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### RESEARCH ARTICLE

#### THE EFFECT OF FREE FARM INPUT SUPPLY ON AGRICULTURAL TECHNOLOGY ADOPTION AMONG SMALL SCALE MAIZE FARMERS IN MATUNGU SUB-COUNTY, KAKAMEGA COUNTY.

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#### Abstract

Fertilizer and certified maize seed use on farms is reported to be low in Matungu Sub-county. In effort to mitigate against this vice, the national government put in place programmes that ranged from subsidies to free input issues aimed at the promotion of use of fertilizers and certified seeds tailored to enhance agricultural productivity among smallholder maize farmers in Matungu and other Sub-counties in general. No study has since been undertaken to measure the effect of free farm inputs supply on agricultural technology uptake in Matungu. However, what is observed is continuous use of traditional planting material and minimal growth of commercial fertilizer outlets in the Sub-county. The purpose of this study was to document the effect of free inputs on agricultural technology adoption among small scale maize farmers. A cross-sectional survey research design was used to collect data. Using the coefficient of variation method, a sample size of 120 respondents was randomly selected from a sampling frame of 2,500 small-scale maize farmers who benefitted from free National Accelerated Agricultural Inputs Access Programme (NAAIAP) fertilizers and maize seed. The programme package aimed at identification of small scale maize producers owning land but unable to purchase inputs for the supply of free certified maize seed, planting and topdressing fertilizers in Matungu. Data was collected using a questionnaire from respondents. The instrument was developed by the researcher in consultation with the peers in the stream of Agricultural Extension. Pilot testing of the instrument was done in Mumias, a neighboring sub-county with similar farmer characteristics. 20 farmers were involved and Cronbach's alpha coefficient of reliability of 0.808 was obtained. Using SPSS computer package, data was analyzed and reported as frequencies, percentages, means and t-test. The study findings indicate that the effect of free farm input issues is significant on Agricultural Technology adoption subject to household food security. The outcome of the study may inform future policy decision making that might guide efforts towards agricultural research development, extension delivery and improved agricultural technology uptake.

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**Introduction:-**

According to the World Bank, African agriculture could and should be thriving. The region is identified to have the right conditions to feed itself such as enough fertile farm land, enough water and favorable climates. In addition, International Fund for Agricultural Development (IFAD, 2015) recognizes that Africa has the potential not only to feed itself, but to become a major food supplier for the rest of the world. Evidence from Asia and Latin America has shown that agricultural productivity growth was an essential element of structural transformation paradigm, with increasing attention being given to the need for major improvements in agricultural productivity to achieve Gross Domestic Product (GDP) growth, food security and poverty reduction goals in the context of Sustainable Development Goals-SDGs (Crawford, Kelly, Jayne, & Howard, 2003).

Kharelah et al (2002) observes that fertilizer costs in Africa are higher than in Latin America and Asia. African farmers rely more on traditional crop varieties that are less responsive to fertilizers than in Asia and Latin America. In addition, most areas in Africa have relatively low population density, providing less incentive to invest in land saving technologies. However, application of fertilizers in farming usually results in better yields. A classic example of free farm inputs program was recorded in Malawi, baptized the 'Starter Pack' program and its successor, the 'Targeted Inputs Program'-TIP implemented by the Government of Malawi with financial assistance from donors in 1998/09 season. In the initial years of operation, the program provided almost every rural smallholder household with a free pack consisting 15 kg of fertilizer, 2kg of hybrid maize seed and 1 kg of legume seed. The inputs were sufficient for the cultivation of 0.1 hectares according to extension recommendations (Oygard, Garcia, Guttormsen, Khadule, Mwanaumo, Mwanawina, Sjaastad&Wik, 2003). The pack was pegged on a number of objectives: Increase maize yields and food security, countering soil nutrient depletion and making new line of fertilizer-responsive semi-flint hybrids available to small scale farmers who otherwise might not take the risk to experiment with them.

The outcome of the program was seen as a relief effort and cheaper than importing maize (Levy, 2003). The Pack and TIP put improved agricultural technology in the hands of poor farmers who could not have afforded these inputs. Consequently, rural households food security and income position for several years was improved (Cromwell, Elizabeth, Kambewa, Mwanza&Chirwa, 2001). Furthermore, fertilizer importers appreciated the program because it purchased fertilizer from established importers rather than using independent channels for importing the programme fertilizer. Ten years since the launch of free or Farm Inputs Subsidized Program (FISP), a series of modifications were made in 2009/10 in Malawi. Despite these efforts, maize yields have remained low, partly due to limited adoption of improved maize varieties, fertilizer use and partly to soil nutrient loss through mono-cropping. The introduction of FISP was hoped that the program would introduce many farmers to improved inputs, stimulate future demand for those inputs and ultimately lead to long term benefits (IFPRI, 2012). Looking back, it is therefore interesting to note that only in the period 1998/99 to 2002/03 when SP and TIP were universally targeted did Malawi produce surplus maize (Harrigan, 2008).

