FACTORS THAT AFFECT THE ADOPTION OF IMPROVED RICE VARIETIES IN EWEKORO LOCAL GOVERNMENT OF OGUN STATE, NIGERIA.

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ABSTRACT
This study aimed at shedding light on the potential factors that influence the adoption of improved rice varieties in Ewekoro Local Government of Ogun State, Nigeria. One hundred and twenty questionnaires were administered among eight villages selected in the Local Government. Data collected were statistically analyzed using inferential statistics such as regression analysis. The result showed that large percentages of respondents' were males(81.0%). While most of the farmers were within economically active ages of 50 and 59 years which accounted for (50.5%). The result shows that (76.1%) respondents were married. The result revealed that the respondents were not planting the former variety (NERICA) again due to its marketability, while other variety (ITA 150) known as OFADA was adopted because of its marketability and acceptability. The study further reveals that the category of adopter (late adopters) constituted high percentage (78.9%) in adopting new innovations. It can also be observed from the result that some constraints facing farmers in rice production are high cost of labour, inadequate credit, pests and diseases, poor transportation and poor extension services. It is therefore recommended that agricultural technology and other inputs for effective processing after harvesting (modern technology) should be subsidized in order to enhance effective rice production in the study area. Police on total ban on importation of foreign rice should be encouraged in order to encourage farmers to invest more in local production for future sustainability.
Key words: Adoption, Variety, Factors, Improved

INTRODUCTION
Agricultural innovation system evolved directly from the concept of national innovation system with the sectorial level as the unit of analysis. Adapting the various definitions of innovation system, agricultural innovation system is defined as a set of agents that jointly and or individually contribute to the development, diffusion and use of agriculture-related new technologies and that directly and or indirectly influence the process of technological change in agriculture (Tugrul and Ajit, 2002). It is important to note that investment in knowledge especially in the form of science and technology has featured prominently and consistently in most strategies to promote agricultural development at the national level. The agriculture innovation system (AIS) comprises a far broader set of actors than the traditional agricultural research, extension and education agencies. Innovation takes place throughout the whole economy and this new perspective places more emphasis on the role of farmers, input suppliers, transporters, processors and markets in the innovation process. (Speilman, 2005).

Farmers have been seen as major constraint in development process, Adoption viewed as a mental process which an individual passes through in deciding to use an innovation. (Cruz 1987). Therefore, it is important to know how farmers perceive improved practices for better understanding of their choice in decision of adoption or not, improved practices are one of resources for agricultural production. According to Ingold (2002) transfer of technology as that which embraces all efforts to make sure that the farmers adopt new technology, for transfer of technology to occur, it must embrace inputs, support, advice and other essentials so that the farmer would have no reason to reject the technology.

In developing countries a large number of resources have been devoted to extension service in order to educate farmers on new agricultural innovations. Specifically in Nigeria, such initiatives have been undertaken through the Agricultural extension project (ADP) and Sasakawa Global 2000 (SG 2000) (Dugje et al., 2008; Donye et al., 2013). The efficiency of these programmes depends on the factors that influence technology adoption. Therefore extension workers and assistants have to know factors affecting technology adoption in order to target and deliver effective programmes. (Mosher 1987, cited by Cruz, 1978) defined that adoption of an innovation is the process by which a particular farmer is exposed to considers, and finally rejects or practices a particular innovation. The innovation by Rogers (1983) shows the process through which an individual (or other decision making unit) passes from first knowledge of an innovation to innovation to forming an attitude towards the innovation, to a decision to adopt or reject to implement of the new idea and to confirmation of this decision.

Many studies on rice technology adoption have been conducted in developing nations including Nigeria (Awotide et al., 2010; Donstop-Nguezet et al., 2011; Mustapha et al., 2012;Kijima and Serunkuuma 2013). However because of variability in natural resources, culture, political system, traditional beliefs and socio-economic factors, the factors affecting technology adoption differs across the locations. For instance, in Nigeria a rice seed is one of the important improved varieties that need adoption in order to improve domestic rice production so as to reduce importation.

