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Effects of Adoption of Improved Maize Seed on Household Food Security in Gwoza Local Government Area of Borno State, Nigeria

By Idrisa, Y.L., Shehu, H. & Ngamdu, M.B
University of Maiduguri, Nigeria

Abstract - This study analyzed the effects of adoption of improved maize seed on household food security in Gwoza Local Government Area of Borno State. The study utilized primary data collected through questionnaire administered to 180 respondents selected through multi-stage sampling procedure. Data were analyzed using descriptive statistics (frequencies and percentages) and inferential statistical tools (the Probit model). The results revealed a preponderance of economically active respondents as the majority **(73.33%)** were between the ages of 26 and 55 years with most **(87.78%)** being male. While majority of the respondents **(64%)** had formal education, **36.67%** of the respondents had no formal education. Majority of the respondents operate at small-scale **(≤ 2ha).** Analyses of determinants of adoption revealed that education and extension contact significantly influenced the likelihood of the adoption of improved maize seed **(ρ ≤ .01).** Access to credit also influenced the adoption of improved maize seed. The study also found that adoption of improved maize varieties reduced the incidence, depth and severity of food insecurity among farming households in the study area.

Keywords : Adoption, improved seeds, food security, Gwoza, Nigeria.

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EFFECTS OF ADOPTION OF IMPROVED MAIZE SEED ON HOUSEHOLD FOOD SECURITY IN GWOZA LOCAL GOVERNMENT AREA OF BORNO STATE, NIGERIA

Strictly as per the compliance and regulations of :

Effects of Adoption of Improved Maize Seed on Household Food Security in Gwoza Local Government Area of Borno State, Nigeria

Idrisa, Y.L.,[α], Shehu, H.[α] & Ngamdu, M.B[σ]

Abstract - This study analyzed the effects of adoption of improved maize seed on household food security in Gwoza Local Government Area of Borno State. The study utilized primary data collected through questionnaire administered to 180 respondents selected through multi-stage sampling procedure. Data were analyzed using descriptive statistics (frequencies and percentages) and inferential statistical tools (the Probit model). The results revealed a preponderance of economically active respondents as the majority (73.33%) were between the ages of 26 and 55 years with most (87.78%) being male. While majority of the respondents (64%) had formal education, 36.67% of the respondents had no formal education. Majority of the respondents operate at small-scale (≤ 2ha). Analyses of determinants of adoption revealed that education and extension contact significantly influenced the likelihood of the adoption of improved maize seed ($\rho \leq .01$). Access to credit also influenced the adoption of improved maize seed. The study also found that adoption of improved maize varieties reduced the incidence, depth and severity of food insecurity among farming households in the study area. The study therefore concludes that level of education and extension contact influenced adoption of improved maize seed among farmers in the study area while adoption of improved maize varieties significantly reduced food insecurity among farming households in the study area. Based on the findings of this study, it was recommended that adult education programmes/campaigns be strengthened in order to expose farmer to opportunities including knowledge about improved crop varieties, improved technologies should be made available to farmer while farmers should be linked to sources of credit.

Keywords : Adoption, improved seeds, food security, Gwoza, Nigeria.

I. Introduction

A significant proportion of the population in sub-Saharan Africa, including Nigeria is food insecure and malnourished. Food security is one of the main concerns in many developing countries (FAO, 1996; IFPRI, 1996). Food crisis is most acute in sub-Saharan Africa, where the attainment of food security is intrinsically linked with accelerating agricultural growth rate (Cleaver and Schreiber, 1994; Matata et al., 2008).

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Agricultural growth has also been found to be four times more effective in reducing poverty, including food insecurity than growth in other sectors (UN, 2008). Consequently, the implementation and scaling-up of initiatives to improve agricultural productivity, particularly among smallholder farmers enhance food security and more efficient food distribution. Nigeria's development policy recognizes agriculture as a pillar of the economy, with priority centered on ensuring food security and increased export earning aimed at diversifying the economy. This zeal is further strengthened by the worsening food crisis of the 2007/2008 which saw the prices of staple food almost doubled. Due partly to high population pressure, farms and farmlands have become smaller and fragmented. This is further exacerbated by the fact that population growth has outstripped agricultural output growth (Lawal and Oluloye, 2008), thus the issue of food insecurity and subsequent food crisis. Low adoption of improved agricultural production technologies that can increase farmers' productivity is generally known to lead to reduced agricultural output. The low rate of adoption of improved agricultural technologies could be due to low expected benefits from the practice or could be due to other factors such as farmers' characteristics or institutional factors which may not encourage the adoption of technologies by farmers (Seyoum et al. 1998; Obwona 2000; Ajibefun 2006). Declining soil fertility and use of local crop varieties are also recognized as major impediments to the growth of African agriculture (Yates and Kiss, 1992; Valnauwe and Giller, 2006). This is further evidenced by low and declining yield per hectare of major crops in Nigeria (NBS, 2006).

Maize is a dominant staple food in Borno State in particular and Nigeria in general. The average annual per capita maize output for 2000-2005 is 85kg (NBS, 2006), while the per capita maize consumption is 175kg (FAO STAT, 2005). As a result, maize has received substantial research and extension attention. This also calls for the need to intensify effort on adoption of improved agricultural technologies for improved productivity and ensure food security. Even though several adoption studies explored technology adoption decision in developing countries (Feder et al., 1985; Rauniya and Goode, 1992; Ouma et al., 2006; Ojaiko et al., 2007; Idrisa, 2009), the studies fall short of

addressing the effect of adoption of improved seed technology on food security status of farming households.

The main objective of this study was therefore to examine the effect of adoption of improved maize variety on household food security in Gwoza Local Government Area of Borno State. The specific objectives of the study were to:

1) examine the socio-economic characteristics of the respondents;
2) analyze the factors influencing the adoption of improved maize seed among the respondent; and
3) analyze the effects of adoption of improved maize seed on household food security in the study area.

II. Materials and Methods

The study was conducted in Gwoza Local Government Area of Borno State. Multistage sampling procedure was used to draw sample for the study. In the first stage, three districts were purposively selected: Dure, Ghambaktha and Takwambare. These are the major maize producing districts in Gwoza Local Government. In the second stage, two communities were randomly selected from each district. Finally in the third stage, 30 respondents were randomly selected from each of the selected six communities, giving a total of 180 respondents used for the study. Data were collected from primary sources using structured questionnaires. The questionnaire elicited information from respondents pertaining to their personal characteristics, characteristics of their farms, their use of improved maize seed and access to agricultural services such as extension and credit.

Model specification

The discrete-discrete and discrete-continuous choice models were used to evaluate the effects of adoption of improved maize variety on household food security in the study area.

The discrete-discrete choice model

Bivariate probit model is most appropriate for assessing whether a farm household will adopt a high yielding maize variety, and whether conditional on adoption, the household risk of falling into food insecurity will reduce.

Let M denote characteristics of the farmer and Z the characteristics of the technology; and let K be the new technology and I the existing technology. The probability of adopting a new maize technology can be implicitly expressed as:

$$P(\mathbf{K}) = \rho(U_{\mathbf{K}}(M, Z_K) + e_k > U_I(M, Z_I) + e_I) \qquad (1)$$

Where:

U_k and U_i are perceived net benefit associated with the adoption of improved technologies k and i, respectively, and e is the stochastic disturbance term. From equation (1), a binary Probit model of technology choice can be formulated on the assumption that the disturbance term is normally distributed (Maddala, 1986).

Equation (1) can be used to predict the probability that household i will adopt improved maize technology k given its characteristics (M) and attributes of the technology (Z). The equation can also be used to assess the effect of technology adoption on food insecurity. Specifically, the predicted probability from equation (1) can be used as a regressor in the food insecurity status equation to examine whether or not household food insecurity and adoption are negatively correlated. The food insecurity status of a household can be computed using the following expression as used by Mwabu et al. (2000), Mwabu et al. (2006) and Idrisa et al. (2008).

$$P_{\acute{\alpha}} = 1/N^* \Sigma_p((S-Y_i)/S)^{\acute{\alpha}} \qquad (2)$$

Where,

$P\acute{\alpha}$= a measure of overall food insecurity;

Y_i= total Calorie consumption of household i per adult equivalent (i = 1…N);

S= food insecurity baseline: i.e Calorie requirement of household

N= total number of households;

p = total number of households facing food insecurity;

$\acute{\alpha}$= interpreted as a measure of food insecurity aversion, for $\acute{\alpha}\geq 0$.

Note that if $\acute{\alpha}=0$, the food insecurity measure, p0 becomes the headcount index, which indicates the percentage of household below food security line. For $\acute{\alpha}=1$, p_1 is the average food insecurity gap and for $\acute{\alpha}=2$, p_2 is the severity index, which is the weighted sum of food insecurity gaps.

Once the poverty status of the household is determined using equation 2, a Probit model of the probability of being food insecure can be estimated along the line of equation (1) and it is given as:

$$P_r(C_i < C_y) = f(X, ß) \qquad (3)$$

Where:

P_r = probability that a household consume calorie lower than the required calorie.

C_i = total calorie consumption of household i.

C_y = food insecurity baseline.

X = a vector of determinant of food insecurity, a subset of M in equation (1).

ß = predicted probability of adoption, derived from equation (1), the coefficient of which shows the effect of technology adoption on food security.

2.2 Discrete – Continuous choice model.

Equation (3) may be written as:

$$W_i = f(\acute{\alpha}, ß) \qquad (4)$$

Where :

W_i = food insecurity depth of household i. Thus dependent variable in this equation is now continuous rather than discrete as in equation (1).

The square of equation (4) measures the severity of food insecurity. apriori, it expected that level of education, income, extension contact and access to credit will have positive and significant influence adoption of improved maize seeds while age of farmers is expected to have negative but significant influence on adoption of improved maize seed by farmers. Similarly, level of adoption of improved seeds maize seeds is expected to have positive and significant influence on food security among farming households in the study area.

III. Results and Discussion

a) *Socio-economic characteristics*

Entries in Table 1 revealed that majority (73.33%) of the respondents were between 26 years and 55 years of age. This implies that the respondents have the required physical strength to engage in food production. Mass participation in food production has great capacity to reduce the incidence of food insecurity at both household level and community level. The majority (87.78%) of the respondents were also male with more than half (63.34%) of the respondents having attained formal education. However, 85% of the respondents operate at small-scale, having no more than two hectare of farmland.

It also determines the rate of application of innovations through counseling and demonstration by extension agents (Lawal and Oluloye, 2008). Nkonya et al. (1997) also opined that exposing farmers to extension services has great effect on reducing food insecurity through the adoption of improved farming practices by farmers and hence, increased yields. In the same vein, Onu (2006) found that farmers who had access to extension adopted improved farming technologies 72% greater than those who had no access to extension services.

Table 1 further shows that majority (62.22%) of the respondents had no access to credit facilities during the study period. Only 37.78% of the respondents had access to credit facilities. Access to credit enhances farmers' capacity to adopt improved production technologies which in turn increases productivity of farmers. As recognized by Ouma et al. (2006), most farmers in developing countries are cash-trapped. They need financial assistance to purchase the technologies and their complementary inputs. This suggests why linking farmers to sources of credit can go a long way in reducing food crisis particularly in developing countries.

Table 1 : Distribution of respondents based on their socio-economic characteristics

Variable	Frequency	Percentage
Age(years):		
≤25	30	16.67
26-40	60	33.33
41-55	72	40.00
>55	18	10.00
Gender:		
Male	158	87.78
Female	22	12.22
Educational qualification:		
No formal education	66	36.67
Primary education	54	30.00
Secondary education	50	27.78
Tertiary education	10	5.56
Farm size (ha.):		
≤1.0	68	37.78
1.1-2.0	86	47.78
2.1-3.0	24	13.33
>3.0	2	1.11
Access to extension services:		
Had access	126	70.00
Had no access	54	30.00
Number of extension visit received:		
≤3	38	21.11
4-6	72	40.00
7-9	59	32.78
>9	11	6.11
Access to credit:		
Had access	68	37.78
Had no access	112	62.22
Yield of maize per hectare (kg):		
≤500	44	24.44
501-650	52	28.89
651-800	50	27.78
>800	34	18.89

Source: Field Survey, 2008

b) Factors affecting the adoption of improved maize seed

The socio-economic characteristics that influenced the adoption of improved maize seeds by farmers include level of education of respondents, yield of maize, access to credit by respondents and extension contact. These factors were statistically significant at 1% and 5%, respectively (Table 2).

Level of education : Table 2 shows that the level of education of the respondents was a very important factor ($\rho \leq 0.01$) that influenced the extent of their adoption of improved maize seeds. The positive and significant relationship between level of education and extent of adoption in this study of maize seed also agrees with earlier studies (Feder et al., 1985; Awe, 1999) that literacy level positively influenced the adoption of fertilizer technology in southwestern Nigeria and Berkeley, USA, respectively. It should be noted that the influence of education on adoption of innovation is more likely to prevail in economies where farm production is modernizing and where farming communities are being exposed to educational opportunities compared to economies where agriculture has attained high level of modernization and almost all farmers have attained the necessary levels of education (Asfaw and Admassie, 2004).

Yield of Maize : Yield of maize was found to be a very important factor that influenced the adoption of improved maize seed among farmers in the study area. The yield variable was found to be positive and significant at 5% level of probability (Table 2). Yield is a direct measure of the seed's performance and a crop variety that is high yielding stands to be adopted by farmers since high yield would raise the output for food security and subsequent gross earning. This finding agrees with Ojiako et al., (2007) that yield of soybean was significant in influencing the adoption of improved soybean in northern Nigeria. Adesina and Zinna (1993) also reported that yield significantly influenced farmers' decision to adopt improved mangrove swamp varieties of rice in Sierra Leone.

Table 2 : Determinants of adoption of improved maize seed

Adoption	Coefficient	Standard error	Z	p>|z|
Age	.0846594	.0576184	1.47	0.142
Gender	-.2507744	1.403885	-0.18	0.858
Education	.6974936	.6455236	1.08	0.000***
Farm size	.5305544	.4560774	1.16	0.245
Income	.4824732	.303217	1.59	0.112
Yield	.0219869	.00774879	2.94	0.003**
Access to credit	4.841265	1.947661	2.49	0.001**
Extension contact	3.590882	1.954888	1.84	0.000***

** Significant at 5%
*** Significant at 1%

Alimi (1991) observed that one of the main problems facing agricultural production in developing countries is low yield. The practice of planting traditional/low yielding variety of crops by farmers may partly be responsible. This necessitated the development of high yielding varieties of crops by agricultural research institutes with the hope that these improved varieties of crops will be adopted by farmers so as to improve their yield. To that effect, a crop variety that has the capacity for high yielding also has high chances of being adopted. The likelihood of adoption is even higher if the crop variety does not depend so much on complementary inputs such as fertilizers and pesticides.

Access to credit : Table 2 also reveals that access to credit was found to be important in influencing the likelihood of adoption of improved maize seed among farmers in the study area. The variable was found to be statistically significant ($\rho \leq 0.05$) and positively related with the likelihood of adoption. Most farmers fear trying improved technologies because they do not have the necessary financial resources to adopt the technologies (Ouma et al., 2006; Omolehin et al., 2007). This is partly explained by the fact that most agricultural technologies require complementary inputs such as fertilizers and pesticides. These complementary inputs are difficult to come by due to the cash-trapped nature of farmers (Idrisa and Ogunbameru, 2008). Access to credit helps farmers out of their predicaments thereby influencing them to adopt innovations. Access to credit also encourages adoption of technologies among farmers in the sense that credit, especially those from formal sources are most likely covered by insurance. This also reduces the level of risk associated with adoption of technologies on the side of farmer, thereby increasing the likelihood of adoption.

c) Effects of adoption of improved maize seed on household food security

Table 3 presents the incidence, depth and severity of food insecurity among the respondents. The yard stick used for categorizing the respondents was the percentage of land devoted to the cultivation of improved maize variety. The result shows that 12.80% and 27.40% of the adopters who devoted 10 – 30% and 31 – 50% of their land to improved maize cultivation have

food insecurity incidence of 71% and 66% respectively, with the food insecurity depth of 0.38 and 0.32 respectively. The results also show that the same category of respondents had food insecurity severity of 0.24 and 0.18, respectively. This implies that as the level of adoption increases, the incidence of food insecurity is likely to decrease. This is attributed to devotion of more land to improved maize variety.

The result also shows that 12.80% of adopters that devoted 10 – 30% of their total land area to improved maize cultivation had food insecurity incidence of 71%, food insecurity depth of 0.38 and food insecurity severity of 0.24 while about 16.70% of the adopters that devoted more than 70% of their land to improved maize cultivation had food insecurity incidence of 53%, food insecurity depth of 0.19 and food insecurity severity of 0.09. This implies that as the level of adoption increases, food insecurity incidence, depth and severity tend to decrease.

Table 3 : Effect of Adoption of Improved Maize seed on the Incidence, Depth and Severity of Food Insecurity among Farming Households

			Food Insecurity		
Percentage of land under improved Maize variety	Number of Adopters	Percentage of Adopters	Incidence (%)	Depth	Severity
10 - 30	15	12.80	71.00	0.38	0.24
31 – 50	32	27.40	66.00	0.32	0.18
51 – 70	40	22.20	68.00	0.24	0.12
71 and above	30	16.70	53.00	0.19	0.09

Source: Synthesis of Field Data.

IV. Conclusion and Recommendations

The results of the study revealed that level education, access to extension services, yield and access to credit were key determinants of adoption of improved maize seed variety. The study also found that adoption of improved maize variety had significant effect on food security status in the study area.

Based on the findings of this study, the following recommendations were proffered:

- Farmers should be exposed to adult education programmes. This will go a long way in changing the attitude and orientation of the farmers towards innovations in particular and modernized agriculture in general.
- Extension services should be strengthened so as to teach farmers the need to adopt improved technologies, how to apply these technologies and how best to utilize the outcomes of these technologies so as to reduce poverty and improve food security.
- Farmers should be linked to sources of affordable credit so as to enable them purchase these inputs and their complementary needs.

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Aflatoxin, Nutritive Values and Microbiological Status of Stored Cakes of Some Selected Nigerian Oil Seeds

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Abstract - Defatted ground nut, soybean and palm kernel cakes were stored for three months at ambient, refrigeration and display conditions. Samples were assayed for nutritive, aflatoxins and microbiological properties. Proximate parameters significantly ($p<0.05$) reduced with storage. Mineral composition reductions of 3.0-35.00%, 1.2-18.75% and 6.2-64.25% were observed for ambient, refrigeration and display condition storage respectively. There was a significant ($p<0.05$) increase in both bacterial and fungal counts with increased storage duration. Aflatoxin B1 contents of 21.65-49.26, 14.57-27.24 and 29.14-61.32 µg/kg were detected in cakes stored at room, refrigeration and display condition respectively while the Aflatoxin B2 contents were 9.85-14.13, 3.24-10.02 and 12.96-17.04 µg/kg respectively. Proper storage/handling of feed ingredients should form a core component of Good Manufacturing Practice (GMP) of feed production in tropical countries. The regulatory agencies in these countries should enforce a revised GMP in order to guarantee a more healthy and productive populace.

Keywords : Oil seed cakes; aflatoxins, storage, livestock feed production, West Africa.

GJSFR-D Classification : FOR Code: 620105, 070204

AFLATOXIN, NUTRITIVE VALUES AND MICROBIOLOGICAL STATUS OF STORED CAKES OF SOME SELECTED NIGERIAN OIL SEEDS

Strictly as per the compliance and regulations of :

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I. Introduction

Good nutrition is a basic human right. In order to have a healthy population that can promote development, the relationship between food, nutrition and health should be reinforced (Achu et al. 2005). An important way of achieving this in developing countries is through the exploitation of available local resources (Achu et al. 2005; Kolapo and Sanni, 2005).