The use of fertilizer and certified seed in Kenya is low due to its high price, attributed to the high cost of transportation and inefficient distribution systems. This is about a third of the level used in India and a quarter of the level used in Indonesia (Agriculture Sector Development Strategy-ASDSP, 2010). In general terms, ASDSP notes that a farmer using fertilizer is assumed to embrace the use of certified seed while the reverse is common to farmers at initial stage of an adoption process.

Matungu Sub-county has 30,786 households and a poverty index of 58 percent (Kenya Bureau Standards-KBS, 2010). Of this, 27,000 households are rated as farm families, engaged in some meaningful subsistence and commercial agriculture (SCAO, 2012). Less than 10 percent of practicing farmers use fertilizer and for the few who do, the amounts applied are far below recommended rates. Fertilizer is purchased in 2 kg tins because of inability to purchase a whole bag of say 25 kg or 50 kg package. That farmers practice spot application explains the low level of the practice of fertilizer use in the Sub-county (SCAO, 2012). The Director of Agriculture, Mumias Sugar Company acknowledges that fertilizer use in the sugar belt dates back to the 1980s where many of the farmers contracted by the company to produce sugar-cane are supplied with fertilizers for cane production. The report observes that a substantial number of farmers sell out the fertilizers for quick cash (MSC Annual Report, 2012). It is noted therefore, while extension services are available, adoption of agricultural technologies is low. In recognition of the poor uptake in use of fertilizer and certified seed, the Ministry of Agriculture launched National Accelerated Agricultural Inputs Access Program (NAAIAP) as a mitigation measure in 75 sub-counties countrywide, including Matungu (MOA, 2009). According to guidelines for NAAIAP implementation, the program had objectives with

clearly spelt out selection criteria for the would be beneficiaries. They include to create an enabling environment for agricultural technology adoption in the use of improved inputs, upscale innovative food security initiatives, promote food security status and improve farm incomes. Like in the Malawian case, this was hoped that the initial free inputs supply will trigger the need for continuous use of improved inputs and hence the demand that in turn will motivate inputs' dealers to open up new outlets within farmers' hinterlands (MOA, 2009).

The objective of the study was to determine the level of adoption of fertilizer and certified maize seed among small scale maize farmers in Matungu Sub-county before and after free farm inputs programme. From the objective, the following null hypothesis was derived and formed the basis for the investigation: Free farm inputs supply has no statistically significant effect on agricultural technology adoption among small scale maize farmers in Matungu Sub-county.

### **Key Factors Affecting Agricultural Technology Adoption:-**

Agricultural extension, also known as agricultural advisory services plays a crucial role in promoting agricultural productivity, increasing food security, improving rural livelihoods and promoting agriculture as an engine of pro-poor economic growth. Extension as a rural support service is needed to meet new challenges agriculture is confronted with such as changes in global food and agricultural systems, including the rise of supermarkets, growing standards & labels, growth in non-farm rural employment, deterioration of natural resource base and climate change (IFPRI, 2006).

International Food Policy Research Institute (IFPRI) has developed a frame work designing and analyzing extension and has several research programmes studying extension projects. They include from "Best practice to Best fit" a framework for designing and analyzing pluralistic agricultural advisory services worldwide. Agricultural advisory services are defined as the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and obtain information, skills and technologies to improve livelihoods and well being (IFPRI, 2006).

Agricultural extension operating within a broader knowledge system, includes research and agricultural education. Food and Agricultural Organization, FAO and World Bank refer to this large system as Agricultural Knowledge and Information Systems (AKIS) for rural development. Agricultural extension is therefore, fundamentally, speeding up the diffusion and adoption of improved agricultural practices. The objective is to reduce the gap between research findings and their practical application in the field (Havenga, 1974).

On the other hand, agricultural extension officers act as the link between critical information/research and farmers. On one side they liaise between farmers and research scientists, and on the other, between farmers and policy makers. Their goal is to assist farmers with decision making by ensuring that efficient knowledge is obtained in order to achieve successful results (Mandalios, 2014).

In Kenya agricultural extension plays a pivotal role in the agricultural sector development. On account of this, extension has evolved from purely public oriented in the 1960s with the notable success being dissemination of information on certified planting material especially hybrid maize seed to being pluralistic and demand driven since the early 2000s (World Bank, 2015). Extension aims to teach rural people how to improve their level of living by their own efforts, through making use of natural resources at their disposal in better systems of farming for the benefit of all (Bradfield, 1971).