Rice is the staple food in many countries of Africa and constitutes a major part of their diet. The challenges faced by countries as regard rice production, however differs from one country to the other in terms of population. The preference attached to the commodity in the list of many household menu calls for expanding production and the productivity of the rice farms. Therefore increase in acreage under high yielding varieties, develop hybrid rice, water nutrient management technologies and accelerate technology transfer are the factors in no doubt that go a long way in defining the potential of a country for expanding rice production.To obtain improvement in rice production the farmers' needs to adopt improved farming techniques, if farmers adopt and apply the improved techniques there would be increase in productivity and improved their standard of living. The Objectives of the study are; to determine the factors that affect the adoption of improved rice varieties, identify the socio-economic characteristics of rice farmers in the study area, ascertain the type of variety planting in the study area, determine the stage of adoption of improved rice varieties among the farmers and ascertain the constraints affecting adoption of improved rice varieties.

METHODOLOGY
The study area is Ewekoro local government area of Ogun State, Nigeria, with headquarters in Itori town, at $6^0 56^i 00^" N$ and $3^0 13^i 00^" E$. The local government area shares boundaries with Yewa South in the west, Ifo local government in the South, Abeokuta North and Obafemiowode in the North and East respectively. The study area experiences two seasons (wet and dry) which allows the practices of both dry season and rainfed cropping. Ewekoro local government area of Ogun State occupies a total land mass of five hundred and ninety four (594 sq.km). Square kilometers and the population is fifty five thousand, one hundred and fifty six (55,156) people (NPC 2006).The major occupation of the people in the area is farming, while alongside other vocational jobs are being practiced. Ewekoro local government area of Ogun State reflects a geographical representation of the state where traditional agriculture is predominant as a primary occupation, especially on rice production.

Map of Ewekoro Local Government Ogun State
The population of the study was the people of Ewekoro Local Government Area of Ogun State. The target populations of the study are the rice farmers in Ewekoro Local Government Areas of Ogun State. Multistage sampling technique which also features randomness was used for this study.Out of 10 wards in Ewekoro local government, 4 wards were randomly selected with 2 villages in each ward with the same process. 33 questionnaires were allocated to ward 4, 25 questionnaires to ward 7, 32 questionnaires to ward 9, while 30 questionnaires were distributed to ward 10. One hundred and twenty (120) copies of questionnaires were administered but 71 copies were retrieved in all.Descriptive statistics such as percentage and frequency distribution was used to analysis the data, while regression analysis was done on the hypothesis.

Formula for Regression Analysis

$$Y = B1 + B2 X1 + B3 X2 + B4 X3 + B5 X4 + B6 X5 + U$$

Y= Adoption
X1 = Marital status
X2 = Age
X3 = Education
X4 = Household size
X5 = Farm size
U = Error term

RESULT AND DISCUSSION
Table 1:Socio-economic characteristics of the respondents

Variable	Frequency	Percentage
Gender		
Male	59	83.1
Female	12	16.9
Total	71	100.0
Marital status		
Married	54	76.1
Divorced	3	4.2
Widow	6	8.5
Separated	8	11.3
Total	71	100.0
Age		
39-49	20	28.1

50-59	36	50.4
60-69	13	18.7
70-79	2	2.8
Total	71	100.0
Education		
Primary education	50	70.4
Secondary education	7	9.9
Non-formal education	14	19.7
Total	71	100.0
Tribe		
Yoruba	68	95.8
Igbo	3	4.2
Total	71	100.0
Religion		
Christian	44	62.0
Islam	23	32.4
Traditional	4	5.6
Total	71	100.0
Household size		
1-5	20	28.2
6-10	45	63.4
Above 10	6	8.5
Total	71	100.0
Farm size		
0.5-1.0 acre	6	8.5
2-3 acres	31	43.7
4-5 acres	23	32.4
6 acres and above	11	15.5
Total	71	100.0
Years of experience		
1-5 years	6	8.5
6-10years	10	14.1
Above 10 years	55	77.5
Total	71	100.0
Method of cultivation		
Mechanical	3	4.2
Manual	68	95.8
Total	71	100.0