Oil crops and their products have diverse applications in human endeavors, and this may have qualified them as the second most valuable commodity in the world trade. In addition to the immense usefulness of the oils from oilseeds, the defatted residues of the oilseeds are used to prepare food for children, pregnant and lactating mothers, old people as well as dietary supplement to be used in human food system as biscuit, soap and snack in Nigeria (Akano and Atanda, 1990; Oladimeji and Kolapo, 2008). Not until recently that the use of cassava starch in compounding animal feed is gaining prominence in the developed world, the use of defatted oilseed for compounding livestock feed is a global practice. However, the substantial portion of animal feeds produced in developing world used defatted oilseed as the major raw materials. For instance, Oluwafemi and Dahunsi (2009) reported that groundnut cake, palm kernel cake and maize are the main ingredients of local feeds in Nigeria.

The literature is replete with reports on the qualities of extracted oils from the oilseed while there is scanty information on the storage qualities of these cakes. Previous report from our laboratory indicated that within one month of storage, there was significant microbial proliferation and subsequent reduction in nutritive properties of stored cakes (Oladimeji and Kolapo, 2008). Based on our interaction with some feed mills in Nigeria, it is evident that defatted seed cakes are used between one to three months of their production. Also, the manner of handling these cakes prior to use appeared to make them a great threat to public health. For example, it is not uncommon for some feed mills to stack the defatted cakes which are intended for use outdoor until the time of usage.

Therefore, the present study is designed to evaluate the effect of such relatively long term storage and manner of handling on the nutritive, aflatoxin and microbiological properties of defatted cakes of three oilseeds namely, groundnut, soybean and palm kernel.

II. Materials and Methods

a) *Collection of Oil seeds, Oil Extraction and Storage of Defatted Residues*

Samples of three oilseeds namely, groundnut, soybean and palm kernel were purchased from local markets in Ibadan, Nigeria in April 2008. Ibadan has a tropical climate which is characterized by dry November to April and wet May to October seasons. The mean annual rainfall of 1150-1500 mm occurs mainly between April and October with major peak in June.

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The samples were dehulled, sundried for 48-72 h and ground in a Kenwood blender to reduce their particles size so as to improve yield. The oils were obtained by cold solvent extraction of the ground samples using n-hexane. Two hundred milliliters of n-hexane was mixed with 500gm of each sample in five batches. The mixture was shaken vigorously and left for about 72 h to settle. The supernatant was slowly decanted and poured into a sterile reagent bottle. The extract from all the five batches were pooled together and allowed to settle again for 24 h. The mixture was distilled by simple distillation. The recovered oil was transferred into sterile bottle, while recycled n-hexane was kept for further extraction. Defatted residues were dried in an oven at 40^0C for five days to obtain residues of between 3.65 and 5.18% moisture content. Cakes of each of the investigated oilseeds were divided into three portions and packed separately inside a sterile polypropylene bag, with each portion stored under different storage conditions for three months. A portion was kept inside a cupboard (room temperature); the second was kept in a refrigerator while the remaining portion was kept outdoor under the sun thus simulating the display condition as practiced by some feed mills in Nigeria. The storage experiments were carried out between April and July 2008. The mean weather conditions for April, May, June and July 2008 were: relative humidity, 80, 79, 85 and 88%; temperature, 23.7-32.7, 23.1-31.9, 22.7-30.4 and 22.5-29.1 ºC respectively.

b) Nutrient Analysis

AOAC (1987) methods were used for the determination of proximate parameters such as fat content, ash content and moisture content. All the samples were analyzed for the following nutrients: N, P, Ca, Mg, K, Na and Fe.

For both N and P analyses, the samples were first digested in a hot sulphuric acid solution with SeO_2 catalyst using a method adapted from Novozamsky et al. (1983) and the ensuing solution was used for subsequent analyses. For P analysis, the ascorbic acid method adapted from Murphy and Rilly (1962) using an acid molybdate solution was employed; while the popular Berthalot (Indophenol reaction) method adapted from Searle (1984) was used for N analysis and the crude protein (NX6.25) was estimated .

Other nutrients were determined sequel to ashing in a muffle furnace (500 ºC). The methods described by Jones and Case (1990), and Hunter et al. (1984), were used for the nutrient analysis.

c) Microbiological Assays of Stored Defatted Residues

The method of Omafuvbe et al. (2000) was adapted for the enumeration of microbial population in the stored defatted residues. Counts were taken at one month interval. Counted bacteria colonies were expressed as colony forming unit per gramme (cfu/g) of samples. Mean values of triplicate plates were recorded. For the fungal counts, potato dextrose agar (PDA) and incubation temperature of 28 ºC for 2-3 days were used. Pure cultures of the isolated bacteria and fungi were obtained by repeated streaking. Bacterial isolates were characterized and identified according to Cowan and Steel (1985) and definition given with reference to Bergey's manual (Sneath et al. 1986). Fungal isolates were identified using the key given by Onions et al. (1981).

d) Detection of Aflatoxins Using Thin layer Chromatography

The method described by Seitz and Mohr (1977) was used for detecting aflatoxins in the pulverized stored samples. Aflatoxins were identified on the basis of co-migration with aflatoxin standards (Fluka) and their characteristics fluorescent color under long Ultra Violet (UV) light at a distance of 360 mm. The concentration of aflatoxins (B_1 and B_2) in the extract was determined by measuring its absorbance at 360 mm and then calculated according to the method of Masri et al. (1969).

e) Statistical Analysis

The statistical analysis of the data was by Analysis of Variance (ANOVA) using 5% level of significance. A Two-way ANOVA analysis was used to test for significance of difference between the storage conditions and between the types of defatted residues.

III. Result and Discussion

The proximate compositions of defatted groundnut, soybean and palm kernel cakes stored for three months are shown in Table 1. A two way ANOVA test of the data depicted that with increased storage time, the proximate parameters (such as crude protein, fat, ash and fiber) were significantly ($p<0.05$) reduced while the moisture contents correspondingly increased. Of all the proximate parameters, the highest significant ($p<0.05$) reduction was observed in the fat content of the cakes stored at display condition. A comparison between the three stored defatted cakes revealed that soybean cake exhibited the most significant ($p<0.05$) reduction in nutritive parameters during the three months storage.

The observed trend of reduction in nutritive qualities is in agreement with previous reports on some selected stored defatted oilseed cakes (Oladimeji and Kolapo, 2008) and soybean daddawa (Kolapo and Sanni, 2007). In those reports, microbial proliferation and subsequent nutrients utilization were suggested to be most probably responsible for the observed nutrient depletion. The main factors that cause rancidity/deterioration of fat are moisture, bacteria, enzymes, light, heat, air and some types of metal (ITDG, 2005). Given that the relative humidity of between '79 and 88%; and temperature of between 24-30 ºC and 23-29 ºC were recorded during the storage experiment, the significant fat depletion observed in the cakes stored

at display condition might also be partly owned to fat rancidity. Meanwhile, rancid oil forms harmful free radicals in the body, which are known to cause cellular damage and have been associated with diabetes, Alzheimer's disease and other conditions. Rancid oils can also cause digestive distress and deplete the body of vitamins B and E as well as causing damage to DNA, accelerate aging, promote tissue degeneration and foster cancer development (Kalmus, 2011). It then appears that the storage of cakes at display condition such as the simulated in the present work might be of public health concern.

Table 2 shows the mineral compositions of defatted cake of groundnut, soybean and palm kernel stored for three months. Both the length of storage and storage conditions significantly ($p<0.05$) affected the mineral contents of the stored defatted cakes. There were significant reductions ($p<0.05$) in the mineral compositions of stored cake with increasing length of storage. In this regard, the cakes stored under display condition were mostly affected. For instance, mineral composition reductions of 3.0-35.00%, 1.2-18.75% and 6.2-64.25% were observed for ambient, refrigeration and display condition storage respectively. The observed mineral contents reduction of the stored cakes could be attributed to the involvement of these minerals in the metabolism of the proliferating micro biota. The favorable nutritive content of defatted oilseed cake qualifies them to find application in the production of animal feeds (Achu et al. 2005; Oladimeji and Kolapo, 2008). It is now becoming evidently clear that the practice of leaving these cakes outdoor prior to use as being done by some feed mills in Nigeria is having a great negative impact on the nutritive quality of feeds obtained from such mishandled cakes.

The result of microbial counts of stored defatted cakes of groundnut, soybean and palm kernel is shown in Table 3 while the associated bacteria and fungal species are shown in Table 4. There was a significant ($p<0.05$) increase in both bacterial and fungal counts with increased storage duration. The cakes stored under display conditions had the highest microbial counts while those stored under refrigeration condition had the least counts. At the end of the three months of storage, the mould count obtained from stored cake is one-tenth fold less than the range (1.1- 9.5 X 105 cfu/g) obtained for fish feed in Nigeria (Oluwafemi and Dahunsi, 2009). The micro flora of the stored defatted cakes in the present study is similar to those found to be associated with groundnut and its products (McDonald, 1964; Akano and Atanda, 1990), maize (Prasad, 1992),

Table 1: Proximate compositions (%) of defatted groundnut, soybean and palm kernel cakes stored for three months

	Room Temperature Storage time (month)				Refrigeration Temperature Storage time (month)				Display Condition Storage time (month)			
Nutrient	0	1	2	3	0	1	2	3	0	1	2	3
					Defatted Ground nut cake							
Protein	48.47^{a}	47.25^{ab}	46.88^{ab}	46.24^{b}	48.47^{a}	47.95^{ab}	47.21^{ab}	46.86^{b}	48.47^{a}	47.25^{ab}	46.88^{ab}	46.24^{b}
Fat	9.87^{a}	9.81^{a}	9.16^{ab}	9.11^{ab}	9.87	9.85^{a}	9.24^{a}	9.13^{ab}	9.87^{a}	9.61^{a}	9.08^{ab}	8.92^{b}
Ash	4.87^{a}	4.76^{a}	4.71^{a}	4.49^{ab}	4.87	4.84^{a}	4.76^{a}	4.58^{ab}	4.87^{a}	4.63^{ab}	4.59^{ab}	4.31^{b}
Fiber	3.56^{a}	3.44^{ab}	3.41^{ab}	3.36^{b}	3.56	3.51^{a}	3.47^{ab}	3.39^{ab}	3.56^{a}	3.35^{ab}	3.39^{ab}	3.18^{b}
Moisture	3.65^{e}	4.87^{cd}	5.21^{c}	5.61^{c}	3.65	3.79^{e}	4.19^{d}	5.24^{c}	3.65^{e}	6.16^{bc}	6.82^{b}	7.45^{a}
					Defatted Soybean cake							
Protein	41.30^{a}	39.55^{a}	37.24^{b}	36.29^{bc}	41.30^{a}	40.25^{a}	38.76^{ab}	37.64^{b}	41.30^{a}	38.50^{ab}	36.92^{bc}	35.29^{c}
Fat	17.65^{a}	17.47^{a}	17.12^{a}	16.98^{b}	17.65^{a}	17.59^{a}	17.43^{a}	17.31^{a}	17.65^{a}	17.39^{a}	17.08^{ab}	15.92^{c}
Ash	3.61^{a}	3.45^{a}	3.42^{a}	3.22^{ab}	3.61^{a}	3.53^{a}	3.47^{a}	3.33^{ab}	3.61^{a}	3.37^{ab}	3.34^{ab}	3.15^{b}
Fiber	4.35^{a}	4.18^{ab}	4.12^{ab}	3.94^{b}	4.35^{a}	4.26^{a}	4.22^{a}	4.15^{ab}	4.35^{a}	4.15^{a}	3.91^{b}	3.54^{b}
Moisture	5.18^{de}	6.80^{bc}	8.13^{a}	8.28^{a}	5.18^{de}	5.37^{d}	6.26^{c}	7.31^{b}	5.18^{de}	6.80^{bc}	8.13^{a}	8.28^{a}
					Defatted Palm Kernel cake							
Protein	19.31^{a}	17.85^{b}	17.43^{b}	16.44^{c}	19.31^{a}	18.55^{ab}	17.97^{b}	16.89^{c}	19.31^{a}	16.80^{c}	16.25^{c}	15.96^{d}
Fat	7.91^{a}	7.81^{a}	7.18^{b}	7.05^{bc}	7.91^{a}	7.79^{a}	7.65^{ab}	7.40^{ab}	7.91^{a}	7.65^{ab}	7.20^{b}	6.74^{c}
Ash	5.61^{a}	5.36^{ab}	5.31^{ab}	5.09^{bc}	5.61^{a}	5.41^{a}	5.38^{ab}	5.16^{b}	5.61^{a}	5.29^{b}	5.26^{b}	4.92^{c}
Fiber	9.08^{a}	8.74^{ab}	8.69^{ab}	8.53^{b}	9.08^{a}	8.83^{a}	8.76^{ab}	8.66^{b}	9.08^{a}	8.62^{b}	8.56^{b}	8.39^{c}
Moisture	4.85^{d}	5.82^{c}	7.37^{ab}	7.33^{ab}	4.85^{d}	4.96^{d}	5.12^{cd}	6.18^{bc}	4.85^{ad}	6.95^{b}	7.92^{a}	7.84^{a}

Values are means of three determinations. Within row, values with different superscripts differed significantly ($p<0.05$).

Table 2 : Mineral Composition (%) of defatted ground nut, soybean and palm kernel cakes stored under different conditions for three months.

	Room Temperature Storage time (month)				Refrigeration Temperature Storage time (month)				Display Condition Storage time (month)			
Nutrient	0	1	2	3	0	1	2	3	0	1	2	3
Defatted Ground nut cake												
Sodium	0.014^{a}	0.011^{b}	0.009^{c}	0.007^{d}	0.014^{a}	0.012^{a}	0.010^{b}	0.009^{c}	0.014^{a}	0.010^{b}	0.008^{cd}	0.005^{e}
Potassium	0.014^{a}	0.012^{a}	0.010^{b}	0.008^{cd}	0.014^{a}	0.012^{a}	0.009^{c}	0.007^{d}	0.014^{a}	0.011^{b}	0.008^{cd}	0.005^{e}
Calcium	0.014^{a}	0.012^{ab}	0.010^{b}	0.009^{c}	0.014^{a}	0.013^{a}	0.011^{b}	0.010^{b}	0.014^{a}	0.011^{b}	0.009^{c}	0.005^{d}
Phosphorus	0.493^{a}	0.482^{b}	0.480^{b}	0.478^{b}	0.493^{a}	0.492^{a}	0.491^{a}	0.487^{ab}	0.493^{a}	0.487^{ab}	0.478^{b}	0.462^{c}
Magnesium	0.032^{a}	0.028^{b}	0.025^{c}	0.023^{c}	0.032^{a}	0.032^{a}	0.028^{b}	0.026^{bc}	0.032^{a}	0.027^{b}	0.023^{c}	0.018^{d}
Iron	0.013^{a}	0.011^{ab}	0.009^{b}	0.006^{cd}	0.013^{a}	0.013^{a}	0.012^{a}	0.011^{ab}	0.013^{a}	0.010^{b}	0.007^{c}	0.004^{d}
Defatted Soybean cake												
Sodium	0.036^{a}	0.032^{b}	0.030^{bc}	0.028^{c}	0.036^{a}	0.035^{a}	0.032^{b}	0.030^{bc}	0.036^{a}	0.027^{c}	0.024^{d}	0.020^{e}
Potassium	0.036^{a}	0.033^{b}	0.032^{b}	0.030^{c}	0.036^{a}	0.034^{a}	0.033^{b}	0.031^{c}	0.036^{a}	0.032^{b}	0.030^{c}	0.027^{d}
Calcium	0.036^{a}	0.034^{a}	0.032^{ab}	0.030^{b}	0.036^{a}	0.035^{a}	0.034^{a}	0.033^{ab}	0.036^{a}	0.033^{ab}	0.030^{b}	0.026^{c}
Phosphorus	0.393^{a}	0.384^{b}	0.380^{b}	0.378^{bc}	0.393^{a}	0.391^{a}	0.388^{b}	0.386^{b}	0.393^{a}	0.380^{b}	0.375^{bc}	0.370^{c}
Magnesium	0.027^{a}	0.025^{ab}	0.022^{bc}	0.022^{bc}	0.027^{a}	0.026^{a}	0.025^{ab}	0.023^{b}	0.027^{a}	0.024^{b}	0.020^{c}	0.018^{d}
Iron	0.017^{a}	0.015^{a}	0.013^{b}	0.011^{c}	0.017^{a}	0.016^{a}	0.015^{a}	0.014^{b}	0.017^{a}	0.014^{b}	0.011^{c}	0.009^{cd}
Defatted Palm kernel cake												
Sodium	0.020^{a}	0.018^{a}	0.018^{a}	0.016^{b}	0.020^{a}	0.017^{ab}	0.015^{b}	0.015^{b}	0.020^{a}	0.018^{a}	0.014^{b}	0.009^{c}
Potassium	0.020^{a}	0.018^{a}	0.016^{b}	0.013^{c}	0.020^{a}	0.019^{a}	0.018^{a}	0.015^{b}	0.020^{a}	0.015^{b}	0.011^{cd}	0.009^{d}
Calcium	0.020^{a}	0.018^{a}	0.016^{b}	0.014^{bc}	0.020^{a}	0.019^{a}	0.018^{a}	0.017^{b}	0.020^{a}	0.016^{b}	0.012^{c}	0.008^{d}
Phosphorus	0.779^{a}	0.774^{a}	0.770^{ab}	0.768^{b}	0.779^{a}	0.775^{a}	0.772^{a}	0.770^{ab}	0.779^{a}	0.768^{b}	0.762^{b}	0.758^{b}
Magnesium	0.043^{a}	0.039^{ab}	0.036^{b}	0.033^{b}	0.043^{a}	0.041^{a}	0.039^{ab}	0.036^{b}	0.043^{a}	0.035^{b}	0.030^{b}	0.025^{c}
Iron	0.018^{a}	0.016^{ab}	0.013^{b}	0.010^{c}	0.018^{a}	0.017^{a}	0.016^{ab}	0.014^{b}	0.018^{a}	0.014^{b}	0.010^{c}	0.009^{cd}

Values are means of three determinations. Within row, values with different superscripts differed significantly ($p<0.05$).

Table 3 : Microbial count (log cfu/g) of defatted ground nut, soybean and palm kernel cakes stored under different conditions for three months

Sample	Room Temperature Storage time (month)				Refrigeration Temperature Storage time (month)				Display Condition Storage time (month)			
	0	1	2	3	0	1	2	3	0	1	2	3
					Bacterial count							
Ground nut cake	2.22^{f}	3.64^{e}	4.50^{c}	5.28^{a}	2.22^{f}	3.28^{e}	4.20^{cd}	5.11^{b}	2.22^{f}	4.04^{d}	4.70^{c}	5.36^{a}
Soybean cake	2.57^{e}	3.94^{c}	4.63^{b}	5.38^{a}	2.51^{e}	3.51^{d}	4.32^{bc}	3.92^{c}	2.51^{e}	4.48^{b}	4.88^{a}	5.34^{a}
Palm kernel cake	2.26^{d}	3.08^{c}	3.34^{c}	5.20^{a}	2.26^{d}	3.45^{c}	3.63^{c}	5.13^{a}	2.26^{d}	4.48^{b}	4.79^{b}	5.38^{a}
					Fungal count							
Ground nut cake	2.00^{e}	3.08^{c}	4.28^{b}	5.34^{a}	2.00^{e}	2.78^{d}	3.08^{c}	5.04^{a}	2.00^{e}	3.62^{c}	4.32^{b}	5.30^{a}
Soybean cake	2.60^{e}	3.08^{d}	4.08^{b}	5.26^{a}	2.60^{e}	2.72^{e}	3.95^{c}	3.94^{c}	2.60^{e}	3.53^{d}	4.46^{b}	5.47^{a}
Palm kernel cake	2.48^{c}	3.34^{b}	3.81^{b}	5.34^{a}	2.48^{c}	2.60^{c}	3.96^{b}	5.08^{a}	2.48^{c}	3.78^{b}	3.97^{b}	5.34^{a}

Values are means of three determinations. Within row, values with different superscripts differed significantly ($p<0.05$).

cassava flour (Oboh et al., 2000), stored soya oil (Ilori et al.,2007), stored soybean daddawa (Kolapo and Sanni, 2006; Kolapo et al., 2007), soybean, groundnut, melon, coconut and cashew cakes (Oladimeji and Kolapo, 2008), stored groundnut, melon, coconut and cashew oil (Kolapo and Oladimeji, 2011).