Another key factor is input subsidy. Fertilizer subsidies can differ in terms of the point at which the subsidy is applied (farmer, trader, local producer), form of the subsidy, how it is provided (cash payment, voucher, reduced transport) and whether direct or indirect (ARD, 2010). Subsidies are advanced for financial, economic and non-economic reasons. Financial aspects count benefits in terms of increased outputs or incomes at the prevailing prices. Economic arguments assert that subsidies can create real economic gains by kick-starting the innovation, while non economic arguments focus on the potential contribution of the restoration of soil fertility, improved food security, poverty alleviation and social and environmental protection. Other alternatives are used in place of subsidies with comparable results to reduce cost of fertilizer and to improve its effect on yields. They include improving the enabling conditions through promotion of policies and institutions that contribute to the efficient markets for inputs, financial services and outputs, including regional markets to achieve economies of scale. It has also included

reducing high cost of transportation, reduce taxation on agriculture and investing in agricultural research, extension and rural education (ARD, 2010).

Sri Lanka has subsidized the cost of fertilizer for paddy farmers with the intention of encouraging the use of fertilizer and offsetting the effect of low crop prices and high costs of production (Tibbotuwawa, 2010). The programme since 2005 ensures that paddy farmers can obtain fertilizer at a fixed price, the government paying a subsidy to importers to cover the difference between the fixed price and the imported cost. However, evaluation reports show a responsiveness of fertilizer use on paddy rice to the price of fertilizer. Kikuchi & Masao (1990), estimated that removing the fertilizer subsidy would reduce the rice yields by only one percent. This conclusion was supported by Ekanayake (2006), who found low elasticity of fertilizer prices on consumption for the three main fertilizers. In his analysis the price of rice was more important in determining fertilizer use than own price of fertilizer.

India originally introduced subsidies in the 1960s to support the green revolution, with major spending to keep down the costs of fertilizer, irrigation water from public systems and rural electricity that drove many of the private irrigation pumps attached to wells. In addition India nationalized the main banks and directed them to provide credit to farmers at concessional interest rates. While studies (Doward, et al, 2004; Smith & Urey, 2002) suggest that during the early phases of the green revolution payment of subsidies on inputs contributed to rapid expansion of production of cereals and thereby to poverty reduction, subsequently it is less clear that the subsidies have continued to do so. Input subsidies also become a major feature of policy and were valuable to farmers faced with declining output prices in the 1980s, they were not, however, key determinants of technology adoption and became damaging when they crowded out capital investment in research, infrastructure and human capital as fiscal constraints began to bite under structural adjustment reforms.

The argument for subsidies is therefore attractive on several grounds. The siren call for subsidies continues to be hard to resist, they are politically attractive, seem to be easy to implement and problems they are intended to address remain compelling at both national and international levels (Craford, Jayne & Kelly, 2008). Subsidies look as though they provide a ready solution to otherwise difficult problems of developing input markets and associated financial services to small farmers. While other ways of overcoming such problems are complicated, with success uncertain, a subsidy is relatively straightforward measure to implement. Politically, subsidies are a highly visible gesture to rural voters, as well as potentially also being an instrument of patronage. To some, moreover, the sight of the state taking direct action to overcome the failings of markets, regarded with suspicion in the first place, is welcome. Moreover, in parts of the developing world orthodox advice to avoid subsidies is treated with suspicion, since it usually comes from people in countries where farmers are subsidized. The advice is seen as hypocritical. Yet perhaps the greatest attraction in the apparent simplicity of a single measure, a subsidy, to meet a wide range of objectives namely, economic, social and political. It is thus necessary to unpick the different justifications that can be offered for subsidies (Craford, Jayne & Kelly, 2008).

The major inputs in Kenyan agriculture are seeds, fertilizers and farm machinery. The input support programmes meant to assist farmers must focus on these type of inputs. The main support programmes put in place in Kenya are Nation Accelerated Agricultural Inputs Access Programme (NAAIAP) and Fertilizer Subsidy Programme (FSP) under the Ministry of Agriculture through National Cereals and Produce Board (NCPB).

NAAIAP which is the subject of this study, was started by the Ministry of Agriculture in 2007 in some counties including Kakamega. The aim was to assist resource poor farmers with inputs to grow maize on one acre of land with a target to reach 2.5 million small scale farmers who were not using fertilizers and certified seeds due to economic challenges (GOK, 2009). The farm inputs included 10 kg of certified maize seed, 50 kg of planting and top-dressing fertilizers respectively. The objective being to start off the farmer for food production with expectation to save some income from surplus production in order to buy farm inputs for next season's crop. The inputs were provided free of charge through a voucher system for a year. The farmer, however, had to meet the cost of land preparation.

### **Methodology:-**

A cross- sectional survey research design was employed for the study. Cross – sectional survey research design is appropriate for collecting data from naturalistic occurring events (Fraekel&Wallen, 2000; Mugenda&Mugenda, 1999). Hence the design was found appropriate for this study as it was collecting data on variables as they were at

that point in time of data collection. This design is fast and can study big sample sizes at little cost or effort, minimizing the worry by the researcher about respondents dropping out during the course of the study (Kombo & Tromp, 2007). It further provides self-reported facts about subjects under study, their feelings, attitudes, opinions and behaviours (Kothari, 2008).