Source: Computed from Research's Survey, 2016

Result in table 1 showed that (83.1%) of the respondents were male while 16.9% were female. These reveals that rice farmers are dominated by male in the study area. The result also showed those men who were relatively stronger were involve in rice production. This may be due to the drudgery. The study also shows that, majority of rice farmers were married with result of (76%), for both widows/widowers haven 8.5% while divorced and separated had (15.5%). This higher marital status might imply large family sizes which could translate to higher use of family labour.More also, the result indicated that farmers within the age 39-49 years accounted for 28.1% while age between 50-59 years, were (50.4%), 18.7% of the farmers were between 60-60 years while 70-79 years of age were (2.8%). It shows that most of the farmers were not too old or too young.Further result showed that (70.4%) attended primary education, secondary education level accounted for 9.9%, while 19.7% were non-formal education. The education level of the study area is very low and this can be one of the factors that constitute to the factors that affect the adoption of improved rice varieties, according to (Perin and Winkelman 1976) that ignorance, resistance to change and inadequate support system can leads to factor militating adoption of improved rice seed.

In terms of tribe, Yoruba is majorly dominated the study area by (95.8%) while Igbo were just (4.2%) and no Hausa practicing rice farming in the study area. The study reveals that majority of the rice farmers were Christians by (62%) while Muslims were (32.4%), Traditional religion are not much in rice production due to the civilization and modern religions that people believed in.

Equally, the result shows the household size of the respondent range from 1-5 accounted for (28.2%), while (63.3%) of the respondents were between 6-10, and10 above were (8.5%). it shows that range of 6-10 are more and this might implies large family size which could be translated to higher use of family labour. This finding supported the observation of Just and Zilberman (1985), that when the number of the non-working adult is greater than the working adult, technology adoption is affected. Furthermore, it was discovered (8.5%) of the farmers were having the farm size of 0.5-1.0 acre, while 2-3 acres is (43.6%), and (32.4%) falls into the category of 4-5 acres. The result agrees with the finding of Manfield (1968) who reported that the total farmland contributes to

technologies adoption. In terms of farming experience, (8.5%) of the farmers had experience range 1-5years, followed by (14%) of the respondent with the range of 6-10years while (77.5%) were above 10years of farming experience of rice production. The farming experience usually increase production and influence managerial abilities and could improve the ability of the farmer to obtain maximum profit.

The method of cultivation is largely based on manual, according to the result, it shows that (95.8%) were cultivating manually while (4.2%) are into mechanize farming. this indicate that most of our farmers are cultivating manually which could leads to low production

Table 2: Types of variety (ies) planting in the study area

Variable	Frequency	Percentage
TYPE OF VARIETY		
Ofada (ITA 150)	71	100.0
Nerica		
No	6	8.5
Yes	65	91.5
Total	71	100.0
Abakaliki		
No	65	91.5
Yes	6	8.5
Total	71	100.0
Now		
Ofada (ITA 150)		
Yes	71	100.0
Nerica		
No	71	100.0
Abakaliki		
No	71	100.0
Why not planting		
High cost of the seed		
No	69	97.2
Yes	2	2.8
Total	71	100.0
Marketability		
No	2	2.8
Yes	69	97.2
Total	71	100.0
Inadequate information		
No	71	100.0
Diseases		
No	71	100.0
For how long have you been planting the new variety?		
1-5 years	8	11.3
6-10 years	2	2.8
10-15 years	61	85.9
Total	71	100.0
Why do you prefer the variety?		
Early maturity		
No	64	90.1
Yes	7	9.9
Total	71	100.0