Table 5 shows the aflatoxin status of defatted oilseed cakes of groundnut, soybean and palm kernel stored under different conditions. Both the length and condition of storage significantly ($p<0.05$) affected the aflatoxin status of the stored cakes. The aflatoxin concentration in the stored cakes increased significantly ($p<0.05$) as storage progressed. Production of aflatoxin was highest in the samples stored under display condition, while the refrigerated samples had the least quantities of aflatoxins.

Aflatoxin B_1 (AFB_1) contents of 21.65-49.26, 14.57-27.24 and 29.14-61.32 µg/kg were detected in cakes stored at room, refrigeration and display temperature respectively. In addition, the Aflatoxin B_2 (AFB_2) contents detected in the samples stored under the same storage conditions were respectively 9.85-14.13, 3.24-10.02 and 12.96-17.04 µg/kg.

The present result is in agreement with some documented reports. Dawlatana et al. (2000) reported aflatoxin contaminated rate of 65µg/kg in groundnut samples from Bangladesh while aflatoxin concentration of 162 µg/kg was reported in Gambian groundnut samples (Hudson et al., 1992; Williams et al., 2004). Bankole and Mabekoje (2003) reported that yam chips had an aflatoxin contamination level of 4-186 µg/kg as Jimoh and Kolapo (2008) reported the presence of AFB_1 in groundnut and yam chips at the concentrations of 7-24 µg/kg and 14 µg/kg respectively in Nigeria.

Based on field report, the nutritional and physiopathological implication of aflatoxin as an environmental pollutant and feed contaminant in Nigeria has been discussed by Aletor (1990) and Atawodi et al. (1994). In a recent study, Oluwafemi and Dahunsi (2009) reported that most feeds imported into Nigeria had low aflatoxin levels compared to feeds formulated in Nigeria. In another development, Bankole et al. (2004) had earlier opined that the high level of aflatoxin contamination of feeds and feedstuff in West Africa countries could be attributable to the tropical climates, poorly developed processing facilities, storage and skilled human resources. The present study has scientifically confirmed that the storage/handling practices to which the feed ingredients are subjected to prior to feed production is critical to determining the aflatoxin contents of the final feed. Hence, proper storage of feed ingredients should form a core component of Good Manufacturing Practice (GMP) of feed production in these West African countries.

As efforts at ameliorating the aflatoxin levels in feed value chain increase, the unskilled human resources which manned various cottage feed mills in

Nigeria and other developing world must be educated on the negative consequences of their unwholesome practice of leaving their feed ingredients outdoor until use. And if possible, the regulatory agencies in these countries should enforce a revised GMP as proposed earlier in order to guarantee a more healthy and productive populace.

Table 4 : Microbial profile of stored defatted ground nut, soybean and palm kernel cakes

Sample	Bacterial Isolates	Fungal Isolates
Groundnut cake	*Staphylococcus saprophyticus, Bacillus subtilis, B. licheniformis, B. alveoli, Micrococcus luteus*	*Rhizopus oryzae, Fusarium poae, Aspergillus flavus, A . melleus, A. restrictus, Candida crusei*
Soybean cake	*Proteus mirabilis, Pseudomonas fluorescens, P. aeuroginosa, Bacillus alveoli*	*Rhizopus oryzae, Penicillium herqui, Aspergillus, flavus, A. niger, Candida valida, C. crusei*
Palm kernel cake	*Staphylococcus saprophyticus, Proteus mirabilis, Pseudomonas fluorescens, P. aeuroginosa, Bacillus alveoli*	*Neurospora sitophilus, Candida valida, Aspergillus flavus A. niger, Penicillium actrovercetum*

Table 5 : Aflatoxin (B1 & B2) contents (µg/Kg) of defatted ground nut, soybean and palm kernel cakes stored under different conditions for three months

	Room Temperature Storage time (month)				Refrigeration Temperature Storage time (month)				Display Condition Storage time (month)			
Sample	0	1	2	3	0	1	2	3	0	1	2	3
						Aflatoxin B1						
Groundnut cake	-	34.29^{d}	41.35^{c}	49.26^{bc}	-	22.46^{e}	25.16^{e}	27.24^{e}	-	48.66^{c}	53.84^{b}	61.32^{a}
Soybean cake	-	26.78^{d}	32.74^{c}	41.62^{b}	-	18.94^{f}	20.32^{ef}	22.44^{e}	-	33.25^{c}	42.66^{b}	51.77^{a}
Palmkernel cake	-	21.65^{d}	27.65^{c}	35.28^{b}	-	14.57^{e}	17.68^{e}	20.12^{d}	-	29.14^{c}	37.28^{b}	44.29^{a}
						Aflatoxin B2						
Groundnut cake	-	11.26^{bc}	12.76^{b}	13.85^{b}	-	8.27^{d}	9.34^{c}	10.02^{c}	-	13.25^{b}	14.69^{a}	16.13^{a}
Soybean cake	-	12.14^{c}	13.18^{b}	14.13^{b}	-	6.28^{e}	7.14^{de}	9.28^{d}	-	14.29^{b}	15.37^{ab}	17.04^{a}
Palm kernel cake	-	9.85^{c}	12.94^{b}	13.97^{b}	-	3.24^{e}	6.54^{d}	8.35^{c}	-	12.96^{b}	13.41^{b}	15.29^{a}

Values are means of three determinations. Within row, values with different superscripts differed significantly ($p<0.05$).

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Influence of Reducing Herbicides Rates in Washington Navel Orange Trees

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Abstract - This study was carried out during two successive seasons 2007 and 2008 on 25 years old Washington Navel orange trees Citrus sinensis L.; budded on sour orange root stock growing in a private orchard. To study influence of reducing herbicides rates in Washington Navel orange trees. The present investigation covered the effect of some herbicides with two rates for each (recommended dose and half of recommended dose + 4Kg urea /fed) as well as hand hoeing on controlling weeds spread in citrus orchard. There was a significant depression in fresh weight of grass, broad leaved and total weeds with hand hoeing and herbicides treatments (Touchdown, Fluazifop-butyl and Pendimethalin with recommended and half recommended dose + 4Kg urea/fed) when compared with unweeded treatment. the urea to a half recommended dose of herbicides gave the same effect of the recommended dose of herbicides to broad –leaved and grass weeds in citrus orchard and none showed any phylotoxic effect on the foliage of citrus plants. Pendimethalin IL + 4 Kg urea / fed treatment gave the highest yield / tree when compared with other herbicides treatments.

Keywords : Herbicides, Weed, Washington Navel orange trees.

GJSFR-D Classification : FOR Code: 860703, 860702, 070308

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Strictly as per the compliance and regulations of :

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A.A.A. Hassan

Abstract - This study was carried out during two successive seasons **2007** and **2008** on **25** years old Washington Navel orange trees *Citrus sinensis L.;* budded on sour orange root stock growing in a private orchard. To study influence of reducing herbicides rates in Washington Navel orange trees. The present investigation covered the effect of some herbicides with two rates for each (recommended dose and half of recommended dose + **4Kg urea /fed**) as well as hand hoeing on controlling weeds spread in citrus orchard. There was a significant depression in fresh weight of grass, broad leaved and total weeds with hand hoeing and herbicides treatments (Touchdown, Fluazifop-butyl and Pendimethalin with recommended and half recommended dose + **4Kg urea/fed**) when compared with unweeded treatment. the urea to a half recommended dose of herbicides gave the same effect of the recommended dose of herbicides to broad – leaved and grass weeds in citrus orchard and none showed any phylotoxic effect on the foliage of citrus plants. Pendimethalin **IL + 4 Kg urea / fed** treatment gave the highest yield / tree when compared with other herbicides treatments.

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I. Introduction

Increasing the production of citrus is of great importance. This may be achieved by improving the agronomic practices among which weed control. Weeds on the other hand when found in citrus orchard might cause great problem because weeds compete directly with citrus trees for moisture and soil nutrients. Weed also represents a tool for transmission of pests, and even light in the case of climbing vines, which can easily cover young trees if left uncontrolled (Rao, 2000), (EL - Shamma, and Hassan, 2001), (O'-connell, and 25 Snyder, 2004) and (Yang et al, 2007)

Nowadays, there is a shortage in farm labour and increase in the cost of hand labour and therefore, chemical control of weeds should be put into consideration. The objective of the present investigation was to study influence of reducing herbicides rates in Washington Navel orange Trees by additional of urea to reduce the rate of used herbicides to give the same effect on weeds and less pollution environment. In the end of experiment, the best treatments which showed good control of weeds with regard to their economical cost, will be recommend to use in citrus orchard (Johannes, et al. 2004) and (Gravena, et al 2009).

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II. Material and Methods

The present study was performed during two successive seasons. 2007 and 2008 on 25- years old Washington Navel orange tree *Citrus sinensis L.;* budded on sour orange root stock growing in a private orchard. The trees were planted in clay loam soil at 5 × 6 meters a parts. The Orchard was under the basin irrigation system. All the experimental trees were treated a like for all agricultural practices except for the purpose of this study.

The experiment included the following treatments

1- Touchdown (Glyphosate – trimesium : N-phosphonomethyl glycine trimethyl – sulphonium at 2L/fed)
2- Touchdown (Glyphosate – trimesium : N-phosphonomethyl glycine trimethyl – sulphonium at IL+ 4 Kg urea /fed.)
3- Fluazifop- butyl (Fusilade) butyl 2-[4 – (5-trifluoromethyl -2- pyridyloxy) Phenoxy] propionate at 2L /fed.
4- Fluazifop –butyl (Fusilade) butyl 2-[4 - (5-trifluromethyl - 2 -Pyridyloxy) phenoxy] propionate at 1L+4Kg urea / Fed.
5- Pendimethalin (Stomp 50%), N-(1-ethylpropyl) - 3, 4 –dimethyl – 2, 6- dimitrobenzamine at 2 L / Fed.
6- Pendimethalin (Stomp50%), N-(1-ethylpropyl) -3,4 – dimethyl - 2,6- dimitrobenzamine at 1L + 4 Kg urea /fed.
7- Hand hoeing : Plots were hoed two times a year the first cultivation was carried out in early December, to a depth of about 20 cm, the second was carried out in early July to a depth of about 10 cm.
8- Control : where weeds were left without control to compare the effect of different weed control treatments on the original weed population and to confirm the density of different kinds of weeds.

The spray volume in herbicidal Treatments was 400 L/ feddan all chemical weed control treatments were applied at July of each season.

For each treatment, four replicates were used, each replicate consisted of one tree, and thus we had a total of 32 trees.

The experimental trees were divided into uniform groups according to the tree vigor and productivity. Each group contained a number of treatments and the completely randomized block design was used.

Weeds were hand pulled from a square meter from the middle part of each treatment at 6 weeks and 12 weeks after application of herbicides.

a) Weeds were classified to three groups

1- Grass weeds 2- Broad –leaved weeds
3- Total weeds

Fresh weight per 1m^2 of each group of weeds was determined.

At the commercial harvesting time (approximately the last week of December) in each season the yield was estimated on the basis of number and weight of fruits per tree.

Data obtained in both season were subjected to the proper statistical analysis according (Snedecor and Cochran, 1990).Treatments means were compared using Duncan's multiple range test (Duncan, 1995) at the 5% level of probability.

III. Results and Discussion

a) Effect of weed control treatments on weed population

The dominant weed species encountered in the experimental plots during the two seasons could be arranged in a descending order as follows:

a) Annual broad – leaved weeds included. Small infestation of pigweed *(Amaranthus* sp.*)* purslane weed *(portulaca oleraceae,* L*),* sea beat *(Beta vulgaris,* L*)* Small nettle *(Urtice urens,* L*),* yellow sorrel *(Oxalis corniculata,* L*)* and nettle leaved *(Chenopodium murale,* L*).*

b) Annual grasses, included beard grass *(Polypogon monspeliensils* L.*)* and junglerice *(Echinochloa colonum* L,*)* link.

Fresh weight of broad – leaved grasses and total weeds in gm per square meter as affected by different weed control treatments, after 6 and 12 weeks from application of herbicides in seasons 2007 and 2008 is presented in Fig. (1).

i. *Broad – leaved weeds (g/m^2)*

Data recorded in Fig. (1) revealed that fresh weight of broad – leaved weeds was significantly affected by different weed control treatments. The results also indicated that hand hoeing (twice) treatment gave the best weed control compared with other treatments in both 2007 and 2008 seasons.

Touchdown 2L /fed. treatment as well as touchdown 1L + 4 Kg urea/fed. treatment gave the highest weed control compared with other herbicidal treatments and decreased fresh weight of broad – leaved weeds at 6 and 12 weeks after application of treatments in both seasons.

The results also indicated that pendimethalin 1L+ 4Kg urea/fed. reduced fresh weight of broad-leaved weeds compared to control treatment by about 43.9, 29.8, 43.2 and 38.6 % at 6 and 12 weeks after application in 2007 and 2008 seasons respectively. These results are in harmony with (Kalita and Bhattacharyya, 1995).They reported that application of Glyphosate at 2Kg /ha three times at 60 day intervals and the integrated practice of hoeing followed by Glyphosate at 1 Kg /ha complemented by paraquat at 0.25 Kg / ha + 0.2 % urea controlled weeds in lemon, is very effectively .

ii. *Grass weeds (g/m^2)*

Data recorded in Fig. (1, 2) revealed that fresh weight of grass weeds was significantly by different weed control treatments. The results also indicated that hand hoeing treatment was very effective in controlling grassy weeds after 6 and 12 weeks from application in both seasons and showed the highest efficiency in decreasing fresh weight than control treatment by 89.7, 93.7, 94.2 and 94.3% respectively . The results also indicated that Touchdown 1L+ 4 Kg urea /fed. Treatment gave the best weed control compared with other herbicidal treatments and decreased fresh weight of grass weeds at 6 and 12 weeks after application of treatment in both seasons. This treatment reduced fresh weight of grass weeds compared to control treatment by about 64.9, 74.9 and 80.7% at 6 and 12 weeks after application in 2007 and 2008 seasons, respectively. These results are agreement with (Stephen, et al. 2000), (Liu and Connell, 2003) and (Koloren and Uygur, 2006).

iii. *Total weeds (g/m^2)*

Generally, results in Fig.(1,2) showed that all weed control treatment statistically decreased fresh of total weeds grown in citrus orchard as compared to unwedded treatment. Which recorded the maximum value of fresh weight of total weeds were 1132.5, 1350.0, 1977.5 and 2507.5 (g/m^2).

With regard to application urea to herbicides data indicated that application of urea to a half recommended dose of herbicides reduced the cost of weed control and gave the same effect of the recommended dose of herbicides to broad – leaved and grass weeds in citrus orchard and none showed any phytotoxic effect on the foliage of citrus plants.

This is safety method of weed control in citrus orchard. These results are in agreement with obtained by (Kalita and Bhattacharyya, 1997) found that paraquat at 0.25Kg /ha + 0.2 % urea controlled weeds in lemons very effectively and resulted in improved flowering , fruiting and fruit yield in comparison to other weed management systems.

b) Effect of weed control treatments on tree production

i. *Number of fruits per tree*

Results in Fig. (3) indicate that all weed control induced a significant increase in number of fruit per tree as compared with control treatment, which gave the lowest values in the two seasons.

ii. *Fruit weight*

Fruit weight Fig. (3) was greatly affected by different weed control treatments. The lowest fruit weight was obtained from control treatment which recorded 102 and 101 at seasons 2007 and 2008 respectively. But pendimethalin at 2L /fed. Treatment and pendimethalin 1L+ 4Kg urea /fed. Increased averages of fruit weight compared with other herbicides treatments. This was true in the two seasons.

iii. *Yield (weight/Kg per tree)*

Yield tree as affected by different weed control treatments was recorded in Fig.(3).

The results showed clearly that, the different weed control treatments were great enough to reach the significant level at 5%. The highest yield per tree was produced by hand hoeing twice the increase in yield of tree due to these treatment amounted to 83.8 and 85.0 % in 2007 and 2008 seasons respectively compared to control treatment. From the results of two seasons it could be noticed that fusilade at 2L /fed. treatment and fusilade at 1L + 4Kg urea /fed treatments produced 46.00 Kg /tree and 47.97 Kg /tree at 2007 season it shows that no significant differences between them as well as touchdown at 2L/fed. and touchdown 1L + 4 Kg urea /fed treatments produced 41.56 Kg /tree and 43.49 Kg /tree at the 2008 season. But pendimethalin 1L + 4Kg urea /fed treatment (which produce 59.62Kg /tree and 64.72 Kg/tree at the 2007 and 2008 respectively), gave the highest yield /tree when compared with other herbicides treatments.

This superiority in tree productively may be due to the accumulative effect of weed control treatment that resulted better eradication and hence eliminated dangerous competitive weed grasses, broad – leaved and total weeds) these results are in harmony with (Hassan and Abd El- Naby, 1998) and (Hassan et al, 2006) they reported that all weed control treatments gave high significant increase in the fruit weight and yield as compared with control treatment.

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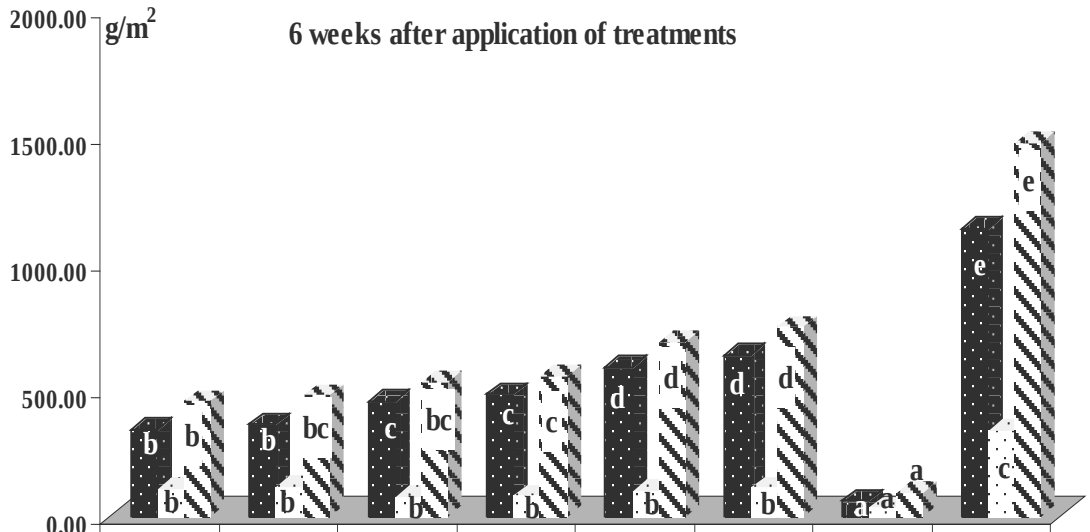
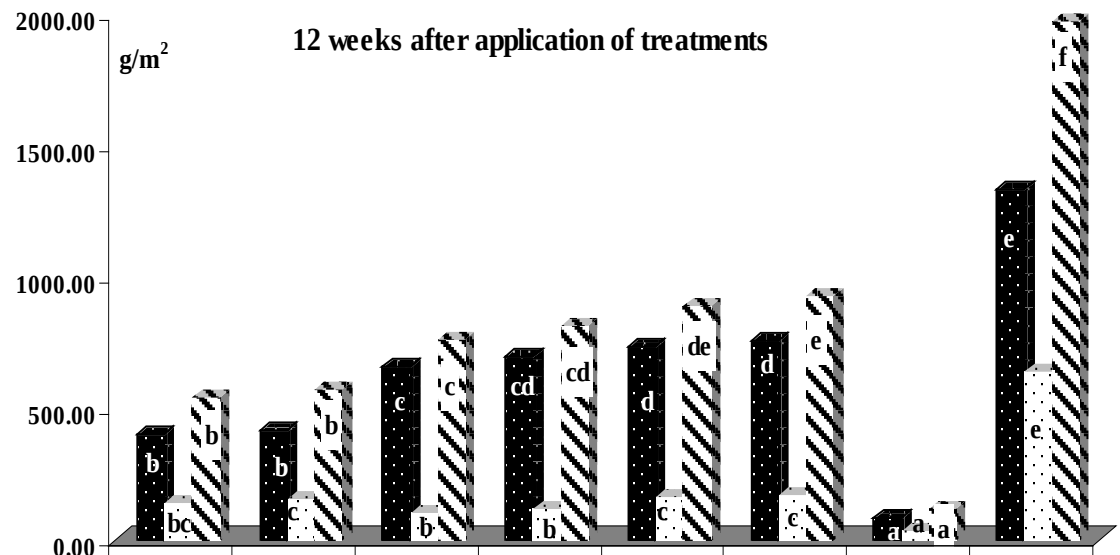
Figure Captions

Fig. 1: Effect of weed control treatments on fresh weight of weeds (g/m2) in season 2007.
Fig. 2 : Effect of weed control treatments on fresh weight of weeds (g/m2) in season 2008.
Fig.3 : Effect of weed control treatments on tree productivity during 2007 and 2008 seasons.