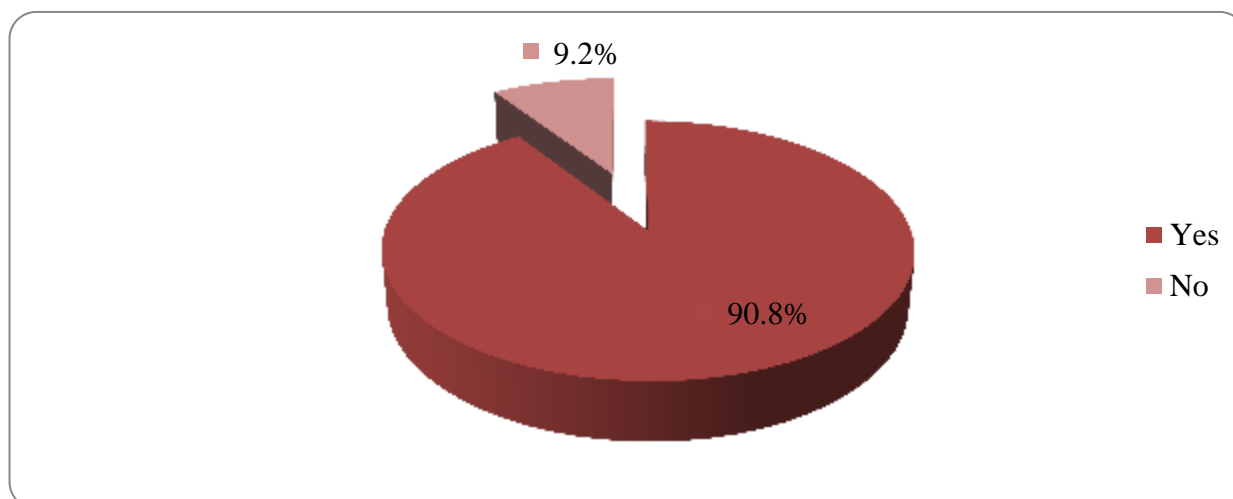
The study was carried out in Matungu Sub-county of Kakamega County in Kenya. Matungu Sub-county in the old constitutional dispensation had two locations, Matungu and Koyonzo. The Sub-county is now formed by five administrative wards namely, Kholera, Matungu, Koyonzo, Khalaba and Namamali. Using the coefficient of variation method (Nassiuma, 2000), a sample size of 120 respondents was selected using simple random sampling for the study.

Data collected was edited, coded and classified for ease of entry and analysis by computing using SPSS. Descriptive and inferential statistics were used in data analysis. Descriptive statistics included frequencies, means and percentages. They were used to describe the respondents' characteristics, status of technology adoption and continued use of technology after programmes exit. Inferential statistics was t-test. The hypothesis was tested at a significance level of  $\alpha=0.05$  using t-test since it intended to determine whether there was a difference in the means of output before and after adoption of the agricultural technology.

## Results And Discussions:-

### Adoption level of fertilizer and certified maize seed Before NAAIAP:-

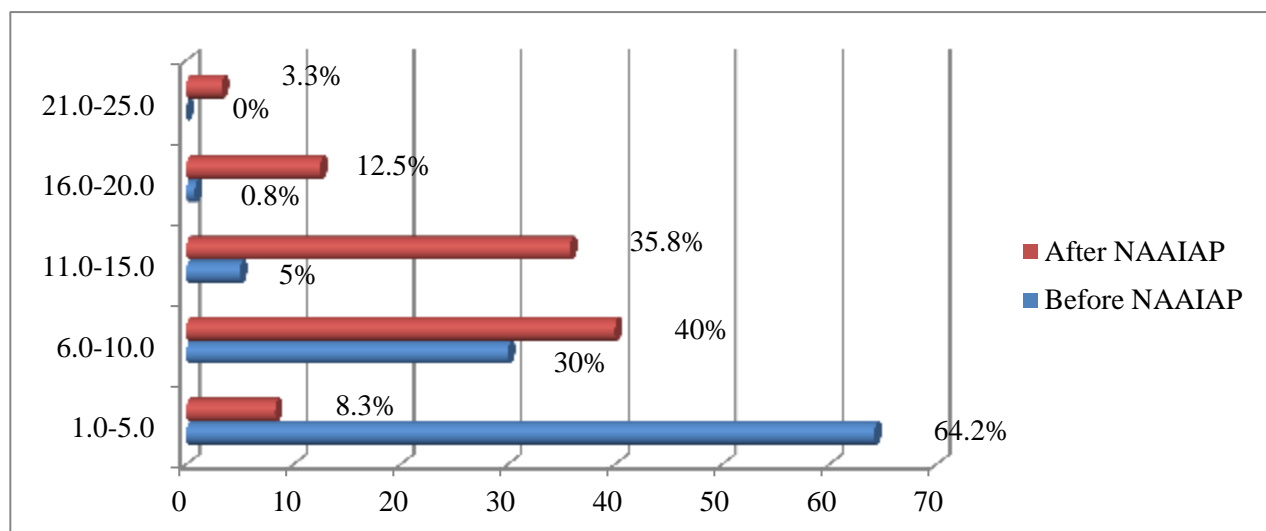
This section sought to investigate the status of adoption level of fertilizer and certified maize seed among small scale maize farmers in Matungu Sub-county before free farm inputs programme. This was done by collecting data on respondents who had used certified seeds and fertilizers before the NAAIAP programme kicked off. The results were as shown below. 90.8 percent of the respondents had already used the inputs before on set of the programme.