Marketability		
No	6	8.5
Yes	64	90.1
3.00	1	1.4
Total	71	100.0
Disease		
No	70	96.6
Yes	1	1.4
Total	71	100.0
What is the maturity period?		
1-6 months	66	93.0
7-13 months	4	5.6
Above 13months	1	1.4
Total	71	100,0
Major pest		
Termite		
No	8	11.3
Yes	63	88.7
Total	71	100.0
Bird		
No	2	2.8
Yes	69	97.2
Total	71	100.0

Source: Computed from Research's Survey, 2016

From the table above, it was revealed that (91.5%) of the respondent were planting Nerica (New Rice for Africa) before, while (8.5%) were planting Abakaliki, this implies that the farmers were only exposed to two varieties. But the introduction of new variety known as Ofada(ITA 150) had made them divert attention from these old varieties to new varieties.

The result shows that all the respondents in the study area are planting Ofada(ITA 150) which accounted for (100%), while (97%) disagreed that it is because of high cost of seed. (97.2%) strongly agreed that it was due to the marketability of the previous varieties that makes them not to be planting them; i.e people are not buying it due to the taste and stress undergone when processing. This shows that the respondents are no more planting nerica again because there is no market for it. The result also shows that inadequate information, diseases and high cost of the seed are not the reason why they are not planting the previous varieties again, but due to the marketability. Furthermore, it was revealed that (11.3%) of the respondent were planting the new varieties between the range of 1-5 years, while

respondents planting the new variety within the years 6-10 falls between the range of (2.8%) while (85.9%) had been planting the new varieties between the range of 10 years and above. From the table above, it was revealed that farmers are planting the new varieties because of early maturity and disease resistance, while (90.1%) agreed that it was due to marketability of the new variety that makes them to prefer the new variety. This means that the major factor that influenced them to prefer Ofada(ITA 150) is due to the marketability because if the variety is not selling, there will be low income according to Obinne (1994) and Arokoyo (1996) who identified low income level of farmers and high cost of inputs as a constraint to technology adoption especially among low income farmers.

The table shows that (66%) of the respondent agreed that the maturity of the variety planting in the study area is between 1-6 months, and (5.6%) of the respondent agreed 7-13 months, which means that the maturity period is falls between 1-6 months. It was also reveals that the major pest affecting the variety is termite and birds

Table 3: determinant of stages of adoption of improved rice variety

Factors	Early Adopters	Late adopters	Non Adopter
Adequate information	14(19.7)	56(78.9)	1(1.4)
Interaction to extension agent	17(23.9)	37(52.1)	17(23.9)
Level of education	10(14.1)	45(63.4)	16(22.5)
Source of seed	13(18.3)	51(71.3)	7(9.9)
Improved variety of crop	15(21.1)	43(60.6)	13(18.3)
Fertilizer application to the variety	10(14.1)	50(70.4)	11(15.5)
Pesticide and insecticide application	12(16.9)	46(64.8)	13(18.3)
Credit facilities	8(11.3)	53(74.6)	10(14.1)
Access to information	12(16.9)	43(60.6)	16(22.5)
Adequate fund	4(5.6)	43(60.6)	24(33.8)

Source: Computed from Research's Survey, 2016

The table shows how factors were used to determine the adoption of improved rice variety. 78.9% of the famers are late adopters because they have access to adequate information and it agrees with the findings of (Caswell et al., 2001) information enables farmers to learn the existence as well as the effective use of technology and this facilitates its adoption.

The result reveals 23.9% are non-adopter because they have no access to interact with extension agents, while 52.1% of the late adopters interact with extension agent, this is in accordance with (Genius et al., 2010) which described interaction to extension agent usually informed about the existence as well as the effective use benefit of new technology through extension agents.

