an effect on the overall farm income. The study was conducted in Nigeria using both descriptive and multiple regression techniques. They found out that malaria incidence had a significant effect on the health and farm income of farmers through increase in the number of days of incapacitation. On other determinants of productivity of farmers such as farm size, education, extension service, food expenditure and non-food expenditure, the results were statistically significant at

one percent while household size was statistically significant at five percent. However, age and days of incapacitation were not statistically significant at ten percent in explaining the variation in the annual income realized from the farm which was used as a measure of productivity of farmers. The two studies by Ajani and Ashagidigbi (2008) and that of Mwabu and Fosu (2007) seem to be diverging on age as a determinant of agricultural production and this could be probably due to the methodology and the type of data used.

According to Ulimwengu (2009), study in rural Ethiopia on the relationship between farmer's health status and agricultural production using a Cobb-Douglas Stochastic Production Frontier approach found out that, the average value of agricultural production per unit of input tends to be higher for healthy farmers than for those affected by illness. The difference in input productivity was also observed in income, where healthy farmers earn 137 birr more per year than those affected by illness and the difference in income ranges from 56 birr (off - farm) to 6 birr (remittance). The results suggest that one more day lost because of illness will increase farmers' inefficiency by 0.5 percent; this implies that substitution of farmers' time through either labor market or family and other social connection may not be perfect. A similar study in Northern Nigeria by Ajani and Ugwu (2008) found out that health variable as measured by the number of days lost was statistically significant at 5 percent with its coefficient large and positively related to the efficiency of farmers. They concluded that a one percent improvement on the health condition of the farmer leads to a 31 percent increase in the efficiency of farmers.

Malaria as no direct impact on agriculture in term of crop production but, its impact can be observed directly on animals like birds, reptiles and mammal and about 30 species of malaria naturally infect non-human primates (Baird, 2013). Some of the malaria parasites that affect animals serves as model organisms for human malaria parasites, such as P. coatneyi (a model for P. falciparum) and P. cynomolgi (P. vivax). Diagnostic techniques used to detect parasites in animal (Non Human Primates) are similar to those employed for humans (Ameri, 2010). Malaria parasites that infect rodents are widely used as models research, such as P. Berghei (Kumar, 2008). Avian malaria primarily affects species of the order Passeriformes, and poses a substantial threat to birds of Hawaii (Lapointe et al, 2012).

The infected nonhuman primates (NHP) like cock, cow, monkey etc are either killed by malaria or reduces their distribution or abundance. Which implies a negative impact on animal production and in turn diminish agricultural productivity? The indirect impact of malaria on agricultural productivity includes, working days lost due to sickness caused by malaria infection, limits poverty-reduction strategies and seriously impends the accumulation of human capital by these malaria infections, low incomes (escalation of poverty), poor health, low productivity, reduced labor efficiency, low output, reduced welfare and high cost of care groups. The health consequences of malaria vary in terms of severity, but the global impact of malaria on human health, productivity, and general well-being is profound.

Malaria exacts a heavy burden on the poorest and most vulnerable communities. It primarily affects low and lower middle income countries. With endemic countries, most severely affected, having the highest risks associated with malaria and the least access to effective

services for prevention, diagnosis and treatment. Thus, malaria control and ultimately its elimination is inextricably linked with health system strengthening, infrastructure development and poverty reduction.

The global impact of malaria on human health, productivity and general well-being is profound and Africa has been particularly hard hit in 2006, more than 90percent of deaths from malaria occurred in Africa where 45 of the 53 countries are endemic for the disease (WHO 2008). Malaria costs Africa more than US $ billion annually and it slows economic growth in African countries by as much as 1.3 percent per year (WHO 2010).