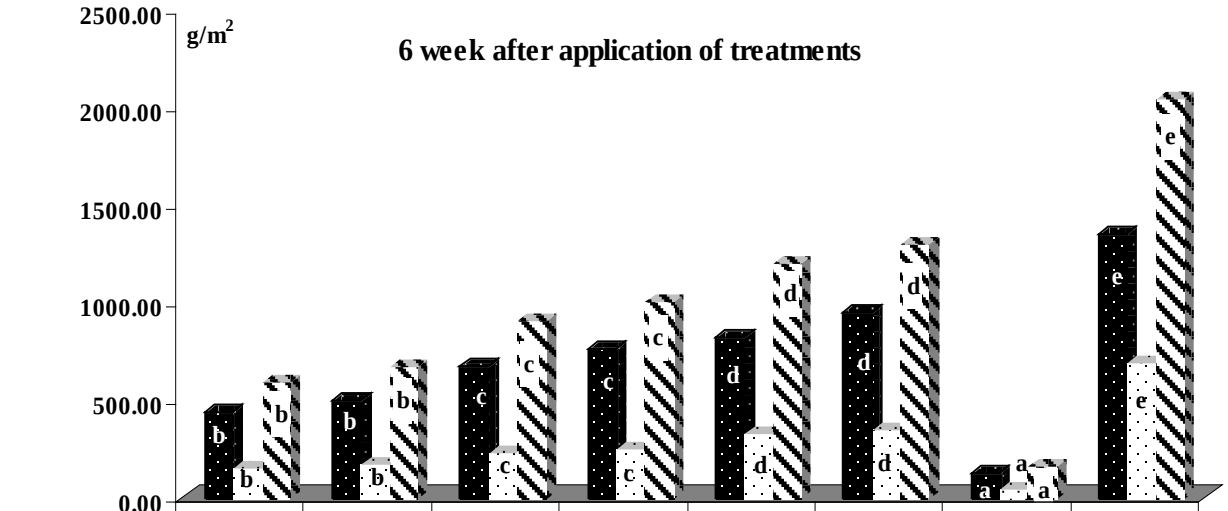


Treatments	Touchdown 2L/fed	Touchdown 1L+4Kgurea /fed	Fusilade at 2L /fed	Fusilad at 1L +4Kg urea /fed	Pendimethalin at 2L/fed	Pendimethalin at 1L +4Kg	Hand hoeing (twice)	Unweeded (control)
Broad - leaved	342.50	360.00	452.50	480.00	587.50	635.00	57.50	1132.50
Grassy weeds	112.50	120.00	78.75	82.50	105.00	115.00	35.00	342.50
Total weeds	455.00	480.00	531.25	557.50	692.50	750.00	92.50	1475.00

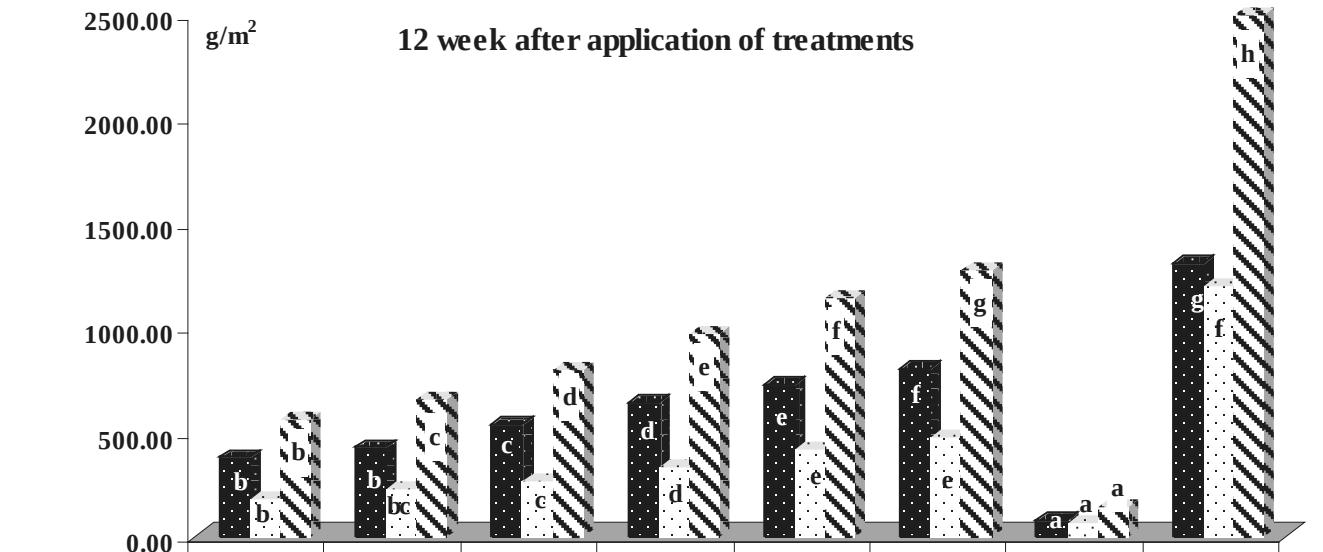


	Touchdown 2L/fed	Touchdown 1L+4Kgurea /fed	Fusilade at 2L /fed	Fusilad at 1L +4Kg urea /fed	Pendimethalin at 2L/fed	Pendimethalin at 1L +4Kg	Hand hoeing (twice)	Unweeded (control)
Broad - leaved	405.00	415.00	660.00	695.00	732.50	755.00	85.00	1330.00
Grassy weeds	142.50	162.50	105.00	120.00	165.00	175.00	37.50	647.50
Total weeds	547.50	577.50	765.00	815.00	897.50	930.00	122.50	1977.50

Fig. 1: Effect of weed control treatments on fresh weight of weeds (g/m2) in season 2007.

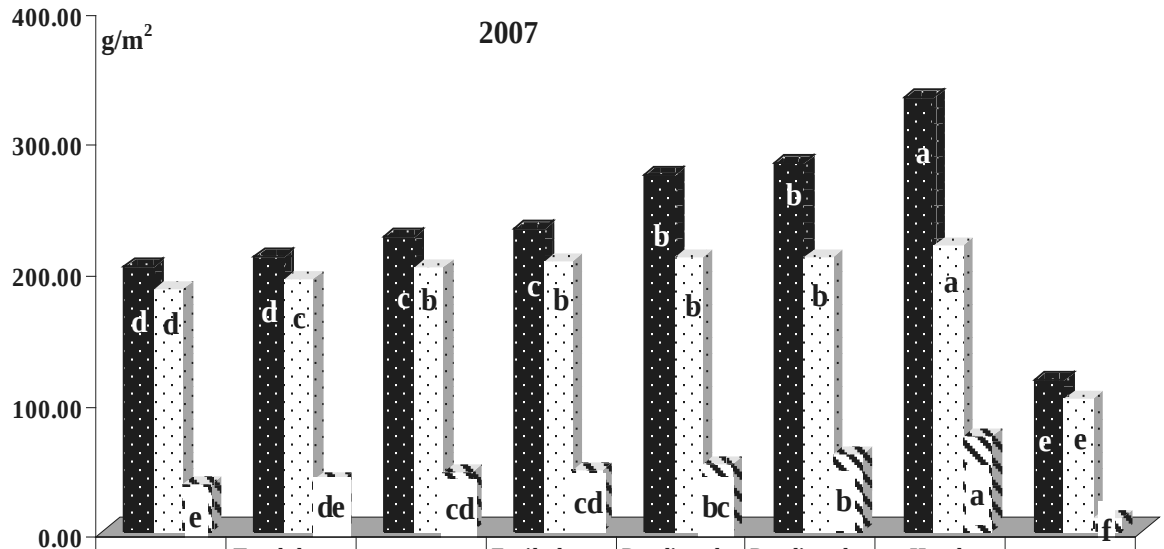


Treatments	Touchdown 2L/fed	Touchdown 1L+4Kg urea/fed	Fusilade at 2L / fed	Fusilad at 1L + 4Kg urea /fed	Pendimethalin at 2L/ fed	Pendimethalin at1L+4 Kg urea/fed	Hand hoeing (twice)	Unweeded (control)
Broad - leaved	437.50	495.00	675.00	757.50	822.50	947.50	122.50	1350.00
Grassy weeds	152.50	175.50	232.50	247.50	332.50	350.00	43.75	695.00
Total weeds	590.00	670.00	907.50	1005.00	1205.00	1297.50	166.25	2045.00

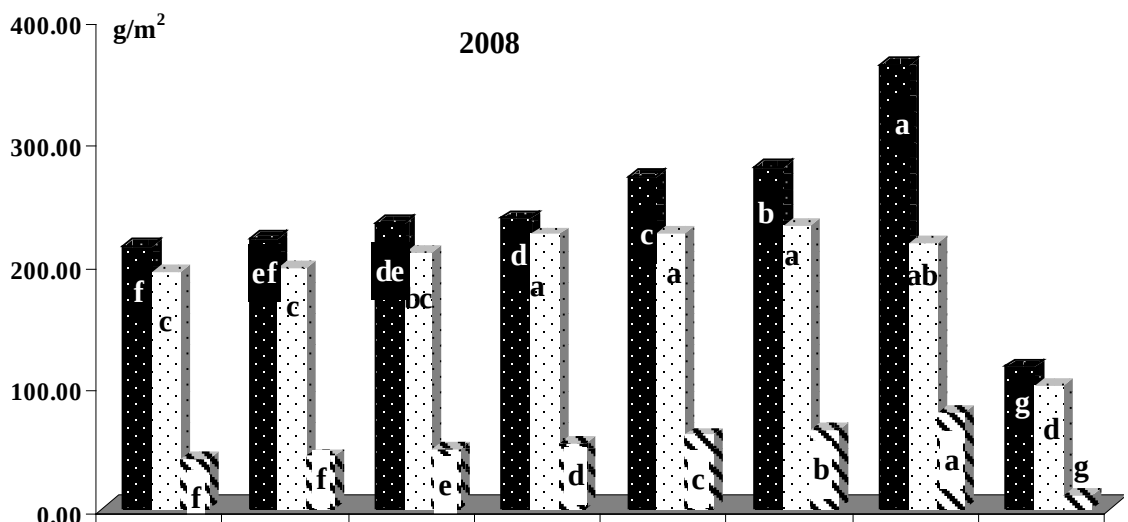


Treatments	Touchdown 2L/fed	Touchdown 1L+4Kg urea/fed	Fusilade at 2L / fed	Fusilad at 1L + 4Kg urea /fed	Pendimethalin at 2L/ fed	Pendimethalin at1L+4 Kg urea/fed	Hand hoeing (twice)	Unweeded (control)
Broad - leaved	377.50	425.00	532.50	640.00	727.50	802.50	77.50	1307.50
Grassy weeds	182.50	231.25	270.00	337.50	420.00	473.75	67.50	1200.00
Total weeds	560.00	656.00	802.50	977.50	1145.50	1276.25	145.00	2507.50

Fig. 2 : Effect of weed control treatments on fresh weight of weeds (g/m2) in season 2008.



	Touchdown 2L/fed	Touchdown 1L+4Kg urea/fed	Fusilade at 2L /fed	Fusilad at 1L + 4Kg urea /fed	Pendimethalin at 2L/fed	Pendimethalin at 1L+4Kg	Hand hoeing (twice)	Unweeded (control)
Number of fruit /tree	203.75	211.00	226.00	231.50	272.50	282.50	332.50	115.75
(Fruit weight (g	185.70	194.00	203.50	207.25	211.00	211.00	220.00	102.00
(Yield /tree (Kg	37.83	40.93	46.00	47.97	52.96	59.62	73.22	11.83



	Touchdown 2L/fed	Touchdown 1L+4Kg urea/fed	Fusilade at 2L /fed	Fusilad at 1L + 4Kg urea /fed	Pendimethalin at 2L/fed	Pendimethalin at 1L+4Kg	Hand hoeing (twice)	Unweeded (control)
Number of fruit /tree	214.00	220.50	233.00	237.00	270.50	279.00	362.50	116.00
(Fruit weight (g	194.25	197.25	209.00	224.50	225.00	232.00	217.00	101.00
(Yield /tree (Kg	41.56	43.49	48.69	53.20	60.86	64.72	78.66	11.71

Fig.3 : Effect of weed control treatments on tree productivity during 2007 and 2008 seasons.

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The National Resource Question and the Potentials of Cartography and Geographic Information Systems as Instruments of Spatial Engineering in a Developing Society

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Abstract - In the last three decades, Nigeria had been confronted with the problem of how to attain balanced and even development. Attempts at resolving this problem had brought about the raging issue of how to evolve an acceptable formula for allocating available resources amongst the various geo-political units. Efforts aimed at evolving such workable arrangements are being hampered by inadequate information on the amount, location and distribution of these resources. Consequently, the problem continues to recur in every facet of national life and have since remained intractable. Against this backdrop, this paper examines crucial issues surrounding the Nigerian resource question, the potentials of cartography and geographic information system (GIS) in resolving these issues particularly as it relates to resource mapping in Nigeria. It goes further to address the place of cartography and GIS as viable instruments of spatial engineering aimed at ensuring balanced development through effective resource allocation in a developing society like Nigeria.

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Abstract - In the last three decades, Nigeria had been confronted with the problem of how to attain balanced and even development. Attempts at resolving this problem had brought about the raging issue of how to evolve an acceptable formula for allocating available resources amongst the various geo-political units. Efforts aimed at evolving such workable arrangements are being hampered by inadequate information on the amount, location and distribution of these resources. Consequently, the problem continues to recur in every facet of national life and have since remained intractable. Against this backdrop, this paper examines crucial issues surrounding the Nigerian resource question, the potentials of cartography and geographic information system (GIS) in resolving these issues particularly as it relates to resource mapping in Nigeria. It goes further to address the place of cartography and GIS as viable instruments of spatial engineering aimed at ensuring balanced development through effective resource allocation in a developing society like Nigeria.

I. Introduction

Resources are fundamental and crucial to development. They serve as basic input necessary for attaining development. Nigeria can only attain development when available resources are effectively mobilized and harnessed towards attaining national goals and objectives as contained in the 1999 Constitution and other policy documents. For resources to be effectively used, there must be adequate information on their types, location, amount and distribution. Availability of this information will guide efforts at ensuring effective allocation and use of resources. Development programmes initiated at various levels of government in recent time have not achieved much due to the absence of the above information needed in fashioning an acceptable arrangement for ensuring effective allocation and use of available resources. Attempts at evolving acceptable and indeed a workable arrangement for resource allocation have thus remained fruitless. Most if not all of this information can be obtained through the application of cartography and GIS.

So far, Nigeria is till lagging behind in the adoption of modern mapping technology. This perhaps explains why mapping is still at a poor state. This scenario not only portend a great danger to the country, but also limits the level of development in the country as there is no data base on which further planning and programme execution can be hinged. Resource mapping as an instrument of providing needed information and allocating available resources in a fair and equitable manner (spatial engineering) has thus suffered a lot of setbacks. This may largely be attributed to lack of commitment on the part of the government as shown by the absence of necessary impetus required to boost its activities. Up till now there exists no viable programme on resource mapping. This stems from the absence of a comprehensible policy and conducive environment for mapping in Nigeria. Past efforts on resource mapping has been largely ad-hoc, uncoordinated and short-sighted (Areola 1982, 1987, 1988 and 1991); Adeniyi(1979,1984,1985a&b, 1986 & 1989) and Balogun (1998). The result has been non-availability of current and reliable information on available resources in the country. Attempts at fashioning workable arrangements on resource allocation have been made difficult. The process of spatial engineering which is predicated on developing means of ensuring efficient distribution of resources among the geo-political units have remained ineffective and problematic. This trend must not be allowed to continue if Nigeria is to be self-reliant and purposeful in the effective management of available resources.

Viewed against this background, the paper makes a strong case for a national programme on resource mapping focused at utilizing the full-potentials of cartography and GIS as an instrument for ensuring effective spatial engineering in Nigeria. In achieving this objective, the paper specifically intends to:

(a) Provide a framework for explaining and clarifying certain concepts relevant to the theme of this paper;

(b) Explore the available tools necessary for spatial engineering as reposed in cartography and GIS;

(c) Review the present state of resource mapping in Nigeria, the organizational framework, achievements and problems;

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(d) Identify fundamental issues and available options involved in the development and execution of a national programme on resource mapping.

a) Conceptual Framework

Concepts central to these of this paper shall be discussed in this section. These concepts seek to shed more light on the major theoretical strands embedded in the arguments developed in the present discourse. Furthermore, they highlight crucial issues as they relate to the place of cartography and GIS in resource development and the critical state it has assumed in the light of present experience in Nigeria.

b) Resources

This is a common term in every day usage. It connotes several meanings depending on the perspective from which it is viewed and the purpose for which it is used. Mitchell (1979); Adeniyi (1985 & 1989); Areola (1982 & 1992), Aweto (2001) have devoted substantial portion of their contributions to the issue of defining a resource. They identified certain issues involved in the evolution of resources and the socio-economic implications it holds for human development. Collectively, the inability to develop an adequate definition for resources may be attributed to following issues:

i. the changing philosophy and nature of resources;
ii. the uses and relevance of resources to human needs and goals;
iii. the complex cultural and technical matters surrounding the concept of a resource.

For our purpose, we may define resources as entities or things that can be used in satisfying human need and additives (inputs) used in the production of good and services. Indeed the concept of resource is better understood if it is considered along side the idea of resistance. Resistance in this context refers to limitations or restrictions on the extent to which an entity can be adopted, identified and assigned to a specific use. Hence the concepts of resource and resistance cannot be separated from one another (Aweto 2001). In all resources could be NATURAL in which case they are found in the physical environment such as minerals, liquids, solid materials and physical substances or HUMAN when they are resident or innate in humankind in form of mental effort, initiative, skills, reasoning power, physical strength, intuition etc. In its strict sense, every development effort is centered primarily on how to adequately allocate and use resources efficiently for the benefits and well being of man.