Table shows that 22.5% were non-adopter due to their lack of education, while 14.1% are early adopters because they of their level of education about 63.4% are late adopters and this agrees with Rogers Feder et al., 1985: Koppel 1994; Foster &Rosenzweig 1996; Singh 1997; Rogers, 2003 and Uaiene 2009) that late adopters carries more percentage because late adopters approach an innovation with a high degree of skepticism.

Furthermore, 60.6% falls under the category of late adopters in improved variety of crop while 21.1% are early adopters and 18.3% are non-adopter. Credit facilities has been reported to stimulate technology adoption (Mohamed &Temu, 2008), this agrees with the result, late adopters constitute 74.6%, while 14.1% are non-adopter because they has no access to credit facilitates.

The result shows that 60.6% constitute late adopter because they have access to adequate fund, while 33.8% of the respondents are non-adopter because they have no access to adequate fund

Table 4: Constraints affecting Adoption of improved rice variety

Constrai	SA	A	U	D	SD
High cost of labour	20(28.2)	49(69.0) -		-	2(2.8)
High cost of improved seeds	15(21.1)	8(11.3)	7(9.9)	-	41(57.7)
High cost of fertilizer	15(21.1)	25(35.2)	14(19.7)	-	17(23.9)
Problem of pest and diseases	9(12.7)	58(81.7)	1(1.4)	3(4.2)	-
Lack of storage facilities	16(22.5)	49(69.0)	3(4.2)	2(2.8)	1(1.4)
Marketing	26(36.6)	29(40.8)	7(9.9)	9(12.7)	-
Poor transportation	9(12.7)	46(64.8)	11(15.5)	5(7.0)	-
Low yielding	4(5.6)	10(14.1)	7(9.9)	49(69.0)	1(1.4)
Lack of technical know-how	12(16.9)	23(32.4)	20(28.2)	15(21.1)	1(1.4)
Lack of access to tools	11(15.5)	28(39.4)	24(33.8)	8(11.3)	-
Unavailability of improved seeds	3(4.2)	26(36.6)	11(15.5)	29(40.8)	2(2.8)
Poor extension services delivery	9(12.7)	44(62.0)	8(11.3)	8(11.3)	2(2.8)
Insufficient land for cultivation	-	12(16.9)	15(21.1)	8(11.3)	36(50.7)
Lack of processing facilities	11(15.5)	36(50.7)	10(14.1)	13(18.3)	1(1.4)
Lack of awareness of technologies	11(15.5)	10(14.1)	43(60.6)	4(5.6)	3(4.2)
Early maturity varieties	1(1.4)	15(21.1)	14(19.7)	37(52.1)	4(5.6)
Diseases resistance varieties	7(9.9)	13(18.3)	17(23.9)	32(45.1)	2(2.8)
Access to agricultural credit	22(31.0)	38(53.5)	6(8.5)	4(5.6)	1(1.4)

Source: Computed from Research's Survey,2016

Result shows that high cost of labour is part of the problems facing adoption of improved rice variety (28%) of the respondent strongly agreed while (69%) agreed; this shows that high cost of labour is affecting the adoption. This is in agreement with Ouma et al., (2000) reported that costs of hired labour is among other factors constraining adoption.

High cost of improved seed is not a major factor according to the table above because (41%) disagree that high cost of improved seed is not a problem while high cost of fertilizer is affecting the adoption, over (56%) of the respondents agreed. Pest and diseases is also part of the factor affecting the adoption, especially pest (Birds and Termite), this really affect the outcome of the production.

From the table, it was revealed that lack of storage is also ranked among the affecting adoption of improved rice varieties with the percentage of (91%) and this is in accordance with Abu et al., 2011) reported that small farm could be a factor which prevents farmers from adopting innovation because of the inappropriateness of modern technologies to the economic realities of small scale farmers. Follow by marketing, is one of the major factor affecting the adoption because people are not buying it due to the taste. Poor transportation reduces adoption because most of the rural roads are not in good condition, and

it's very difficult for farmers to transport product from rural to urban area.