**Use of fertilizer and certified seed before free input supply:-**

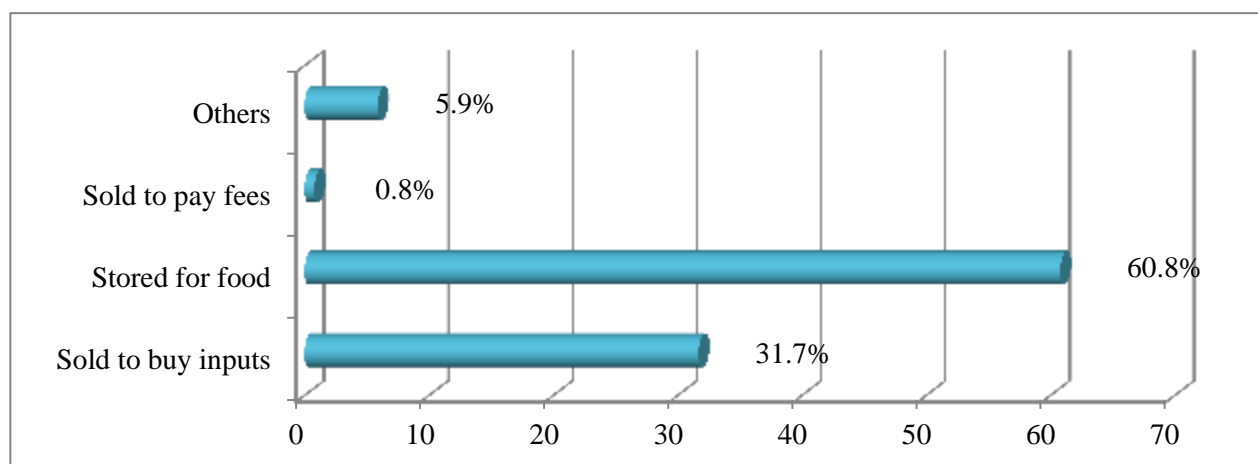
### Effect of Free Farm inputs on Agricultural Technology Adoption:-

This section sought to investigate the effect of free inputs on agriculture technology adoption among small scale maize farmers in Matungu Division. Since the free farm inputs provided by NAAIAP programme were a constant factor, change in the yield obtained upon use of the free inputs was used as the indicator for agricultural technology adoption. This was done by comparing the yields obtained before and after the programme. Respondents were requested to give the yield of maize they obtained in 90kg bags per acre (0.04 ha) before and during NAAIAP programme. Before the programme the yield ranged between one and twenty 90kg bags per acre and the mean yield was 4.9 bags. After the programme set in, the minimum bags yield per acre rose to four and the maximum to 25 as the mean yield shot to 11.6 bags per acre. The NAAIAP programme was accompanied by training of farmers on the proper use of the inputs and this could explain the difference in means as well as maximum production before and during the programme. The results are shown in figure below:



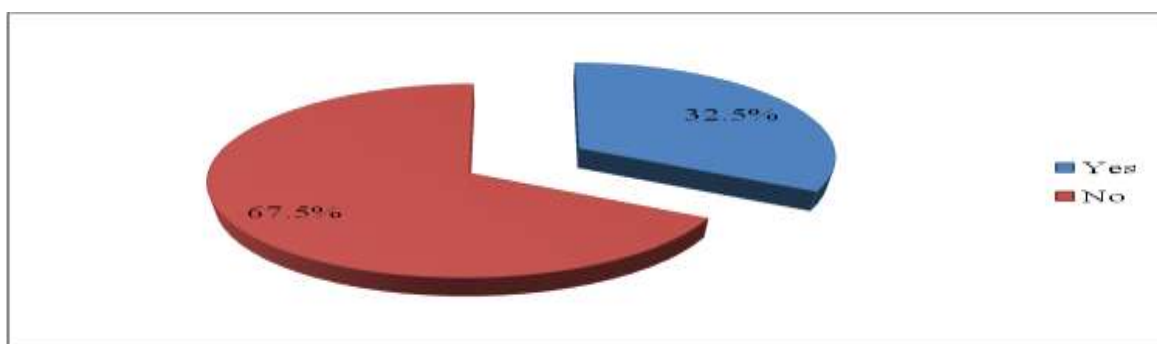
#### Maize yield in bags per acre before and during NAAIAP:-