In recent times, however, the domain of the concept of resources has widened to include the following attributes.

a. A resource is only when it is considered capable of satisfying human wants and needs.
b. Every resource has a specific use ascribed to it.
c. The development of a resource occurs in stages beginning from the perception of its existence. Next is the recognition of its ability to satisfy human needs and finally the development of a strategy devised towards ensuring its full utilization through exploration and eventual exploitation.
d. Resources are dynamic owing to the increasing effects of human knowledge, modern technology and changing societal objectives.
e. Resources are not equitably or uniformly spread over space. This probably explains why some places are more naturally endowed than others.
f. Resources are subjective in nature as they depend on 'individuals' perception and what they are eventually used for.
g. The adoption, use and development of a resource rest squarely on human decision. Man thus stands as the motivating force behind every search for a resource.

c) Resources Analysis and Evaluation

This is a recent field and discipline whose interest centers on determining the amount of available resources, the activities or uses to which they are appropriated and the generation of reliable information about such resources. The objective of the exercise is to determine where the resources are located and how they can be effectively allocated in such a way that they are better utilized. Resource analysis has in the last three decades emerged as a multi-disciplinary activity involving the collaborating efforts of specialists such as geographers, cartographers, economists, surveyors, engineers, and policy makers etc. all of whom provide necessary input into ensuring an equitable and fair allocation of available resources among the various segments of the society. In Nigeria, this field is confined strictly to the domain of certain policy sciences such as geography, economics, and policy administration. Its effective operation had been seriously hampered by the absence of reliable information on the location, stock and distribution of available resources.

d) Resource Management

This is a wider field of activity that is concerned with the process of making far-reaching decisions on principles guiding the identification, exploitation, allocation and eventual use of resources. It encompasses activities such as resource analysis, resource planning, resource survey, preparation and publication of resource inventories in the form of maps and tables etc. Often times it involves deciding on ways of preserving and prescribing means of ensuring the judicious use of resources in order to avoid wastes and inefficiency. Since, this is a wide field; the activities of several professionals are involved. However, these activities are often dominated by the contribution of several professionals particularly policy makers who are expected to advise and guide the use and allocation of resources.

e) Resource Inventory

This is a list or stock of available resources, their quantity, quality, location and distribution. It also provides information on abundant and depleting resources. Most inventories come in the form of maps, tables, and charts. Resource inventories stand as one of the by-products of resource surveys whether comprehensive or simply ad-hoc and it seeks to provide the basic data required in the various processes of resource analysis, planning and development.

f) Spatial Engineering

This is a relatively new concept in spatial and physical planning. It primarily centers on the ways of allocating resources as a means of tackling the problem of uneven development. The major thrust of this activity centers on how to ensure accessibility to available resources equitably over a given geographical area.

Spatial Engineering according to Okafor(2000) involves:

i. the division of a geographical area into district units for the purpose of administration and development.
ii. Creation of new spatial structures in the form of industrial estates, business zones, residential areas for the purpose of allocating available resources. This of course, constitutes the major task in physical planning.

In essence, spatial engineering stands as an instrument in planning used for ensuring fair and equitable allocation of available resources in order to ensure even development and socio-economic well being.

g) Geographic Information System

This is a recent technology used for collecting, storing, manipulating and analyzing spatial data in assisting certain cases that involves decision-making.

h) Cartography

This is a discipline that involves the collection, analysis and presentation of spatial or geographic data in the form of map and other related products as maps, globes, map models etc.

The Nigerian National Resource Question

This is a burning national issue that has over the years generated a lot of controversy particularly since independence. Contributors to this topical issue at different fora believe strongly that it has socio-economic, political and cultural dimensions. Toyo (1993), Kayode (1993), Mbanefo (1993), Dunmoye (2002) in their respective submissions, summarizes the Nigerian resource question as a collection of issues bordering on:

(a) What resources are available in the country?
(b) How should such resources be shared among the various geo-political units?
(c) How gets what and in what proportion? This issue relates to the problem of fashioning out an acceptable formula for resource allocation among the various tiers of government
(d) Who controls the resources? This is a recent dimension in the resource debate. It had recently been resolved through the judicial process. In spite of this, it generated a lot of political tension and heat, which is beyond the scope of this paper.

All the above questions put together simply translates to the issues bordering on the amount of available resources and the formula to be adopted in allocating and using the resources such that it is well appropriated and every segment of the nation is adequately served. Of course, these issues if placed in their proper context reveal the spatial dimension they have since assumed. This implies that a search for an effective solution to this problem requires that the spatial context must not only be acknowledged but be adequately considered whenever attempts are made at fashioning effective arrangement at allocating such resources. This also demands that information be made available regularly as to the amount, location and distribution of these resources such that resources are allocated with due regards to the principles of fairness, equity and distributive justice.

Viewed against this background in the relevance of cartography and GIS as a reliable and effective instrument for providing the basic information required in arriving at an effective allocation formula. No doubt, a lot of principles and formula have been proposed and applied at various times yet the resource debate still abates. It is apparent that most revenue allocation commissions set up so far are yet to tackle the problem effectively. Perhaps, the persistence of this debate constitutes a reflection of the complexity of the resource question. Yet it can never be fully resolved until current and reliable information on resources are made available particularly as it pertains to the type, amount, location, and distribution of resources. It is thus obvious that planning will continue to be shortsighted and defective in the absence of such information. The inability to plan how to allocate and use resources effectively has been largely responsible for the present state of under-development in the country.

There is no gain saying the fact that for balance development to be realized, there is a dire need to seek ways by which the required baseline data on the type, amount distribution and location of resources can be obtained on a regular basis. In recent times, cartography and GIS have come to be recognized as one of the effective means of obtaining, analyzing and representing this information in such a way that they can be directly applied into every planning exercise. The remaining part of this paper addresses the state of resources mapping in Nigeria and the way forward in the development and execution of a national programme on resource mapping. This is seen as a fundamental step

that ought to be taken in the stride towards the allocation and efficient utilization of resources.

The State of Resources Mapping in Nigeria

Resource Mapping is as old as general mapping in Nigeria. This is because mapping is a specialized activity aimed at providing adequate information on physio-cultural features, as they exist on the landscape. Balogun (1985 & 1992), Uluocha (1999), Amori (2001) and Dada (2001) have examined the various stages of resources mapping in Nigeria and all seem to have reached a consensus that there still remains much ground to cover.

By way of definition, resource mapping may be regarded as a collection of activities, programme, efforts and tasks directed towards the production and presentation of baseline information (usually in the form of maps) showing the location, type, availability and distribution of resources both natural and human. Resources mapping can thus be seen as a specialized form of mapping in the sense that its focus is on the presentation, display and production of spatial information on resources available in a given geographical area. Viewed from this angle, one may be tempted to regard it as just an aspect of thematic mapping. However, this may not be entirely so as most resource maps come in large scales and often contain more than one information, for example, topographic maps, cadastral maps and township maps.

Resource maps come in several forms and types. As earlier mentioned, examples include topographic maps, cadastral maps, geological and mineral maps, hydrographic charts, water resources/drainage maps, land use maps, vegetation maps, soil maps, tourist maps, economic maps/trade maps, agricultural map, flow charts, road maps etc. Some of these maps are available and are produced in most cases by specialized agencies usually government organizations. Hence it is clear that resource mapping is a regular exercise and function of the public service in Nigeria. The following table shows the various mapping organizations, their products and attributes:

Table 1: State of Topographic Mapping in Nigeria

Mapping project	No of sheets covering	No of sheets published	% Covering	Period of Publication	Revision
1:500,000	16	16	100%	1952 - 1960	10 sheets revised up to 1960 and 6 sheets revised to 1965
1:500,000 (New Series)	33	8	24.24	1960 – 175	-
1:750,000	15	15	100	1938	-
1:1,100,000	4	4	100	1944, 1988, 1992	-
1:125,000	85	59	72.94	1957 – 1983	1 (Warri) sheet revised in 1983
1:125,000	Only for selected area (337)	227	72	1910	18 sheets revised
1:100,000	357	306	85	1938	Once, 1 sheet 3 times and 1 sheet four times
1:50,000	1,348	1,122	83.23	1949 – 1986	-
1:2,000,000	1	1	100	1924, 1944,1950	-
1:1,500,00	1	1	100	1955, 1956, 1972, 1973, 1988	Use

Table 2 : The State of Resource Mapping in Nigeria

AGENCY	PRODUCTS	CHARACTERISTICS
Federal Survey Department	Topographic Maps, Township Maps, and National Atlas	1:500,000 & 1:750,000 contain maps, agric maps, flow charts, tribal maps etc.
State Survey Department	Ditto	
Geological Surveys	Geological & Mineral Maps	Exists at small and large scales.
Federal Department of Forestry	Vegetation Maps, Land Use Maps.	i. 1:100,000 & 1:250,000 at 69 sheets ii. Compiled from SLAR imageries obtained from the NIRAD project held between 1976 and 1978 and 1995

Federal Department of Agricultural and Land Resources	Soil Maps, Land Use Maps	Exists at scales like 1:250,000 & 1:100,000
National Population Commission	Enumeration Area Maps, Township Maps, Population Maps	i. Mostly sketch maps ii. Not geo-referenced iii. Lacks modern cartographic standards.
Hydrographic Surveys (Nigerian Ports Authority)	National Charts	i. Exists at small and large scales. ii. Used for establishing water courses. iii. Strategic and defense purposes
Department of Civil Aviation (now Nigerian Airspace Management Authority MAMA)	Aeronautical Charts.	Shows the various air routes and extent of the Nigerian Airspace.
Nigerian Meteorological Department (Federal Ministry of Aviation)	Weather & Climatic Charts	Show weather and climatic zones
Federal Inland Waterways Department (Federal Ministry of Transport)	Drainage Map	i. Shows major Nigerian rivers. ii. Depict major drainage patters and regions
Oil Companies (Shell BP, Total, chevron, NNPAC)	Oil concession Maps	i. Shows major oil fields and other potential sources of petroleum resources
Private Mapping Companies (Cartography, Geographical Bureau, Nigerian Mapping Company)	Atlases, Wall Charts, Road Maps, Street Guides, Political Maps	i. A collection of small scale maps covering several themes. ii. Products meant specifically for educational purposes.
Publishing Houses (UPL. Longman, OUP etc	Atlases, wall charts	Ditto
Source : Balogun (1992), Dada (2001) and Field Survey (2002)		

From the above tables, the following can be deduced:

i. Most of the maps are grossly outdated as regular revisions are yet to be made;
ii. Maps produced by private organizations and some official mapping agencies have restricted circulation due to either low production, limited distribution channels or based on security considerations.
iii. Most agencies have not been involved in regular mapping activities in recent times. This is informed by the increasing mapping projects often contracted out by these agencies.

i) Benefits of Resource Mapping in Nigeria

In spite of the low state of resource mapping pint in Nigeria, there is no doubt that if pursued vigorously, it is capable of conferring substantial benefits on the country as a whole. Areola (1985 & 1986), Adeniyi(1985), Eden(1986) identified the following as the benefits accruable from a comprehensive programme on resource mapping:

1. It provides adequate and reliable information on the:

i. amount, types of available resources, their distribution over space, rate of usage and exploitation as shown by the present stock;
ii. capability and potential usage of untapped resources;
iii. identification of resources in terms of their location and composition;
iv. detection of changes in the volume of resources over a given period of time as a result of over-exploitation, deterioration or damage.

2. It facilitates the art of decision-making particularly as it has to do with the planning and control of resource use, its conservation and assessment of quality and quantity.
3. It provides solutions to problems of indiscriminate exploitations of resources owing to excessive usage and possible damage by providing information on alternative sources of resources, their location and stock.
4. It assists in the assessment of the condition of available resources especially on issues such as level of usage forms of degradation or damage and the effects of such on the stock of other resources and the environment in general.
5. It helps in the generation of reliable data, specifically official statistics which is useful in the execution of activities relating to resource, analysis and evaluation.

j) Problems of Resource Mapping

Attempts at enhancing effective resource mapping exercises in Nigeria has been bedevilled with certain problems which have limited the benefits that should normally accrue as a result of availability of reliable maps. Some of the problems include:

1. The absence of a comprehensive programme on resource mapping that would have ensured the effective execution of the various stages involved in resource mapping such as the conduct of systematic resource surveys, classification and inventory of resources as found within Nigeria's territorial space.

2. The death of reliable spatial data on Nigeria's environmental resources as shown by the lack of current maps showing the amount, types and distribution of resources. Available resource maps such as topographic maps, vegetation maps, soil maps etc are not only outdated but most are out of print. They require urgent revision if they are to be used for any meaningful planning exercise and public use. Apart from the huge costs that such a project will involve, the technical and manpower requirements for such exercises are too formidable for the official mapping agencies to afford and bear, at least within the limits of resources available at their disposal.
3. The dependency on foreign and private local consultancy firms to undertake resource mapping projects on behalf of official mapping agencies have made resource mapping to be ad-hoc and fragmented. It is no longer news that most mapping projects in Nigeria in the last four decades were undertaken by foreign consultancy firms and a few private Nigerian mapping companies. This can be attributed to some reasons. First, most official mapping organizations are not technically capable of undertaking large scale mapping projects due to the obsolete equipments they use in their various activities. Not only that, their personnel is not proficient enough in modern techniques of map production and may not be competent to undertake these projects in view of their complex technical nature. Hence, the projects are usually contracted out to the private mapping companies who are technically superior and better staffed to execute them. The present situation is certainly untenable since Nigeria by all standards and level of development is expected to be capable of executing such tasks without recourse to foreign involvement. Yet, the present situation contrasts sharply with this expectation. Hence, the scenario subsists while government continues to demand self-sustenance from her various mapping agencies.
4. Inadequate manpower and staffing within the mapping agencies have made the execution of these projects difficult it not, impossible. The available one are loaded with much duties such that they are unable to cope with the demands of their job. This problem had been further compounded with the inability of these agencies to recruit capable hands to help fill the gap. The result is a management structure that is filled with many officers at the top and few ones at the lower cadre. Balogun (1985b) in addressing the problem of man power shortage in official mapping agencies had identified the following factors:

   i. Constant review of remuneration packages in the public service. Indeed most of the reviews had recommended an upward adjustment of salaries and wages coupled with an attractive pension scheme. These reviews instead of retaining manpower in the public services had on the long run provided incentives for the few lower cadre officers to veer into private practice in view of the attractive remuneration packages. This had resulted in the mass retirement of available manpower to the lucrative private practice. What is more, the prevailing practice of awarding mapping contracts to the few available private mapping companies had further encouraged the early retirements of these officers as their involvement in such projects have kept them busy unlike when they were in public service.

   ii. The increase in official mapping projects following the oil boom period and the prevailing culture of awarding the projects to private mapping outfits had encouraged the drifting of capable hands from official mapping agencies to the private organizations most of whom are better equipped and staffed to undertake such projects.

   iii. Sustained political exercise involving the jurisdictional partitioning (division) of the Nigerian entity into states and local government since 1976. It is instructive to note that Nigeria had had not less than four exercises in state creation within a spade of twenty years. This situation had exacerbated the manpower situation as it created imbalance in staffing resulting in the eventual dispersal and fragmentation of available manpower as most of them had to move to their respective states of origin to start new mapping outfits there. It was not surprising therefore to note that most have remained idle since then, more so when the senior officers had to occupy the top posts with the middle and lower cadres being left vacant for several years.

   iv. Legal enactments and regulation on labour and trade union matters which prohibited private practice while in public employment. This arrangement created certain incentives for those desiring private employment and, made many to opt out of public service earlier than they should.
5. The ad-hoc nature of previous resource mapping projects without an in-built system for ensuring effective monitoring, evaluation and appraisal of executed projects. Experience has shown that as soon as most mapping projects have been completed then all other activities are wound up such that results of the executed projects are left unattended to by way of evaluation. This probably explains why monitoring and evaluation activities in the form of map revision exercise are never undertaken. Once a mapping project is completed, nothing is done by way of review and evaluation and by implication the end of such projects have come. In essence, opportunities for project appraisal as a way of fine-tuning gray areas are thus lost.

Developing a National Programme on Resource Mapping: The Way Out

There is no debate as to the need for a comprehensive programme on resource mapping at least as a step towards ensuring its gains and allowing for a conducive environment where maps are made available as and when required. In instituting such a programme, however, certain issues have to be addressed. The concern in this section is to briefly identify them and also proffer strategies for ensuring the eventual success of the programme whenever it is put in place. The issues include:

(1) There is an urgent need for a policy on mapping and an official body (backed by law) to see to the implementation of the policy. Such a body should be given free hand to coordinate and administer the execution of mapping activities in the country including the adoption and implementation of digital mapping (especially GIS).

(2) The adoption of modern mapping technology particularly GIS by the official mapping agencies as a basic step towards diversifying their activities, enhancing effective map production and much importantly meeting the mapping needs of the country. The implication of this arrangement may boil down to the discarding of obsolete equipment currently in use in these mapping agencies and the acquisition of modern mapping equipment such as computers, workstations, scanners, digitizers, plotters, mapping software etc.

(3) The training of qualified manpower to run the affairs of the mapping agencies. This issue demands urgent and serious attention. Not only must the available manpower be trained regularly as a way of equipping them with latest mapping skills, they should be sent on regular refresher courses as a way of updating their knowledge on their respective beats. The effective training of mapping personnel will help reduce drastically the practice of contracting out important mapping projects. In addition they will be kept busy since they will be actively engaged in one mapping project or the other.

(4) Regular and proper funding of mapping projects especially those initiated by the official mapping agencies. One of the problems affecting effective mapping operations is poor funding in spite of huge budgetary allocation devoted to mapping. The trend must be reversed if resource mapping is to yield the required dividends. Funding does not necessarily have to be solely dependent on the government. The mapping agencies must seek for viable means of generating revenue outside government subvention which unfortunately had been on the decline in recent years due to the prevailing economic crunch. A better way of generating revenue may be to devise better marketing strategies for their various products. They may also need to convince government of the need to actively fund the mapping projects at least as a means of providing reliable and current data required for planning purposes.

(5) Since resource mapping falls largely within the domain of thematic mapping it may be appropriate to consider the establishment of another mapping organization to handle the production of these maps. Currently, the Federal Surveys is saddled with the responsibility of producing the National Atlas, which was published last in 1981 in addition to other mapping functions. This arrangement has made it difficult for the organization to adequately cope with these functions in the face of dwindling financial and materials resources occasioned by the current economic recession. Not only will this arrangement help in relieving the FSD of much workload, it may on the long run help foster professionalism and specialization, which also will increase productivity and efficiency.

(6) A conducive mapping environment is crucial to efficient map production. Hence it is necessary that such an environment be created whereby map users and producers will be afforded the opportunity of interacting regularly in exchanging ideas and also proffer ways by which mapping can be made more effective. Such a forum will equally assist in ensuring the realization of objectives of the various organizations involved in mapping. Needless to say that this proposed arrangement will be better guaranteed whenever the body earlier advocated for is established to coordinate mapping activities in the country.

II. Conclusion

This paper has shown that the current debate on the Nigerian resource question can be effectively resolved by tapping the potential of cartography and GIS as instrument of spatial engineering. The resultant effect will be a better resource mapping base on which future planning will be hinged. The way forward is to initiate positive measures aimed at enhancing the gains and benefits of resource mapping as currently reposed in cartography and GIS.

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Data Envelopment Analysis Approach to Resource - Use Efficiency among Rice Farmers in Anambra State - Nigeria

By Daniel C. Okeke, Christopher O. Chukwuji & O'raye D. Ogisi
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Abstract - This study examines the technical and scale efficiencies for a sample of irrigated and rainfed rice farmers in Anambra State, using data envelopment analysis (DEA). Two(2) local government areas were purposively selected; three communities were randomly selected giving a total of six(6) communities. Twenty five(25) rice farmers were randomly selected from each communities to give a sample size of one hundred and fifty. Structured questionnaire was used to elicit information from the respondents. Data were analysed using descriptive statistics and Data Envelopment Analysis. Results show that irrigated rice farmers were more efficient in resources utilization. The result further indicated a significant scope for a reduction in input usage while maintaining the same output levels. Rice farmers' education level should be improved to enable them take advantage of modern agricultural techniques for improved productivity.