More also, the result shows that low yielding is among the factor militating adoption, lack of technical know-how is partially agreed with (32.4%) while some respondent strongly agree with (16 .9%), this shows that lack of technical know-how is part of factor affecting adoption of improved rice. Farmers have no access to technological tools due to high cost of the tools. Land is not a problem for the farmers to cultivate improved rive. Early maturity is not a factor because it was reveals that rice is four months before harvesting.

Lastly, one of the major problem is problem of acquire agricultural credit, (60%) of the respondents agreed it is very difficult for the farmers to get money from the government and if there is no money adoption will be difficult, this agrees with (Mohamed &Temu, 2008) the result Credit facilities has been reported to stimulate technology adoption.

Table 5 Regression Analysis for constraints affecting the adoption of improved rice varieties

Model	Beta	Standard error	t-value	Sig
Gender	-751	.692	-1.086	.282NS
Marital status	-021	.261	-079	.937NS
Age	-082	.040	-2.041	.046*
Education	.376	.285	1.321	.191NS
Household size	-.519	.441	-1.178	.243NS
Farm size	-.118	.287	-.412	.681NS

Source: Computed from Research's Survey, 2016
$R^2 = 0.62\%$
F = (statistic) – 19.31
Prob. (F-stat) – 0.05
*Significant at 5% level of probability
NS – Not significant at 5% level of probability

From the table above, it is shown that Age is significant to the adoption of new rice variety in the study area; While, Household size, Gender, Educational level and farm size are not significant to the adoption of the new rice variety in the study area. Adjusted R^2 of $R^2 = 0.62$ implies that there is a good fit for regression equation.

CONCLUSION
The study revealed that majority of respondents was able to adopt the new varieties of rice production technologies in the study area due to the marketability of the new varieties. The respondents level of adoption could be constraint by lack of credit facilities as attested to by majority of the respondents.

RECOMMENDATION
Government should fund research adequately and partner with private organizations to come up with high yield improved rice variety for increase production.Government should subsidize agricultural technology and other inputs for easy

accessibility.Government should help to provide the necessary equipment needed for effective processing of after harvesting (modern technology).

REFERENCE
Abu, I.A, Pur, J.T and Ogunbameru B.O (2011) Analysis of socio economic factors influencing the adoption of rice technologies by farmers in Borno State. Nigeria

Ahn S,-W., Bonman, J.M,. Brandon, D.M., Groth, D.E., Gunell, P.s Hibino, H., Hollier, C.A., Lee, F.N., Mew, T.W., Prot, J.C., Rush, M.C., Schneider, R.W., Wedster, R.K., Whitney, G. (1992). Compendium of Rice Diseases, Webster, R.K., Gunnell, P.S. (eds). APS Press

Arokoyo T. (1996). Agricultural technology Development and Dissemination.A case study of Ghana and Nigeria G.A. The Netherlands P. 15

Awotide, B. A., Diagne A. Awoyemi, T. T., and Ojehomon, V. T. (2010).Farm level

constraint and adoption of improved rice varieties in Nigeria.Journal of Agricultural and environmental studies, 1 (2), 12-29.

Cruz FA. (1978). Adoption and diffusion of agricultural extensions, In An introduction to extension delivery systems by JB Valera, VA Martinez, and RF Plopino eds.) 1987. Island Publishing House, Manila, P. 97-127.

Dontop-Nguezet, P. M., Diagne, A,.Okuruwa, V. O., and Ojehomon V. (2011). Impact of improved rice technology on income and poverty among rice farming household in Nigeria: A local Average treatment effect (LATE) approach. Contributed paper prepared for the 25th conference of the centre for the studies of African economies (CASAE) 20-22nd March, 2011. St Catherine College, University of Oxford, UK.