Malaria morbidity and caretaking have serious consequences on agricultural productivity. Potential impact (direct and indirect) of malaria on agricultural productivity could be summarized as follows:

1. Reduction of time for farming due to productive workdays lost by the sick person and the sick person's caregiver.
2. Reduction of effort in working.
3. Reduction and absence of investment in agriculture due to cost of prevention and treatment
4. Loss of farm labor through the death of adults, keeping in mind that agriculture in Africa is very labor intensive, most of the time using family and hired labor.
5. Adoption of less productive farming techniques due to incapacitation.
6. Reduction in cultivated area due to reduced labor and capital
7. Changes in cropping patterns.
8. Migration from agricultural lands infested with mosquitoes.
9. Loss of farm animals

## Sampling Procedure and Sample size

The study was conducted among farmers in a farm settlement-Araga farm settlement and Lagos State Agricultural Youth Empowerment Scheme (Agric-YES) Settlement Araga, Epe,Lagos State .It is a farm settlement with a population of about 200 farmers. Simple random sampling technique was used to select eighty (80) respondents from the population. A structured questionnaire was administered to elicit responses on causes of malaria, effect on productivity and how it can be controlled.

Simple percentage and Standard Deviation were used to analyse the information gathered from the respondents. The hypothesis formulated: Ho- There is no significant difference between the perception of male and female farmers on the impact of malaria on farm productivity was tested using Chi-square to test the level of significance at 5%.

## Results and Discussion

The result shows that 54 (67.5%) of the respondents were male while 26 (32.5%) were female as is usually the case in many agricultural based enterprises.62 (77.6%) were less than forty years, within 20-40 while only 18(22.4%) were 41 years and above. All the respondents were educated and qualifications such as NCE/OND (23.7%),HND/B.Sc (43.8%), M.A./M.Sc.(31.2%) and PhD.(1.3%).This is in line with the objective of the farm settlement scheme which aims at encouraging young and educated people to venture into agriculture. 77 (97.7%) of the respondents perceived that agricultural support systems can reduce the impact of malaria while 3 (3,8%) disagreed.48 (60%) agreed that the use of prophylactic drugs could be used for prevention in areas where malaria is endemic. 45 (56.3%) of the farmers agreed that malaria can be controlled through indoor spraying of mosquitoes with insecticides. This finding correlate with the opinion of Bates (2010), who opined that methods used to prevent the spread of the disease where malaria is endemic include prophylactic drugs, mosquito eradication and the prevention of mosquito bites

However, only 21(26.3%) of the respondents agreed that wearing long, light coloured, loose clothing can help to avoid mosquito bites and in turn reduce malaria. 57(71.3%) of the respondents agreed that the use of mosquito nets and bednets is a reliable way of preventing and controlling malaria infection, this is in line with the fact stated by WHO that death attributable to malaria in year 2010 were reduced by over a third from a year 2000 estimate of 985,000,largely due to the widespread use of insecticide treated mosquito net.

Table A: Showing the Chi-Square Tests on perception of Male and Female Respondents on the impact of malaria on Agricultural Productivity

| Chi-Square Tests | | | |
|---|---|---|---|
| | Value | Df | Asymp. Sig. (2-sided) |
| Pearson Chi-Square | 16.583 | 12 | 0.166 |
| Likelihood Ratio | 21.857 | 12 | 0.039 |
| Linear-by-Linear Association | .098 | 1 | 0.755 |
| N of Valid Cases | 80 | | |
| a. 21 cells (80.8%) have expected count less than 5. The minimum expected count is .33. | | | |

Source: Field Survey, 2013

Table A shows that $\chi^2(12, N = 80) = 16.583$, $p = 0.166$. This shows that there is no statistically significant association between gender and impact of malaria on agricultural productivity. That is, both males and females equally perceive impact of malaria on agricultural productivity similarly, both agree that malaria has negative impact on agricultural productivity. This is in line with Sanusi's (2013) assertion that farming as a business is profitable with or without taking economic cost of malaria into consideration but profitability of the business reduces by about 5% when malaria cost considered.