Keywords : irrigated and rainfed farms, Data Envelopment Analysis, Resources-use, Nigeria.

GJSFR-D Classification : FOR Code: 820402, 620103, 849804

DATA ENVELOPMENT ANALYSIS APPROACH TO RESOURCE USE EFFICIENCY AMONG RICE FARMERS IN ANAMBRA STATENIGERIA

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Data Envelopment Analysis Approach to Resource – Use Efficiency among Rice Farmers in Anambra State – Nigeria

Daniel C. Okeke[α], Christopher O. Chukwuji[σ] & O'raye D. Ogisi[ρ]

Abstract - This study examines the technical and scale efficiencies for a sample of irrigated and rainfed rice farmers in Anambra State, using data envelopment analysis (DEA). Two(2) local government areas were purposively selected; three communities were randomly selected giving a total of six(6) communities. Twenty five(25) rice farmers were randomly selected from each communities to give a sample size of one hundred and fifty. Structured questionnaire was used to elicit information from the respondents. Data were analysed using descriptive statistics and Data Envelopment Analysis. Results show that irrigated rice farmers were more efficient in resources utilization. The result further indicated a significant scope for a reduction in input usage while maintaining the same output levels. Rice farmers' education level should be improved to enable them take advantage of modern agricultural techniques for improved productivity.

Keywords : irrigated and rainfed farms, Data Envelopment Analysis, Resources-use, Nigeria.

I. Introduction

A major cause of Africa's increasing poverty is the poor performance of its agricultural sector, which has been the case in most developing world (Kauffmann, 2004). This has resulted in falling incomes and increasing food insecurity. Nigeria is one of the 43 nations that have been classified as "Low income food deficit countries, LIFDCs (FAO, 1997). A survey of 1,718 household in Kano State by FAO (1996) to usher in the Pilot phase of the National Special Programme for food security (NSPFS), showed that 80% were food insecure.

Among the crops of importance in Nigeria, rice is outstanding both in terms of food for the teaming population as well as in terms of income and employment generation to the producers, processors, marketers and others directly and indirectly linked in production-consumption processes. The International Rice Research Institute (IRRI), (1991, 1995) had it that the 360,000 tonnes of rice produce in the 1960s was enough to meet local demand, but, the 1.45 million tones produced in the 1990s was not. Thus, importation rose from 7,000 tonnes in the 1960s to 657,000 tonnes in the 1990s (IRRI, 1991, 1995). The drain on foreign reserve led the Nigerian government to initiate policies aimed at improving production and reducing importation.

Efficient utilization of available resources by the farmers is required to achieve optimum production level. Olukosi and Erhabor (1988) defined efficiency as the quantity of output per unit of input. Efficiency measurement according to Bravo-Ureata and Evenson (1994), is important because it leads to a sustainable resource savings, which have important implications for both policy formulations and farm management. Similarly, Ogunjobi (1999) stated that reasons for efficiency measurement include that it is a success indicator and performance measure by which production units are evaluated and; it is in only measuring efficiency and separating its effects from the effects of the production environment that one can explore hypothesis concerning the sources of efficiency differential.

The cultivable land to rice in Nigeria according to Singh et at (1997) is spread over five major ecologies – upland; inland or shallow swamp, irrigated rice, deep water or floating rice, and tidal mangrove or swamp. The study by Osterbean, Gunnenwe and Huizing (1986); Fashola, Olaniyan, Aliyu and Waktsuki (2000), revealed that the economic productivity (benefit: cost ratio) was higher in the water controlled system of rice production than in other lowland rice production systems.

The resource use efficiency of farmers in both irrigated and rain fed production systems has not been established in the study area using Data Envelopment Analysis approach. The result of this study will direct emphasis on the area of concentration and resource allocation. Thus, the specific objectives of this study are to:

1. examine the socio-economic characteristics of the rice farmers in the study area;
2. determine the technical efficiency as an index of resource use efficiency of the rice farmers for both production systems under the assumption of variable returns to scale.

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II. Methodology

The study was conducted in Anambra East and Ayamelum Local Government Areas of Anambra State, Nigeria. Irrigated rice production and rainfed rice production is carried out in Ayamelum and Anambra East L.G.A. respectively in commercial quantity. The lower Anambra irrigation project (LAIP) of the Anambra-Imo River Basin Development Authority is located in Ayamelum L.G.A. with an area of more than 10,000 hectares. Three community and twenty five farmers from each community were randomly sampled to give a total of 150 respondents for the study.

Primary data for the study was collected using questionnaire. The data collected were analysed using descriptive statistics and Data Envelopment Analysis (DAE) method. Data on socio-economic characteristics of farmers and variable factors of production such as fertilizer, labour, pesticides areas of operation-rainfed and irrigated were collected.

Data Envelopment Analysis (DEA) is a non-parametric mathematical programming technique first used by Farrell (1957) as a piecewise linear convex hull approach to frontier estimation. DEA technique is used to estimate efficiency scores or levels of inputs or outputs from either an input or output orientation by using constant returns to scale (CRS) or variable returns to scale (VRS) models.

Following from coelli et al, (1998) the linear programming models for the input oriented measure of technical efficiency under the assumption of VRS, the envelopment from of the input-oriented VRS DEA model can be specified as:

$$\text{Min}_{\theta\lambda}\theta,$$

$$\text{Subject to} - y_1 + Y_\lambda \geq 0,$$

$$\theta_{Xi} - X_\lambda \geq 0,$$

$$N1^1 \lambda = 1$$

$$\lambda \geq 0.$$

Where θ_1 is the ith firm's technical efficiency (TE) score relative to the other firms in the sample ranging from zero to one. The θ value of 1 indicates a point on the frontier (100% efficiency), otherwise, the firm is operating below the frontier, with various degrees of inefficiency, with zero indicating 100% inefficiency. Scale efficiency (SE) is established when there is variation between the values of efficiency scores in the CRS and VRS models indicating either increasing or decreasing returns to scale (IRS/DRS). (Fare and Grosskopf, 1994).

$$SE_1 = \frac{\theta_1^{CRS}}{\theta^{VRS}}$$

Scale efficiency can vary between zero and one in value. A scale efficiency score of one indicates that the firm is operating at an optimal scale, that is CRS. The resource use efficiency of irrigated and rainfed farms was compared using Z-statistic.

$$Z = \frac{\bar{X}RF - \bar{X}IRR}{\sqrt{\frac{S^2_{RF}}{n_{RF}} + \frac{S^2_{IRR}}{n_{IRR}}}}$$

III. Results and Discussion

Socio economic characteristics of the farmers in Table 1, indicated male dominance in both production system with a ratio of approximately 3:1, 75% against 25% of male to female. Also, the age distribution showed that majority were within the age range of 30-59 years which is the most active labour age. Again, 79% of the farmers were married against 21% that were single. The level of education of the farmers was encouraging. However, the irrigated rice farmers secondary and post secondary education level of 38% and 26% respectively was slightly higher than 28% and 17% of the rainfed farms. The level of coordination of production activities/practices in the irrigated production system, from enquiry, enables the farmers to appropriate time for part time educational studies. Every activity from planting to harvesting is planned such that the slack periods could be utilized for educational engagement.

Technical efficiency was estimated by employing the input orientated DEA models under VRS. The summary statistics is presented in Table 3. The mean technical efficiency VRS score of 77.60 and 58.82 for irrigated and rainfed farms respectively indicate a significant scope for a reduction in input usage by about 23.40% and 41.18% for the two farm category while maintaining the same output levels. Also, the corresponding scale efficiency of 95.01 and 89.66 for irrigated and rainfed farms respectively suggests that by operating on an optimal scale, a further reduction in input usage by as much as 4.99 and 10.34 percentage is possible for irrigated and rainfed farms respectively. This is consistent with Chavas and Aliber, (1993). Wubeneh and Ehui (2006) posted similar result in their resource-use efficiency analysis of wheat farm in Turkey with technical efficiency (VRS) score of 0.79 and TE(CRS) 0.66.

The irrigated rice farmers differed significantly ($P<0.05$) from the rainfed rice farms in technical and scale efficiencies. The result shows that the irrigated rice farmers were more efficient than the rain fed rice farmers with mean difference of 18.78 and 5.35 for technical and scale efficiencies respectively. The farmers in both production system are adviced on the basis of this finding to increase their scale of operation

to further enjoy economies of scale. A firm may be scale inefficient of it exceeds the most productive scale size therefore experiencing decreasing returns to scale or, if it is smaller than then most productive scale size therefore failing to take full advantage of increasing returns to scale (Bayda, 2003).

The efficiency level for both production system in Table 2 and figure 1 differed under the assumptions of VRS model. About 13% of the irrigated farmers as against 6% of the rainfed farms were on the frontier (100% efficient) in resource utilization. Overall, only 9.34 percent of the pooled sample were on the frontier with the rest exhibiting different levels of inefficiency.

Table 1 : Socio-economic characteristics of the rice farmers

Variable	Frequency Irrigated	Rainfed	Total
Gender			
Male	52(74)	61(76)	113(75)
Female	18(26)	19(24)	37(25)
Total	70(100)	80(100)	150(100)
Age (Years)	13(19)	10(13)	23(15)
30 – 39	16(33)	21(26)	37(25)
40 – 49	23(33)	25(31)	48(32)
50 – 59	10(14)	17(21)	27(18)
60 and above	8(11)	7(9)	15(10)
Total	70(100)	80(100)	150(100)
Marital Status			
Single	16(23)	16(20)	32(21)
Married	54(77)	64(80)	118(79)
Total	70(1000)	80(100)	150(100)
Level of Education			
No formal education	9(13)	25(32)	34(23)
Primary education	16(23)	18(23)	34(23)
Secondary education	27(38)	23(28)	50(33)
Post secondary education	18(26)	14(17)	32(21)
Total	70(100)	80(100)	150(100)

Note : Figures in parenthesis are percentage of column totals
Source : Field Survey data, 2011

Table 2 : Variable returns technical efficiency

Technical efficiency	Irrigated	Rainfed	Total
Less than 20%	0(0.0)	0(0.0)	0(0.0)
20 – 39%	0(0.0)	23(29.0)	23(15.33)
40 – 59%	7(10.0)	26(33.0)	33(22.00)
60 – 79%	37(53.0)	17(21.0)	54(36.00)
80 – 99%	17(24.0)	9(11.0)	26(17.33)
100%	9(13.0)	5(6.0)	14(9.34)
Total	70(100)	80(100)	150(100)

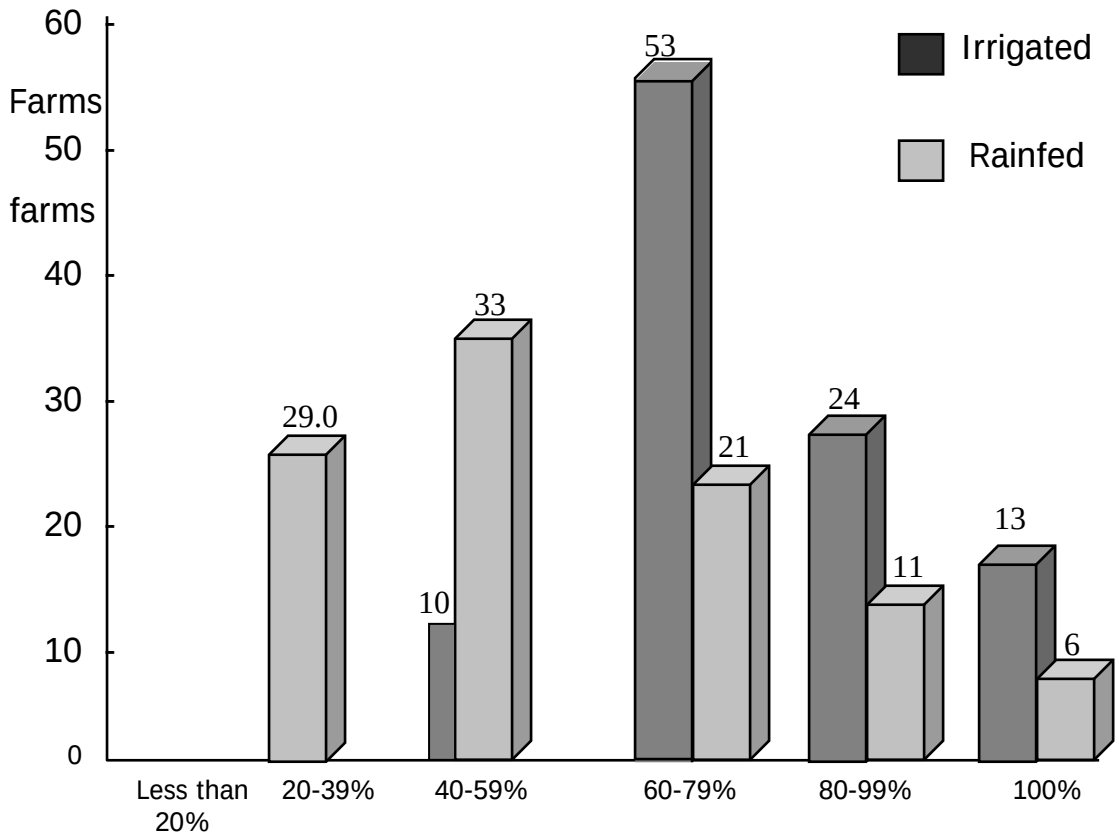
Note : Figures in parenthesis are percentage of column totals.
Source : Field survey data, 2011.

Table 3 : Result of t-test for mean difference

Variable	Irrigated mean	Rainfed mean	Mean difference	df	T	Decision
Technical efficiency	77.60	58.82	18.78	148	8.071	Rejected
Scale efficiency	95.01	89.66	5.35	148	2.132	Rejected

Source : Field survey data, 2011

Figure 1 : Technical efficiency of farmers.



IV. Conclusion and Recommendations

Rice farming was seen to be dominated by male farmers who are married. They were mostly within the age range of 30-59 years and are moderately educated. The mean technical efficiency (VRS) score for both production system indicated a significant scope for a reduction in input usage and, the corresponding mean scale efficiency suggested a possible further reduction in input usage even at optimal scale of operation.

The farmers level of efficiency in resource utilization was on the average low. The irrigated rice farmers were however observed to be more efficient than their rainfed counterpart. The farmers education level should be improved to enable them take advantage of improved agricultural techniques. Also, extension visits should be encouraged for the farmers to be abrest of the new improved farm management practices.

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Possibility of Using Calcite Powder as A Calcium Supplement for Livestock

By Abegaze Beyene
Jimma University College of Agriculture and Veterinary Medicine, Jimma, Ethiopia

Abstract - This research project was conducted to study the possibility of using calcite powder as a calcium supplement for livestock feeding. Samples of calcite powder procured from different parts of India were analyzed for dry matter (DM), total ash, acid insoluble ash and major and trace minerals using Atomic Absorption Spectrophotometer followed by determination of ruminal solubility of calcium carbonate, calcite, dolomite, lime stone powder and di-calcium phosphate powder as source of calcium. The results showed that samples of calcite powder procured from different parts of India, varied in Ca content (%) from 39.0 to 41.3 with an average of 40.03 ± 0.27%. These values were comparable to the Ca content of calcium carbonate samples (39.17 ± 0.3%). However, P and Mg contents of calcite powder were higher than that of calcium carbonate. Mn content of both the calcium sources was similar, but Cu and Zn contents of calcite powder were higher than in calcium carbonate. Levels of toxic minerals like lead and cadmium were lower in calcite powder than in calcium carbonate but the fluorine content in the later was lower than in calcite powder indicating that calcite powder has the potential to be used as a source of calcium in the animal ration.

Keywords : Calcite, Calcium, Livestock, Powder, Ruminal, Solubilty, Supplement.

GJSFR-D Classification : FOR Code: 079902

POSSIBILITY OF USING CALCITE POWDER AS A CALCIUM SUPPLEMENT FOR LIVESTOCK

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Keywords : Calcite, Calcium, Livestock, Powder, Ruminal, Solubilty, Supplement.

I. Introductions

Animal production depends on several factors like genetic, environmental, nutritional and manage - mental practices followed. Nutrition plays an important role in animal production, as more than 50% of the farm expenditure goes towards feeding of animals. All the nutrients (carbohydrate, proteins, fat, vitamins, minerals, and water) are equally important as one or more of these can hamper the productivity of animals when requirements are not fulfilled. Minerals may constitute a small fraction of the total ration but perform vital role in the body. Mineral elements exist in the cells and tissues of the animal body and their characteristic concentrations vary with the element and tissue. The concentrations of essential elements must usually be maintained within the narrow limits, if the functional and structural integrity of the tissues is to be safeguarded and the optimum growth, health and productivity of the animal are to be maintained. Continued ingestion of diets that are deficient, imbalanced or excessively high in a mineral develop biochemical lesions since physiological functions are affected adversely resulting in structural disorders based on the type of the element, degree and duration of dietary deficiency (9).

Large number of livestock in many parts of the world consume diets which do not meet their exact requirements (21), necessitating the need for mineral supplementation. Mineral supplements are nutritional devices to fortify the normal feeds and fodders in the areas to meet the mineral needs of livestock and poultry at specific levels of animal productivity. Mineral supplements are available under various trade names in the market. The Bureau of Indian Standards (BIS) imposes compositional standards of feeds and mineral mixture for different categories of livestock and modifies the standards periodically. (14) recommended the use of bone meal, chalk powder and di-calcium phosphate as a source of Ca and P in mineral mixture. Quality specifications were also laid down (15). (16) allowed the use of calcined bone meal, in addition to steamed bone meal, chalk powder and di-calcium phosphate. In 1982, ISI recommended the use of ground limestone in the list of ingredients for use in formulation of mineral mixture. In 1992 specifications for Mg and S were laid down (5).

In 2002, the BIS withdrew the use of supplements of animal origin i.e. bone meal, di-calcium phosphate of animal origin, calcined bone meal, etc., and allowed the use of calcite powder in mineral mixture. Indian cattle feed industry is using calcite powder on wide scale on account of it's being easily available and cheaper source of calcium (22). (21) reported that various mineral supplements differ in their bio-availability, which must be taken into consideration. Before the use of any such supplement it is necessary to comparatively scan them for availability of useful elements and ensuring the absence of toxic levels of incriminating minerals.

Unfortunately there is no literature on the availability/ utilization of Ca from calcite powder in livestock although; calcite has been used as a buffer in

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high milk producing cows (18). Keeping the above in view it was proposed to study the possibility of using calcite powder as a calcium supplement for livestock with the following objectives:

- To study the content of calcium and other minerals in calcite powder obtained from different parts of India (locations).
- To determine ruminal distribution and disappearance of calcium from calcite powder and its influence on rumen fermentation.