With the increased maize production after inception of the NAAIAP programme, respondents were asked to indicate how they utilized the excess yield. Their responses are as indicated below:



#### Ways of handling the surplus yield:-

Depending on how surplus yield was treated, it was of major concern as an outcome indicator to the free inputs programme. Only 32.5 percent of the respondents continued using the inputs as expected after exit of the NAAIAP programme. This is the percentage of the respondents who fully adopted the technology. The 32.5 percent were able to sustain the adoption by selling the surplus yield to buy the inputs as shown below.



Respondents who fully adopted the technology after NAAIAP exit

### Test of the Hypothesis:-

Hypothesis stated that “Free farm inputs supply has no statistically significant effect on agricultural technology adoption among small scale maize farmers in Matungu Sub-county”. A t-test was used to establish whether there existed a statistically significant effect by comparing the mean yield levels before and after inception of the NAAIAP programme. The results were as shown in the table.

**The t-test Results showing the effect of Free Farm Inputs on Agricultural Technology Adoption**

The t-test Results showing the effect of Free Farm Inputs on Agricultural Technology Adoption									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
	Yield level before NAAIAP	-	3.13398	.28609	-	-	-	119	.000
	Yield with NAAIAP	6.65000		.42802	7.21649	6.08351	23.244		

Yield levels before NAAIAP were lower and statistically lower from the yields obtained during NAAIAP programme. Thus free farm inputs supply has statistically significant effect on agricultural technology adoption among small scale maize farmers in Matungu Sub-county.

### Conclusions And Recommendations:-

Free farm inputs supply has a significant effect on agricultural technology adoption. The results revealed that the mean yield level increased from 12 to 29 - 90kg-bags per hectare. As a consequence of the significant effect, 60.8 percent of the respondents stored surplus yield for food while 32 percent sold the surplus yield to buy farm inputs and thereby sustainably continued using fertilizer and certified seed as envisaged by NAAIAP. From the findings, it is observed that food security was a priority (60.8%) as compared to those who invested in technology (31.7%) to buy inputs.

It was also revealed that household food security is a prerequisite to the consideration of apportioning a percentage of maize yields by small-scale farmers for sale to purchase inputs for sustainable use on the farms. Hence the need for stakeholder inventory and formation of participatory partnerships that should support small scale maize farmers with free or subsidized farm inputs to enable them improve on the yield obtained and shift from subsistence to commercial maize production.

Consequently, there is need to form Maize Value Chain Platform that is all inclusive bringing all stakeholders such as researchers, extension service providers, farm input merchants and maize farmers. This will facilitate networking, resource flow and mobilization. The ultimate objective will be to enable small scale maize farmers make informed decisions as well as be able to solve some of the challenges faced during maize production cycle.

### References:-

1. Agriculture and Rural Development (ARD). (2012). *Implementing Agriculture for Development – Action Plan 2010 -2012*. Retrieved on 28/8/2012 from [http://siteresources.worldbank.org/INTARD/Resources/Agriculture\\_Action\\_Plan\\_web.pdf](http://siteresources.worldbank.org/INTARD/Resources/Agriculture_Action_Plan_web.pdf)
2. Ani, A. O. (2004). Assessment of farmers Extension Education needs in Yobe State.
3. Nigerian Journal of Agricultural Education, 1: 152-8.
4. Annon., (2005). *Adoption of Technologies for Sustainable Livelihood*. Sokoine University of Agriculture, Morogoro, Tanzania.
5. Ariga, J, Jayne, T.S, & Nyoro, J. (2005). *Agricultural Inputs and Services: Impacts on Agricultural Productivity, Competitiveness & Food Security*. Tegemeo Institute of Agricultural Policy & Development, Egerton University, Njoro.
6. *Agriculture Sector Development Programme-ASDPS, Ministry of Agriculture*. Government Printers, Nairobi Kenya.
7. Borg, W.R. & Gall, M.E. (1983). *Educational Research: An introduction*. New York, NY: Longman Inc, pp. 257- 265.
8. Bradfield, D.J (1971). *Guide to Extension*. FAO: Rome.