Table B: Showing Thesymmetric measures on perception of male and Female Respondents on the incidence of Malaria on Agricultural Productivity

| Symmetric Measures | | | |
|---|---|---|---|
| | | Value | Approx. Sig. |
| Nominal by Nominal | Phi | .455 | 0.166 |
| | Cramer's V | .455 | 0.166 |
| N of Valid Cases | | 80 | |

Source: Field Survey, 2013

Table B reveals that the strength of association between the variables is weak: Phi (φ) = 0.455 and thus gender accounted for 20.7% of the variance in the score on impact of malaria on agricultural productivity.

## Summary

Malaria as no direct impact on agriculture in term of crop production but, its impact can be observed directly on animals like birds, reptiles and mammal . The indirect impact of malaria on agricultural productivity includes, working days lost due to sickness caused by malaria infection, limits poverty-reduction strategies and seriously impending the accumulation of human capital by malaria infection, low incomes (escalation of poverty), poor health, low productivity, reduced labor efficiency, low output, reduced welfare, high cost of care groups. The health consequences of malaria vary in terms of severity, but the global impact of malaria on human health, productivity, and general well-being is profound. Malaria morbidity and caretaking have serious consequences on agricultural productivity. Potential impact (direct and indirect) of malaria on agricultural productivity can be summarized as follows:

1. Reduction of time for farming due to productive workdays lost by the sick person and the sick person's caregiver.
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4. Loss of farm labor through the death of adults, keeping in mind that agriculture in Africa is very labor intensive, most of the time using family and hired labor.
5. Adoption of less productive farming techniques due to incapacitation.
6. Reduction in cultivated area due to reduced labor and capital
7. Changes in cropping patterns.
8. Migration from agricultural lands infested with mosquitoes.

## Conclusion and Recommendations

It can be deduced from this study that malaria has negative direct and indirect impacts on agricultural productivity and such impacts impede maximum agricultural production which results from malaria attack on farmers who are the agricultural producers.

Based on the study conducted on the Impact of Malaria on Agricultural Productivity, the following recommendations are offered for this study:

1. Awareness on impact of malaria on agricultural productivity should be made among farmers and rural dwellers.
2. Farmers should learn to prevent and control malaria in order to maximize agricultural productivity.
3. More efforts should be made by the government and the populace towards the eradication of malaria vectors i.e. mosquito to get rid of malaria endemicity in Nigeria.
4. The recommended policies arising from the economics implication of these empirical findings were that public enlightenment under the aegis of the "Roll back Malaria campaign" should be intensified in the rural households.
5. Farmers on their part should keep clean environment because farming communities suffer most from malaria.

References

Ajani, O.I.Y., & Ashagidigbi, W.M. (2008). Effect of malaria on rural households' farm income in Oyo state, Nigeria. Department of Agricultural Economics, University of Ibadan, Nigeria, *African Journal of Biomedical Rersearch*,11(3) 259-266

Ajani, O.L.Y., & Ugwu, P.C. (2008). The impact of adverse health on agricultural production of farmers in kainji basin north central Nigeria using a stochmastic production frontier approach. Department of Agricultural Economics, University of Ibadan, Nigeria.

Asenso, O.K., Asante A. F, Tarekegn J., & Andain K.S. (2011). *Addressing the links among agriculture, malaria and development in Africa*. Leveraging Agriculture for Improving Nutrition and Health. 2020 Conference Brief 16. February

Baird, J.K (2013). *Evidence and implications of mortality associated with acute plasmodium vivax malaria*. Clinical Microbiology Reviews 26(1)36–57.

Bledsoe, G.H. (2005). Malaria primer for clinicians in the united states. *Southern Medical Journal 98*(12)1197-1204. Retrieved September 3, 2012, from http://journals.lww.com/smajournalonline/Fulltext/2005/12000/Malaria_primer_for_Clinicians_in_the_United_States.12.aspx

Collins, W.E, & Barnwell, J. W. (2009). Plasmodium knowles: finally being recognized. *Journal of Infectious Diseases199* (8)1107–8.