Donye, A. O., Ja'afar-Furo, M. R. and Obinne, C. P. O. (2013). Improving smallholder farming and extension in Nigeria: the Sasakawa Africa fund for extension education strategy. Agriculture and Biology Journal of North America, 4 (2), 97-102.

Dugje, I.Y,.Oniyibe, J.F., Ekeleme, A. Y., Tegbaru, A., Omoigu, L. O. and Bassi, S. A. (2008). Guide to Certified Seed Production in Borno State, Nigeria. IITA, Ibadan, Nigeria.20 pp.

Garris, A.J., T.H. Tai,J. Coburn, and S. McCouch, (2005). Genetic structure and diversity in Oryza sativa L. Genetics 169: 1631-1638.

Genius, M., Koundouri M, Nauges, C and Tzouvelekas , V.(2010). Information Transmission in Irrigation Technology Adoption and diffusion: Social learning Extension Services and Spatial Effects

Heisey, P. and Mwangi, W. (1993). An Overview of Measuring research Impacts Assessment, in Heisey, P. and Waddington, S. (Eds). Impacts on farm Research.Proceedings of a Net workshop on Impacts of Farm Research in Eastern Africa. CIMMYT Eastern and Southern Africa on Farm Research Network Report No. 24. Harare. Zimbabwe, Pp. 28-36

Ingold Tim.(2002). The Perception of the Environment, Essays in livelihood, dwelling and skill. Published by Routledge Taylor & Francis Group, London and new York..p. 294-322

International Rice Research Institute (2002). Growth and Morphology of the Rice plant.

IRRI, (International Rice Research Institute). (1978) Rice research and production in China: an IRRI team's view. Los Banos, Philipniess. 119 pp.

Kaneda, C., (1972). Terminal report on studies on the breeding for cold resistance international Rice Reseach Institute, Los Banos, Philippiness 80 pp

Kijima, Y., and Sserunkuuma, D. (2013).The adoption of NERICA rice varieties at the initial stage of the diffusion process in Uganda. African Journal of Agricultural and Resource Economics, 8 (1), 45-56.

Koppel, BM. (Ed), (1994). Induced Innovation Theory and international Agricultural Development: A Reassessment the Johns Hopkins University Press, Baltimore

Linares, O.F. (2000) African rice (Oryzaglaberrima): history and future potential. Proceedings of the National Academy of Science of the United State of America 99: 16360-16365

Matsui, T., Omasa, and T. Horie. (1997a) High temperature-induced spikelet sterility of japorica rice at flowing in relation to air temperature, humidity and wind velocity condition Japanese Journal of Crop Science 66: 449-455

Matthews, R.B., M.J. Kropff, T. Horie, and D. Bachelet. (1997). Simulating the impact of climate change on rice production in Asia and evaluating options for adoption Agric. Syst. 54:399-425

McDolnald, D.J. (1979). Rice.Chapter 3. In: Australian field crops vol 2: tropical cereals, oilseeds, grain legumes and other crops. Argus and Robertson, London pp 70-94

Mohamed, K. and Temu A. (2008) Access to credit and its affect on the adoption of agricultural technologies: The case of Zanzibar, African Review of Money finance and Banking pp, 45-89

Moldenhaur, K.A.K., Gibbons, J.H. (2003). Rice Morphology and Development Chapter 2.1. In: CW Smith, RH Dildayeds, Rice, Origin, History, Technology, and Production, John Wiley and Sons, Inc, Hoboken, New Jersey. Pp 103-127.

Moya, T.B., L.,H. Ziska, O.S. Namuco, and D. Olszyk (1998). Growth dynamics and genotypic variation in tropical, field-grown paddy rice (Oryza sativa L.,) in response to increasing carbon dioxide and temperature. Global change Biol. 4:645-656

Mustapha, S. B., Undiandeye, U.C., Sanusi, A. M. and Bakari, S. (2012). Analysis of adoption of improved rice production technologies in jeer local government area of Borno state, Nigeria", International Journal of Development and Sustainability, 1 (3) 1112-1120.