II. Materials and Methods

a) Sample Collection and preparation

Samples of calcite powder were procured from different sources/ locations and compared with pure $CaCO_3$ (Table 1). During the collection efforts were made to procure as many batch samples as possible. Approximately 1-2 gm of dried mineral supplement sample was taken in silica basin and charred to remove smoke and ashed at 550°C in a muffle furnace for two hrs. Acid extract was prepared by quantitative transfer of ash to a dried clean glass beaker to which 20 ml of 5 N HCl was added. This was boiled for 5 minutes and filtered through what man filter paper No. 42 into 250 ml volumetric flask. The filter paper was washed with hot distilled water until free of acid; the volume was made to the mark with distilled water. This extract was used for analysis of Ca, P, Mg, Fe, Cu, Zn, Mn, Pb and Ca.

b) Laboratory Chemical Analysis

The laboratory analysis was run in triplicate for dry matter (DM), total ash, acid insoluble ash (AIA) and major (Ca, P and, Mg), trace (Fe, Mn, Zn and Cu) and toxic minerals (Pb, Cd and F). Total ash and AIA were analyzed by the method of (4). Macro, trace and toxic minerals were analysed using AAS (Hitachi Z-500). Fluorine was estimated using Ion selective electrode method (25) whereas P was analysed by the spectrophotometer method (6) using molybedate reagent.

c) Determination of Ruminal Solubility

In vitro experiments were conducted to determine ruminal solubility of Ca from various Ca supplements at different pH. The calcium supplements included dolomite, dicalcium phosphate (DCP), lime stone powder (LSP) and calcite powder. The solubility data were compared with those of pure calcium carbonate. The procedure of (26) with slight modification was used in the determination. Determination of Ca was made with the help of Atomic Absorption Spectrophotometer. Finally Ca solubility from different Ca sources was estimated by the method given (27) following the formula given below.

$$\text{Ca solubility in SRL (\%)} = \frac{\text{Amount of Ca present in the supplement obtained from 25 ml of ruminal buffer (Aliquot I) - Blank}}{\text{Amount of Ca presen tin 25 ml of uncentrifuged ruminal buffer (Aliquot II) - blank}}$$

III. Results and Discussions

a) Calcium and other Mineral Content of Calcite Powder

The mineral chemical composition of the calcite powder samples analyzed are shown in Table 2, 3, and 4. In the present experiment compositional quality of calcite powder was compared with $CaCO_3$ which is a conventional source of Ca supplement for livestock. It was evident from Table 2, that the content of AIA in calcite powder varied from 0.74 to 4.07 with an average of 2.84± 0.39. The AIA content in $CaCO_3$ was observed to be 1.34 to 1.48 with an average of 1.42 ± 0.04 for AIA. The Ca content in calcite powder varied from 39.0 to 41.3 percent which was quite high and similar to that of $CaCO_3$ (Table 2). (19) reported that carbonate of Ca were rich in Ca contrary to sulphate forms of Ca. The sulphate forms of Ca such as gypsum and phosphogypsum were found to contain 12 - 35.6% Ca. Acid insoluble ash (AIA) content in the calcite powder varied from 0.74 to 4.07 percent with an average of 2.41 ± 1.67 percent. Since calcite powder contained high amount of Ca and low amount of AIA so it could be considered a suitable source of Ca supplement for livestock.

The (7) restricted AIA content to 2.5 to 3.0% in the final mineral mixtures as high levels of AIA lowers the utilization of nutrients and palatability. (3) reported that high levels of AIA in the ration of livestock depressed the utilization of P and certain other micronutrients. It was evident from the (Table 2) that Mg content in the calcite powder obtained from Delhi was highest followed by samples procured from Itola and Dehradoon. The presence of Mg in calcite powder moderate quantity was an added advantage. (13) suggested that lime stone that contained 36.4% Ca can safely be fed free choice mixed with salt to livestock, however due to high Mg CO_3 content (about 5% in dolomite limestone) it should not be used in feeding of poultry. Table 2 further showed that calcite powder contained moderately high levels of Fe and Mn which could be of added advantage in livestock feed. The fluoride content in calcite powder samples varied from 370 to 600 ppm as compared to $CaCO_3$ which contained 380 ppm. (19) reported that marble powder which is also a carbonate form of Ca contained 45-68 ppm F which was much lower than that found in calcite powder. (20) reported that Ca and P content in rock phosphate varied from 20 to 36% and 12 to 18% respectively and that Ca and P content of rock phosphate are observable. They

suggested that high fluoride content present in this supplement to be harmful. In the present study the F content in all the samples of calcite powder was lower than 4000 ppm. (20) suggested that phosphate was safe as it contained <0.4% F.

In India mineral supplements for livestock feeding are marketed under various trade names. The quality standards of such products are regulated according to specification of ISI/ BIS (1962, 1968, 1982, 1992 and 2002). In most cases due to cost considerations Ca sources in mineral mixtures are included in the forms of ores, rocks and other locally available natural sources. Apart from compositional variabilities, in such sources there could be one or more toxic mineral elements (2) which may limit the use of such ingredients, (17) recommended the use of bone meal, chalk powder and DCP as Ca supplements in mineral mixtures. Recently in 2002 in view of growing concern against the use of bovine origin ingredients as mineral supplements to ruminants, in its fourth revision the BIS withdrew the use of mineral supplement of animal origin and has proposed the use of calcite powder in mineral mixture (7). Indian cattle feed industry is using calcite powder on a wide scale on account of its cheaper and easy availability, but the literature is scanty on the efficiency utilization of calcite from calcite powder in livestock, although it has been used as buffer in high milk producing cows (18).

The trace and toxic mineral compositions of the calcite samples analyzed are shown in Table 3 and 4. According to Table 3 and 4, it is evident that all samples of calcite powder investigated in the present study were safe and had low F content. However, F content may vary in samples obtained from different areas and thus need to be checked before incorporating in mineral supplement/ feeds. Perusal of Table 3, further indicated that calcite powder samples contained 39.10 to 106.1 and 1.5 to 6.0 ppm Pb and Cd, respectively where as $CaCO_3$ was found to contain 123.1 to 123.2 and 6.4 ppm Pb and Cd, respectively. (19) observed that various sources of Ca and P contained from 0-100 ppm Pb and 0-5.0 ppm Cd. (12) found that lambs tolerated 15 mg Cd Kg^{-1} DM whereas (11) observed that diet containing as little as 3.0 to 3.4 mg Cd Kg^{-1} DM lowered the Cu status of pregnant ewes and subsequently of the lambs. In view of above discussion Cd concentration of 1.5 to 5.92 ppm found in calcite powder was quite safe even if calcite powder was used as sole supplement in the ration of livestock for meeting the requirement of Ca. According to the results of this study, it could be concluded that calcite powder could be used as a possible alternate source of Ca, because of low AIA and other toxic elements i.e. Cd, Pb and F. However, actual use needs to be confirmed on the basis of solubility studies in the rumen and availability of Ca to the animals. In summary the Compositional scanning of calcite powders obtained from various locations of India suggested that calcite powder had the potentiality of being used as calcium supplement as it contained 40.43 ± 0.27% Ca. The AIA content of calcite powder was also within the limits. Apart from being a potential source of Ca, calcite powder contained moderate quantities of Mg, Fe and Mn which could be of added advantage to livestock.

b) In Vitro Ruminal Solubility

The solubility data of different Ca supplement and pure CaCO3 are presented in Table 5 and Fig. 1. It was observed that at any pH studied, Ca solubility from different chemical forms of supplements was essentially not-similar. At pH 6.0 Ca from calcite powder showed better solubility of 11.15±4.65% while dolomite showed the least solubility than the others. At pH 2.5 calcium carbonate, limestone powder and calcite powder showed higher solubility i.e.72.74±5.47, 72.63±6.12% and 72.39±12.34 respectively. The data (Table 5) further revealed that Ca solubility from various Ca supplements, such as dicalcium phosphate, dolomite, lime stone powder, calcite powder and pure calcium carbonate was not similar even at neutral pH 7. At neutral pH 7 of the buffer the solubility ranged from 1.74 % (dolomite) to 2.94% DCP. By scaling down the pH of the ruminal buffer the Ca solubility was seen to increase in all the cases which are in concurrence with the findings of (19). In case of CaCo3 it reached to 72.74%, whereas in case of dolomite and calcite it was 47.84 and 72.39% respectively. (19) reported the solubility of $CaCl_2$ to the extent of 98.8% in ruminal buffer at pH 4.0. It was further evident as pH approached that of abomasal fluid, the solubility of all forms of Ca studied (Table 5) increased.

Many mineral elements do not have similar solubility in different part of gastrointestinal tract. Solubility of any mineral element in the gastrointestinal tract is an important criteria to assess its availability to the animal (10). (1) observed that ferrous sulphate and ferric chloride had higher biological availability to sheep than ferrous carbonate and ferric oxide as the latter two compounds were less soluble sources of iron. Similarly, (23) reported that Mg from MgO is more utilized by sheep than Mg from dolomite limestone because Mg from former source is more soluble, thus any other mineral which is less soluble is supposed to be less available to ruminants.

Solubility of any mineral in the gastrointestinal tract is related to the prevailing pH at that part of the gut. (24) found that Ca and Mg present in the abomasal contents of sheep were in soluble form. (8) studied the changes in concentration and solubilities of Zn, Mn and Cu in the different parts of alimentary, tract of sheep and found that a relationship existed between the solubilities of the metal and pH values of the gut content. This pattern of changes could be reproduced *in vitro* by adjusting the pH of rumen and abomasal samples.

The calcium solubility at pH 6 and 2.5 increased in all the calcium sources under study. (24) reported that all the Ca and Mg present in abomasal content of sheep

existed as insoluble form in the pH range of 2-3. (8) suggested that pH of gut influenced solubility and availability of certain trace elements. He studied the changes in the concentration and solubility of Zn, Mn and Cu in the different parts of the alimentary tract of sheep and found that a relationship existed between the solubilites of the metal and pH of the gut contents.

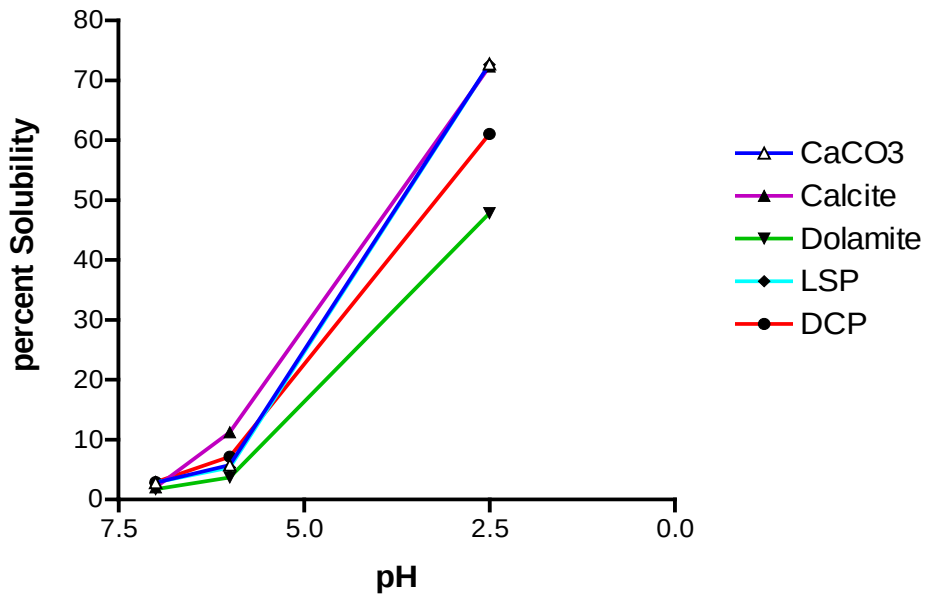

Fig. 1 : In vitro ruminal calcium solubility at different pH

If reaction of the gut influenced the solubility of Ca from different Ca supplement sources to such a great extent, it might be anticipated that the distribution of Ca into soluble and particulate phases in the rumen and flow rates of the two phases from the rumen may influence the rate at which Ca could be made available at the absorption sites lower down the gut. Therefore, different sources of Ca supplements may not be of similar value. Evidently, there is need to modify the quantitative proportion of alternate sources of Ca in a mineral mixture not only on the basis of composition but also on the basis of solubility and net availability. The solubility results of the *In vitro* experiments were compared with that of pure $CaCO_3$. At pH 7.0 the solubility values ranged from 1.74% in case of dolomite to 2.94% in case of dicalcium phosphate. Even the Ca solubility in case of pure $CaCO_3$ was 2.81% at pH 7.0. With decrease in buffered SRL pH these values increased to as high as 47.74 percent in case of pure $CaCO_3$. On decreasing the buffered SRL pH from 7.0 to 2.5, the solubility of all the Ca supplements increased to variable proportions. In summary it was concluded that calcite and lime stone powders may be good source of Ca under the conditions when ruminal pH is towards lower side.

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Effects of Some Socio-Demographic Factors on the Assessment of Public Water Distribution in Iju-Ishaga, Lagos

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Abstract - The study examined the extent to which some socio-demographic factors (gender, age, marital status, occupation, family size, socio-economic background and location (study area) determined public perception of water distribution problems in Iju-Ishaga, a suburb of Lagos. It used 240 respondents (128 males and 112 females) spread across the six wards in the town. Data collection involved the use of questionnaires while multiple regression was used in data analysis. The results showed that 5.6% of variation in public perception of water distribution problems could be attributed to the effect of the socio-demographic variables. Age, gender, marital status, occupation and socio-economic background were significant contributors to the prediction. The results raises critical issues for the effective distribution of public water in Iju-Ishaga. The paper concluded that public water supply can be better enhanced in Iju-Ishaga if there issues are given utmost consideration by agencies responsible for the provision of potable water.

Keywords : Socio-Demographic Factors, Public Water Distribution, Service Delivery, Assessment and Water Reforms.

GJSFR-D Classification : FOR Code: 090509, 960912, 960913, 900404

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Strictly as per the compliance and regulations of :

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I. Introduction

All over the world, the issue of access to safe and potable water supply is such that has received a lot of attention. Indeed, the provision of potable water supply is not only a service accorded public institutions but a right which the society ought not to be denied of. Access to safe and potable public water supply can only be guaranteed where there is an efficient distribution system. This is so because places of water consumption are relatively far from the source, and there ought to be a system whereby water is effectively transported from the source of treatment to the places where they are to be used. To ensure the effective distribution of potable water, pipes and joints are needed to help transport the water to the various users. In addition to this, there must be adequate power supply to allow for the pumping and treatment of water and the movement of water from the main plants through the boaster stations till it gets to the final consumers. Hence, it is clear that in addition to a well defined distribution network, there must be regular power supply that will allow the public water treatment plants and booster stations to operate optimally and by so doing ensure a high service delivery in the provision of public water supply.

In developed countries, due to improved power supply backed up with an ideal maintenance of existing water distribution network, the provision of potable water supply is never a problem. b However, the situation is not the same in the developing countries that is characterized by poor water service delivery and inefficient water distribution system. The result of this has been a limited access to public water supply. It is thus a known fact that access to safe and potable water supply can only be guaranteed by an efficient water distribution system. In otherwords, poor access to public water supply is largely caused by a poor water distribution network Adebayo and Ifabiyi (1999), Walski (1984) and Linsley, et al (1992).

The regular incidents of water pipe vandalisation, leakages due to poor pipe quality, road construction and wide-range erosion have all combined to make the distribution of public water supply a difficult exercise in Nigeria. This problem has not only affected the quality of service provided by public water agencies but made access to public water supply a problem that has defied all known solutions in recent times. The increasing fluctuation in power supply has also made several public water plants to operate below the optimum capacity level which has further compounded the problem of public water distribution.

The severity of the above problem serves as the impetus and rationale for this study. Hence, this study investigated the effect of some socio-demographic variables on the perception of the problems affecting the distribution of water supply in Iju-Ishaga, a suburb of Lagos. This is to help determine the extent to which these variables can influence the way and manner the public perceives the problems of public water distribution in Iju-Ishaga.

a) *Research Problem*

This study determined the extent to which some demographic factors (gender, age, marital status, occupation, family size, socio-economic background and location determined public perception of water distribution problems in Iju-Ishaga, Lagos State.

Specifically, it sought to provide answers to the following questions:

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(i) To what extent would the demographic variables listed above when taken together-predict public perception of water distribution problems in Iju-Ishaga?

(ii) What is the relative contribution of the variables to the prediction of public perception of water distribution problems in Iju-Ishaga.

II. Methodology

a) Sampling and Sampling Procedure

The study used a sample of 240 respondents consisting of 128 males and 112 females spread across six wards in Iju-Ishaga. The respondents were selected using stratified random sampling on the basis of wards and residential location.

b) Instrument

The major instrument used in the study for collecting data from respondents was a questionnaire titled "Questionnaire on the Public Perception of Water Distribution Problems in Iju-Ishaga. It consists of three sections with section A covering issues on personal background information of respondents such as age, sex, occupation, marital status, educational background and family size. Section B covers issues bordering on the nature of problems affecting the distribution of public water supply in Iju-Ishaga while Section C dwells on public perception of problems affecting the distribution of public water supply in the study area. Before administration on respondents, the instrument was tested for reliability and it yielded a cronback alpha value of 0.715.

c) Procedure

i. *Data Collection*

The data collection exercise was undertaken by the researcher with the assistance of two trained research assistants. Questionnaires were administered on the respondents and were retrieved immediately after they had been filled. It lasted three weeks.

ii. *Data Analysis*

Analysis of the collected data involved the multiple regression (backward solution procedure) which examined the relationship between a dependent variables and a set of independent variables. The independent variables in this case are the aforementioned six demographic variables while the dependent variable is perception of water distribution problems in Iju-Ishaga.

Multiple regression was also used in determining the joint and relative contributions of each independent variable to the prediction of the dependent variable. Analyses were computed with the aid of statistical packages for the Social Sciences (SPSS) Software Version 15.0 for windows.

III. Results

The results of the study are presented in tables 1 and 2. Table 1 shows the joint (composite) contribution of the seven independent variables to public perception of water distribution problems. It yielded a multiple regression coefficient ® of 0.237 and a coefficient of determination (R^2) of 0.056. The table also showed analysis of variance for the multiple regression data yielded on F-ratio of 0.178 which is not significant at 0.05 level. From the table, it is evident that the independent variable have a multiple correlation of 0.237 with perception of water distribution problems. This implies that the independent variables do not predict perception of water distribution problems. Similarly, a coefficient of determination of 0.056 was obtained. The implication of this result is that the combination of the independent variables explained or accounted for 2.37% of the variance in perception of water distribution problems leaving 97.63% of the Variance to error and other factors not investigated in this study.

In order to determine the statistical significance of the joint (composite) contributions of these variables to the prediction, analysis of variance was computed as revealed in the ANOVA table. It showed that the correlation value was not significant at 0.05 level as the t significant value of 0.176 is greater than 0.05 level of significance set for the test. The implication of this result is that perception of water distribution problems was not significantly influenced by a combined contribution o the independent variables. In other words, the independent variables did not effectively predict public perception of water distribution problems.

Table 1 : Regression Analysis on Independent Variables Joint Prediction of Public Perception of Water Distribution Problem

Multiple R = 0.237 R Square = 0.056 Adjusted R square = 0.018 Standard Error of the Estimate = 3.279					
Analysis of Variance					
Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F-ratio	Sig
Due to Regression	7	111.153	15.879	0.178	0.176
Due to Residual	174	1870.913	10.752		
Total	181	1982.066			

Table 2 showed the contribution of each of the variables to the prediction of public perception of water distribution problems.

Table 2 : Relative Contribution of the Independent Variables to the Prediction

S/N	Variable	Unstandardized Coefficients B	Standard Error	Standardized Coefficients	T ratios	Sig T	Remarks
	Constant	17.253	1.814		9.513	0.000	
1	Location	-0.699	0.296	-0.187	-2.360	0.019	5*
2	Age	0.156	0.365	0.046	0.429	0.668	NS
3	Sex	0.206	0.542	0.031	0.380	0.704	NS
4	Marital Status	0.011	0.711	0.002	0.015	0.988	NS
5	Occupation	-0.165	0.143	-0.099	-1.160	0.248	NS
6.	Family Size	-0.584	0.463	0.105	1.261	0.209	NS
7	Socio-Economic Background	0.207	0.452	0.037	-0.459	0.647	NS

- *Sig at 0.05*

The contribution of each variables to the prediction of perception on water distribution problems are reflected in the values of the regression coefficient which ranged from – 0.699 to 0.011, standard errors (ranged from 0.143 to 0.711) and standardized coefficients (ranged -0.187 to 0.105); t ratios (ranged from -2.360 to 1.261). In its real sense, the relative or individual contributions of the independent variables are determined by computing the unstandardized regression coefficients, (beta), the standardized weights (b) and the standard error. The estimates above were later tasted for significance so as to ascertain whether the independent variables associated with each value is contributing significantly to the variance in the dependent variables. The information is reflected in the columns on t ratios and the significant. T. The contribution of each independent variable to the prediction of the dependent variables are largely determined by the standardized regression coefficients. They show the potency or otherwise of the contributions of the various independent variables to the prediction of the dependent variable. The standarised regression coefficient is itself a partial correlation coefficient which is a measure of the relationship between an independent and a dependent variable with the influence of other independent variables being held constant. Table 2 shows the unstandardised regression coefficients, the standardized regression coefficient, the standard error of the estimate (Seb), significant T and remarks.