8. Chand, J, Ramesh, K & Kumar, P. (2004).Determinants of Capital Formation and Agriculture Growth.Economic & Political Weekly 39(52) 25 December2004, 5611. <https://www.verywell.com>. Retrieved on 14/09/2016
9. Chambers, R. (2013). Rural development, Putting the last first.
10. Published by Routledge Park Square, Milton Park, Abingdon, Oxon OX14 4RN 711 Third Avenue, New York, NY10017, USA.
11. Crawford E, Kelly V, T.S. Jayne & Howard J, (2003) *Input use and Market Development in Sub- Saharan Africa: An Overview of Food Policy* 28. FAO Publication, Rome.
12. Crawford E, Valeria A.K & T.S. Jayne, (2003).*Evaluating Measures to Improve Agriculture Input Use*.Staff Paper 01-55. Department of Agriculture Economics, Michigan State University.
13. Cromwell, Elizabeth, Kambewa P, Mwanza R &Chirwa R, (2001).*Impact Assessment Using Participatory Approaches: 'The Starter Pack' and Sustainable Agriculture in Malawi*. Network Paper 112. London: ODI
14. Dorward, A. &Kydd, J. (2004). "The Malawi 2002 Food Crisis: The Rural Development Challenge." *Journal of Modern Africa Studies* 42(3): 343-3
15. Ekanayake, H. K. J. (2006). The Impact of fertilizer Subsidy on Paddy Cultivation in Sri Lanka.Staff Studies 36(1&2)73.Pdf retrieved on 14/09/2016
16. Emukule, J. (2011) District Agricultural Office, Annual Report, (2011). Office Publication
17. Unpublished.
18. Ezeano, C.I. (2010). Constraints to Sweet Potato Production, Marketing and Utilization among
19. Small-Scale Farmers in South-Eastern Nigeria. *Agronomical Nigeriana*. Vol. 9, No.
20. 1&2; 280-282.
21. FAO, (1999).*Fertilizer Strategies*.Food & Agriculture Organization of United Nations, Rome.
22. FAO, (2004).*Increasing Fertilize Use and Farmer Access in SSA Literature Review*. Tropical Soil Biology & Fertility Institute of International Center for Tropical Agriculture, Nairobi Kenya.
23. Farrington, J. & Martin, A. (1988).*Farmer Participation in Agricultural Research*.A Review of
24. concepts and practices. London: ODI.
25. Fraenkel, J. &Wallen, N. (2000).*How to Design and Evaluate Research in Education*. New York. McGraw Hill Higher Education(4<sup>th</sup> ed.).
26. GOK, (2008). Ministry of Agriculture Strategic Plan, 2008-2012. Kilimo House, Nairobi.
27. GOK, (2009).Economic Review of Agriculture 2009.Ministry of Agriculture, Nairobi.Dorward, A. &Kydd, J. (2004). "The Malawi 2002 Food Crisis: The Rural Development Challenge." *Journal of Modern Africa Studies* 42(3): 343-361
28. Heinrich, G.M (1993). *Strengthening Farmer Participation Through Groups: Experiences and Lessons from Botswana*. OFCOR Discussion Paper No.3 : ISNAR.
29. Havenga, C (1974). The Importance of Opinion Leaders in Agricultural Education Mount Edge Combe, South Africa.
30. IFPRI Lilongwe 3 Malawi, (2012).*International Food Policy Research Institute*
31. 2033 K st. NW, Washington, DC 20006 – 1002, USA.
32. *International Journal of Agriculture and Biology* 1560-8530 / 2004/06-5-802-805
33. <http://www.ijab.org> Retrieved on 01/02/2016.
34. John, H. (2011). *Cross-Sectional Research Design*. Retrieved on 25/4/2012 from [http://www.collegeboard.com/prod\\_downloads/yes/4297\\_MODULE\\_05.pdf](http://www.collegeboard.com/prod_downloads/yes/4297_MODULE_05.pdf)
35. Kendra, C. (2016). The Incentive Theory of Motivation. <https://www.verywell.com>. 2795382. Retrieved on 15/09/2016.
36. Kenya Agricultural Productivity & Agribusiness Project, (2011). Government Printers, Nairobi Kenya
37. Kerlinger, F.N. (1973). *Foundation of Behavioural Research*, Published by John Wiley, New York.
38. Kherellah, Mylene, Delgado C, Eleni, G.M, Minot N & Johnson, M. (2002).*Reforming Agriculture Markets in Africa*.Baltimore, MD:IFRI / John Hopkins University Press.
39. Kikuchi, S. Masao, H. &Aluwihare, P. B. (1990). Fertilizer Response Functions in Sri Lanka: Estimation of some Application In Colombo, Sri Lanka: International Irrigation Management Institute.
40. Kingori, A., Wachira, A. and Tuitoek, J. (2010).Indigenous Chicken Production in Kenya.
41. *International Journal of Poultry Science* 6 (4) : 309-316, 2010. Retrieved on 28/08/2011 from <http://www.pjbs.org/ijps/fin1669.pdf>
42. Kombo, D. & Tromp, D. (2008).*Proposal and Thesis Writing: An Introduction*, P. 168. Nairobi: Pauline's Publications Africa.