Obinne C. (1994). Fundermentals of Agricultural Extension, ABIC Publishers, Enugu, Nigeria.

OECD (1988).Consensus document on the biology of Oryza sativa (rice). Report No. ENV/JM/MONO(99)26, OECD

Environmental health and Safety Publications, Paris.

Oka, H.I., Morishima, H. (1967). Variations in the breeding systems of a wild rice, Oryzaperennis. Evolution 21:249-258

Osada, A., V. Sasiprapa, M. Rahong, S. Dhammanuvong, and H. Chakrabandhu.(1973). Abnormal occurrence of empty grains of indica rice plants in the dry, hot season in Thailand.

Ouma, J,.Murithi, F, Mwangi, W., Verkuijl H., GethiM.De Groote, H. (2000) Adoption of maize seed and fertilizer Technologies in Embu District, Kenya. CIMMYT (International Maize and Wheat Improvement Center), Mexico, D.F

Peng, S.B., J.I., Huang, J.E, Sheehy, R.C. Laza, R.M. Visperas, X.H. Zhong G.S Centeno, Khush and K.G Cassman, (2004), Rice yields decline with higher right temperature from global warning. Proc. Natl. Academy of Science 101:9971-9975

Perin, R and Winkelman D. (1976). Impediments to Technical Progress on small Large farms American Journal of Agricultural Economics 58(5) 888-894.

Rogers, E.M (2003). Diffussion of innovations (5th ed). New York: Free Press.

Rogers, E.M., (1983). Diffusion of Innovations New York, New York: Free Press

Sato, K. (1967). The report on the technical support to develop the U.A.R desert (in Japanese). Overseas Technical Cooperation Agency,Tokyo. 100 pp.

Scott, H,D., Miller, D.M.,and Renaud, F.G. (2003). Rice soils: Physical and chemical characteristics and behavior. Chapter 3.3 In CW Smith, RH Dilday, eds Rice. Origin, History, Technology, and Production John Wiley and Sons Inc., Hoboken, New Jersey.Pp 297-329

Shahi, B. B, and M.H. Heu. (1979). Low temperature problem and research activities in Nepal. Pages 61-68 in International Rice Research Institute.

Sheehy, J.E., P.L. Mitchell, and A.B. Ferrer (2006), Decline in rice grain yields with temperature: Models and correlations can give different estimates, Field crop Res. 98: 151-156

Singh, B.N, Fagude, S, Ukwungu, M.N., Williams, G., Jagtab, S.S, Oladimeji, O; Effisue A and Okhidevbie O. (1997), Rice growing environment and biophysical constraints in different agro ecological Zones of Nigeria. Met Journal 2(1);35-44

Speilman,D.J, (2005). Innovation Systems Perspectives on Developing-Country Agriculture: A Critical Review. ISNAR Discussion paper 1: 10-40.

Takahashi, N. (1984b). Seed germination and seedling growth.Chapter 3.Inc S Tsunoda, N Takahashi, eds. Biology of rice, Volume 7, Elsevier, Amsterdam.Pp 31-67

Turgrul T, Ajit M (2002). The cotton supply chain in Azerbaijan, ISNAR, the Hague, Netherlands, pp. 13-17.

Vaughan, D.A., Morishima, H. (2003). Biosystematics of the genus Oryza.Chapter 1.2.Inc.

Virk, P.S., J.Zhu, H.J. Newbury, G.J. Bryan, M.T. Jackson, and B.V. Ford-Lyod, (2000).Effectiveness of different classes of molecular marker for classifying and revealing variations in rice (Oryza sativa) germplasm.Euphytica, 112: 275-284

Ziska, L.,H., W. Weerakon, O.S. Namuco,and R. Pamplona, (1996b). the influence of nitrogen on the elevated CO_2 response in field-grown rice. Aust J. Plant Physio. 23.45-52