Coluzzi, M. (1999). The clay feet of the malaria giant and its African roots: hypotheses and inferences about origin, spread and control of plasmodium falci parum." *Parassitologlia 41*,277-283.

Conradie, B., Piesse, J., & Thirstle, C. (2009). What is the Appropriate Level of Aggregation for Productivity Indices? Comparing District, Regional and National Measures." *Agrekon 48*(1)9-21.

Kirsten, J., & Vink, N. (2003). *Policy module south Africa.* Presented under the Roles of Agriculture Project in International Conference on the 20- 22 October 2003, Rome, Italy, Agriculture and Development Economics Division, Food and Agriculture Organisation of the United Nations.

Klinkenberg, E., & Boelee, E., (2002). *Research priorities on malaria and agriculture in west and central Africa (WCA).* Workshop Documentation of the SIMA WCA stakeholder Consultation, IITA, Ibadan, Nigeria, 2002. 18 – 20 March, 2002. SIMA Document 1 Colombo, Sri Lanka: International Water Management Institute.

Kwiatkowski, D.P (2005). How malaria has affected the human genome and what human genetics can teach us about malaria. *American Journal of Human Genetics, 77* (2).

LaPointe D.A, Atkinson C.T., & Samuel M.D (2012). *Ecology and conservation biology of avian malaria*. Annals of the New York Academy of Sciences 1249, 211-226.

Lengeler, C. (2004). *Insecticide-treated bed nets and curtains for preventing malaria*. Lengeler, Christian. Cochrane Database of Systematic Reviews (2).

Martens, P., & Hall, L. (2000). Malaria on the move: human population movement and malaria transmission. *Publmed Journal on Emerging Infectious Diseases Mar- Apr* , 6(2),103 – 9.

Mwabu, G., & Fosu, A. (Edts) (2007). *Malaria and Poverty in Africa.* Kenya: The University of Nairobi Press.

Oladepo, O., Tona, G.O., Oshiname, F.O., & Titiloye, M.A. (2010). Malaria knowledge and agricultural practices that promote mosquito breeding in two rural farming communities in Oyo state, Nigeria. *Malaria Journal* , 9(9) 1.

Richter, J., Franken, G., Mehlhorn H, Labisch, A., & Häussinger, D. (2010). *What is the evidence for the existence of plasmodium ovalehypnozoites?*. Parasitology Research107 (6).

Systemwide Initiative on Malaria and Agriculture (SIMA) (2002). *SIMA on Malaria in Irrigated Agriculture Colombo.* Sri Lanka: International Water Management Institute, Eline Boelee, Flemming Konradsen, Wim van der Hoek, 1-8.

Thirtle, C., & Von Bach, H.S. (1993). Total factor productivity in south African agriculture. 1947-91. *Development Southern Africa, 10*(3)301 – 318.

Thirtle, C., Piesse, J., & Gousse, M. (2005). Agricultural Technology, Productivity and Employment: Policies for Poverty Reduction. *Agrekon, 44*(1)41-44

Ulimwengu, J. A. (2009). *Farmer's health and agricultural production in rural international food policy research institution (IFPRI)*. Washinton DC Vol.3, No.2.

Wang'ombe J. K., & Mwabu, G.M. (1993). Agricultural land use patterns and malaria conditions in Kenya. *Social Science and Medicine, 37*(9)1121-30.

WHO (2010). *Economic costs of malaria 2001 – 2010 united nations decade to roll back malaria.* Accesssed December2, http.//rbm.who.int/cmc_upload/0/000/015/363/RBMhifosheet_10.htm

World Health Organization (2005), *Malaria* (PDF). The First Ten Years of the World Health Organization. World Health Organization. Pp. 172–87.

*World Malaria Report, Geneva WHO*, (2008). World malaria Report, Geneva