43. Kothari, C. (2008). *Research Methodology: Methods and Techniques*, (pp. 1-56). New Delhi: New Age International (P) Limited, Publishers.
44. Ladele, A.A. (1998). Strategies to Integrate Youth In Agricultural Development in Nigeria. *Niger Agric. Rural Manage.* 4.3; 70-76.
45. Levy S, Sarah, Barahona C. (2001). *Main Report of Monitoring & Evaluation*. Submitted to
46. Ministry of Agriculture, Malawi.
47. Levy S, & Barahona C. (2002). *Findings of Starter Pack & TIP: Implications for Policy and Beyond*. Department of International Development, UK.
48. Levy, Sarah, Barahona & Chisinga, B. (2004). *Food Security, Social Protection Growth and Poverty Reduction Synergies*. The Starter Pack Program, Lilongwe, Malawi.
49. Mandalios, Z. (2014). The Importance of Agricultural Extension Officers. Global Head Hunters International.
50. Ministry of Agriculture (2009). *Economic Review of Agriculture*. Government Printers, Nairobi.
51. McDermott, J. (1987). *Making Extension Effective: The Role of Extension/Research Linkage*, University of Florida.
52. Mugenda, O.M & Mugenda, A.G. (1999). *Research Methods: Qualitative Approach*. Nairobi, Kenya
53. Mumias Sugar Company, Annual Report. (2012). Company Press, Nairobi Kenya.
54. Muyanga, M. & Jayne, T.S. (2006). *Agricultural Extension in Kenya: Practice and Policy Lessons*. Tegemeo Working Paper No. 26/2006. Tegemeo Institute of Agricultural Policy & Development, Egerton University, Kenya.
55. Norman, D, Baker, D, Heinrich, G, Jonas, C, Maskira, S. and Workman, F. (1989). *Farmer Groups for Technology Development*. Intermediate Technology Publications, London.
56. Nassiuma, D. K. (2000). *Survey Sampling: Theory and Methods*. Nairobi: Nairobi University Press, pp. 59-61
57. OECD Glossary, (2003). *Glossary of Environmental Status*. Studies in methods, Series F No. 67. United Nations, NY
58. Oygard, R, Garcia R, Guttormsen A, Khachule R, Mwanaumo A, Mwanawina I, Sjaastad E & Wik M. (2003). *The Maze of Maize: Improving Input/Output Market Access for Poor Smallholders in South Africa*. Regional experience of Zambia & Malawi. Report No. 26, Agriculture University of Norway.
59. Pickering, D.C. (1983). *Agricultural Extension: A tool for Rural Development*. The World Bank, Washington, DC.
60. Pontius, J, Dilts, R. & Bartlett, A, (2002). *Ten Years of IPM Training in Asia*. FAO Community IPM Programme, Bangkok.
61. Reijntjes C, Haverkort B, & Bayer A. (1995). *Farming for the Future: An Introduction to Low-External & Sustainable Agriculture*. Lensden, Netherlands. McMillan ILEA.
62. Prokopenko, J. (1987). *Productivity Management*. A Practical Handbook, Geneva.
63. Rogers, M.E, (1962). *Diffusion of Innovation*. NY Free Press.
64. Rogers, M.E, & Shoemaker, F.F, (1971). *Communication of Innovations*. A Cross-cultural Approach. NY Free Press.
65. Smith, L. E. D. & Urey, I. (2002). Agricultural Growth and Poverty Reduction: A Review of Lessons From the Post Independence and Green Revolution Experience in India.
66. Tibbotuwawa, M. (2010). Better Targeting of transfers: The Fertilizer Subsidy Talking Economics Blog. <http://ipslk.blogspot.com/2010/08>. Retrieved on 14/09/2016
67. Trochim, W. (2006). *Research methods knowledge base, website center for social research methods*. Retrieved on 27/04/2012 from
68. <http://www.socialresearchmethods.net/kb/timedim.php>
69. Wanzala M, Jayne T, Staatz J, (2002). *Fertilizer Markets and Agricultural Production Incentives: Inside from Kenya*, Working Paper No. 4, Tegemeo Institute, Egerton University. Nairobi, Kenya.
70. Welsch, D.E. (1965). Response of Economic Incentives by Abakaliki farmers in Nigeria. *Journal of Farm Economics*, Vol.47, No. 4.
71. William, S.K.T. & Williams, C.E. (1971). Farmers Contact with Agricultural Extension Services in Western States of Nigeria. *Bulletin of Rural Economics and Sociology* Vol.6, No. 1.
72. World Bank, (2014). *Reaching the Rural Poor, Renewed Strategy for Rural Development*. Washington DC, USA.