From table 2, it can be seen that, location, occupation and family size had negative beta values of -0.699, -0.615, -0.884 respectively while other independent variables have positive values. This implies that as the value of location, occupation and family size increase, the dependent variables perception of Water distribution problem) decreases.

The column on the standardized regression coefficient as mentioned earlier on shows the contribution of each of the independent variables to the prediction of perception of water distribution problems which is the dependent variable. The column show that variable 6 that is family size with a weight of 0.105 was the most potent contributor followed by variable 2 9age), variable 7 (socio-economic background) Variable 3 (gender) and variable 4 (marital status) with weight of 0.046, 0.0337, 0.031 and 0.002 respectively.

As for the extent to which each of the seven independent variables contributed significantly to the prediction of the perception of water distribution problem, the values of t ratios and significant Tas shows in table 2 indicate that my variable 1 (location) contributed significantly to the prediction of the perception of water distribution problems while other variables had no significantly contributions.

IV. Discussion

The results presented above showed that the independent variables save location, occupation and family size contributed to the prediction of public perception of public water supply in Iju-Ishaga. This goes to show that perception affecting the distribution of public water supply is largely affected by age, gender, marital status and socio-economic background. On the other band, location, occupation and family size had no appreciable impact on the prediction, judging by the negative value of their weights. In other words, perception of problems affecting the distribution of public water supply is not affected by location, occupation and family size. Regardless of location, occupation and size of families, respondents all perceived problems affecting the distribution of public water supply in Iju-Ishaga the same way.

Furthermore, of all the independent variables, only location had a significant T value. This implies that all other variables never had a significant contribution to the prediction.

The implication of the result presented shows that people perceived the problem of public water distribution in Iju-Shaga the same way as they are all aware of the enormous problems affecting the distribution of available water and hence are not adequately served by the existing distribution network. There is no gainsaying the fact that the existing water distribution network in Iju-Ishaga cannot cover adequately the consumers. This has resulted in the occurrence of water scarcity in the area. Respondents covered in the study also confirmed this. It becomes urgent and necessary that problems emanating from the existing distribution network be resolved so as to ensure an effective water supply in Iju-Ishaga.

V. Conclusion

This study sought to determine the effects of some socio-demographic factors on the assessment of public water distribution in Iju-Ishaga. The study established that four variables namely :family size, age, socio-economic background and marital status contributed to the prediction of public assessment of water distribution problems in Iju-Ishaga. Furthermore, location was a significant contributor to the prediction. This implies that family size, age, socio-economic background and marital status had a strong influence on respondents' perception and assessment of water distribution in Iju-Ishaga. In essence, efforts at improving the distribution of public water in Iju-Ishaga must take cognizance of the perception of the public and the influence of the socio-demographic factors especially family size, age, socio-economic background and marital status.

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Application of Rainfall-Potential Evapotranspiration Model for Determining Optimum Planting Date of Yam *(Dioscorea Rotundata)* in a Tropical Wet-and-Dry Climate

By A.O. Eruola , N. J. Bello, G.C. Ufoegbune & A. A. Makinde
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Abstract - The application of Rainfall–Potential evapotranspiration (P - PE) model to yam (Dioscorea rotundata) production was carried out in an on-farm yam trial during the 2006-2007 and 2007-2008 cropping seasons in Abeokuta, South-western Nigeria. The experiment was a 3 x 2 factorial arrangement of three varieties of yam (Efuru, Ise-osi and Oniyere), two planting dates (early and late). The resulting 6 treatments were replicated three times with 14 mounds in each plot, in randomized complete block design. The general model for selecting the planting date of each yam cultivar in the two experimental years was $0.1PE < P < 0.5PE$. This was partitioned for the purpose of attaining optimal planting date into early and late, respectively as $\Sigma(P\text{-}0.1PE) \leq 0$ designated as T_1 and $\Sigma(P\text{-}0.5PE) \leq 0$ as T_2. For the rest of the season defined by $P > PE$, the physiological parameters and hydrothermal agro-climatic indices measured during the different phenological stages of yam grown were analyzed with respect to the various treatments. The result showed that model T_1 defined as $\Sigma(P\text{-}0.1PE) \leq 10mm$ appeared as the best model that significantly $(P < 0.05)$ influenced emergence rate, phenological growth and tuber yield. The implications of the study for appropriate schedule of farm operations vis-à-vis agronomic practices for yam cultivation have been noted.

Keywords : Yam, Rainfall-Potential Evapotranspiration, Planting date, Agro-climatic indices.

GJSFR-D Classification : FOR Code: 070301,070104, 070106

APPLICATION OF RAINFALL-POTENTIAL EVAPOTRANSPIRATION MODEL FOR DETERMINING OPTIMUM PLANTING DATE OF YAM DIOSCOREA ROTUNDATA IN A TROPICAL WET-AND-DRY CLIMATE

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Application of Rainfall- Potential Evapotranspiration Model for Determining Optimum Planting Date of Yam *(Dioscorea Rotundata)* in a Tropical Wet-and-Dry Climate

A.O. Eruola [α], N. J. Bello[α], G.C. Ufoegbune[α] and A. A. Makinde[σ]

Abstract - The application of Rainfall – Potential evapotrans - piration (P-PE) model to yam (*Dioscorea rotundata*) production was carried out in an on-farm yam trial during the 2006-2007 and 2007-2008 cropping seasons in Abeokuta, South-western Nigeria. The experiment was a 3 x 2 factorial arrangement of three varieties of yam (Efuru, Ise-osi and Oniyere), two planting dates (early and late). The resulting 6 treatments were replicated three times with 14 mounds in each plot, in randomized complete block design. The general model for selecting the planting date of each yam cultivar in the two experimental years was 0.1PE <P < 0.5PE. This was partitioned for the purpose of attaining optimal planting date into early and late, respectively as Σ(P-0.1PE) ≤ 0 designated as T_1 and Σ(P-0.5PE) ≤ 0 as T_2. For the rest of the season defined by P> PE, the physiological parameters and hydrothermal agro-climatic indices measured during the different phenological stages of yam grown were analyzed with respect to the various treatments. The result showed that model T_1 defined as Σ(P-0.1PE) ≤ 10mm appeared as the best model that significantly ($P < 0.05$) influenced emergence rate, phenological growth and tuber yield. The implications of the study for appropriate schedule of farm operations vis-à-vis agronomic practices for yam cultivation have been noted.

Keywords : Yam, Rainfall-Potential Evapotranspiration, Planting date, Agro-climatic indices.

I. Introduction

Yam is an important tuber crop in Nigeria and the entire West African region. Nigeria produces about 74% of the total world annual output of about 25million tones of yam (Olasantan, 1999). However, climate change and variability particularly increasing anomaly in the onset, cessation and duration of the rains and incidence of dry spells during the early growth stages of yam has led to low production of yam in many yam growing areas in Nigeria. Consequently, for economic reasons, a number of farmers have shifted to other crops. This has led to relatively low supply and an increase in the price of yam tubers. There is no doubt that tuber yield is influenced by climatic condition, fertile soil, quantity of planting material (seed yam) and considerable labour input and effective agronomic operation (Orkwor, 1990 and Ezeh, 1991). But the variability of moisture based agro-meteorological indices appears as the most critical factor for yam production in the humid tropics. The major concern of farmers is how to minimize the damage to crops during the periods when rainfall exceeds potential evapotranspiration as well as the effect of deficiencies arising from incidence of dry spells when potential evapotranspiration exceeds rainfall amount during the preparatory period. It follows therefore that the P- PE model assumes a great significance in assessing water supply for agriculture and particularly for schedule of farm operations of a crop particularly yam in a rain-fed agricultural region. To this end, this study intends to apply P-PE model to the determination of optimum planting date of white yam in tropical wet-and-dry climate.

II. Materials and Methods

a) *Description of the study area*

The field experiment was conducted at the Teaching and Research farm of University of Agriculture along Alabata road, Abeokuta (7° 15'N, 3°25'E) in Odeda Local Government Area of Ogun State, South Western Nigeria during the 2007 and 2008 cropping seasons(Fig. 1). The study area is characterized by a tropical climate with distinct wet and dry seasons with bimodal rainfall pattern and mean annual air temperature of about 30°C. The actual rainfall totals during the 2007 and 2008 cropping season were 1177.2 and 1201.6mm, respectively. The region is characterized by relatively high temperature with mean annual air temperature being about 30°C. The soil at the experimental site was categorized as a well-drained tropical ferruginous soil. The A horizon of the soil is an Oxic Paleudulf of the Iwo series with 83% sand, 5% silt and 12 % clay with a pH of 6 considered tolerable for yam cultivation (Olasantan, 2007).

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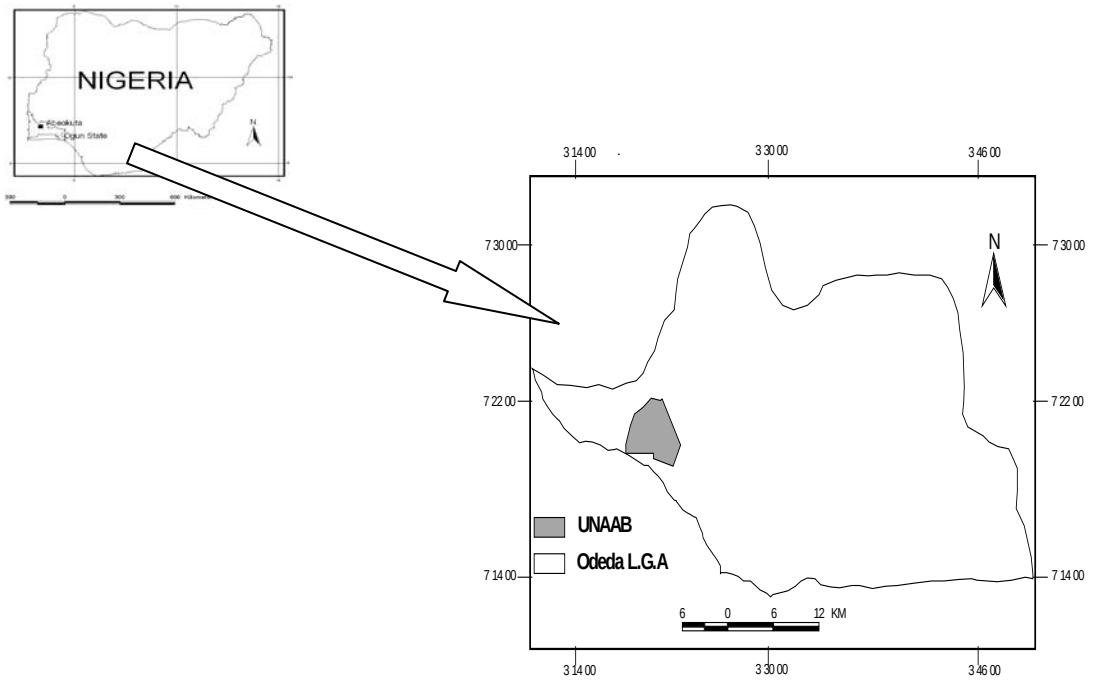


Fig. 1 : Location of University of Agriculture, Abeokuta within Odeda Local Government Area in Ogun State, Southwestern Nigeria.

b) Experimental design and field measurement

The experimental land 30 x 60m^2 had been previously cultivated with beans and groundnut intercrop but left to fallow for over 3 years (from 2004-2006). The site was cleared manually in November 2006, in preparation for the 2006-2007 cropping following the popular practice by the farmers in the study area. This period marks the preparatory period for the cultivation of early yam planting in the study area. Yam mounds were made manually using African hoe during the two experimental years. The mounds were of height 60cm and spaced 1.5 x 1.5m^2 a walk way of 1m between adjacent row. The mound tillage system was selected for the study not only because it is the most widely use method in the study area, but also because it improves the soil aeration and hydrothermal conditions for crops emergence, root development, crop growth and yield (Kutugi, 2002).Three local white yam, *Dioscorea rotundata* cultivars (Efuru, 'A_1; Ise-osi 'A_2; and Oniyere 'A_3) were used. The choice of selection was due to the fact that the cultivars were the most important edible yams widely grown by farmers in the University's extension villages around the study area. During each year of study, rainfall-potential evapotranspiration (P-PE) model according to the procedure of Cocheme and Franquin (1967) were followed to determine start and end of planting. The model used in this study was formulated to incorporate farmer's conventional calendar for yam cultivation. Consequently, planting date was selected based on the following general model $0.1PE < P < 0.5PE$.

where

PE = Potential evapotranspiration

P = Rainfall

0.1PE = One tenth the potential evapotranspiration

0.5PE = Half the potential evapotranspiration

Two specific planting dates (T_1 & T_2) generated from the general model above is as below

$\Sigma(P\text{-}0.1PE) \leq 0$ …….. T_1

$\Sigma(P\text{-}0.5PE) \leq 0$ …… T_2

Where

$\Sigma(P\text{-}0.1PE) \leq 0$ = accumulated difference between rainfall (P) and one tenth the potential evapotranspiration (PE) is zero

$\Sigma(P\text{-}0.5PE) \leq 0$ = accumulated difference between P and half PE records zero

The terms P, PE, 0.1PE and 0.5PE are as previously defined.

It follows that the two planting dates (T_1 & T_2) in each experimental years were determined from the model. For instance, the planting dates for the 2006-2007 experimental year are as below

$T_1 = \Sigma(P\text{-}0.1PE) \leq 24mm$ = March 22 which fell in the 9th decade of 2007

$T_2 = \Sigma(P\text{-}0.5PE) \leq 259mm$ = June 5 which fell in the 16th decade of 2007

Whereas the planting dates for the 2007-2008 experimental year happened to be:

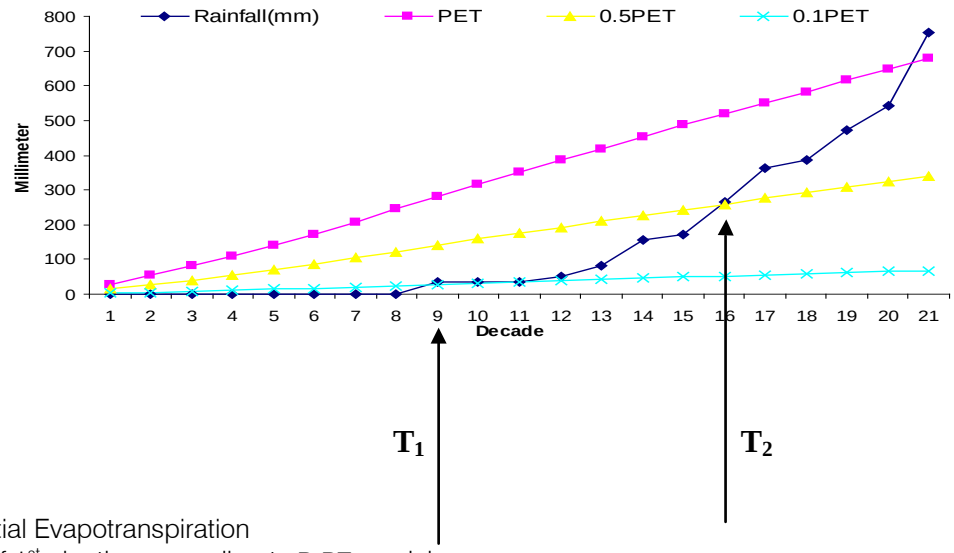
$T_1 = \Sigma(P\text{-}0.1PE) \leq 10mm$ = January 21 which fell in the 3rd decade of 2008

$T_2 = \Sigma(P\text{-}0.5PE) \leq 182mm$ = April 6, 2008 which fell in the 10th decade of 2008

Figures 2 & 3 showed the planting dates for the two cropping seasons 2007 and 2008 respectively.

Using a new knife, each yam cultivar was cut into yam setts weighing an average of 550grams, and

planted at an average depth of 15cm on mounds. The experimental plots were laid out in randomized complete block design (RCBD) with three replicates. After sprouting, the yams were staked to about 3m high and the vines were trained regularly. No fertilizer and insecticide were applied and all plots were regularly hand weeded. Bush rat was controlled by regular clearing of the surroundings of the project site.



Where
PET = Potential Evapotranspiration
T_1 = date of 1st planting according to P-PE model
T_2 = date of 2nd planting according to P-PE model

Fig. 2 : Planting dates as determined using decadal cumulative rainfall–potential evapotranspiration (P-PE) model in 2007 cropping season

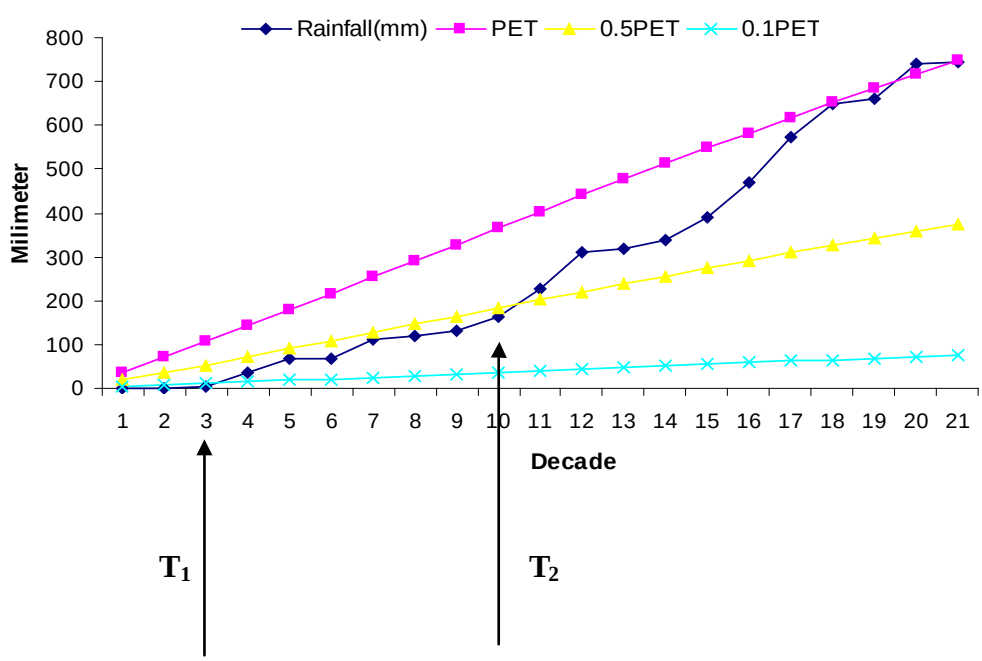


Fig. 3 : Planting dates as determined using decadal cumulative rainfall– potential evapotranspiration (P-PE) model in 2008 cropping season.

The result of yield from experiment (as determined from rainfall – PE model) and the yield obtained from farmers in University's extension villages around the study area, the data gathered from Ogun State Ministry of Agriculture and Ogun state Agricultural Development Program were compared to ascertain the effectiveness of model. The yield from farmers in University's extension villages around the study area were determined from questionnaire administered during the two experimental years.

III. Results and Discussion

In the present study, the P-PE model date of early planting designated T_1, coincided with the date during which the accumulated differences between rainfall (P) and one tenth of the potential evapotranspiration (PE) is zero [i.e $\Sigma(P-0.1PE) \leq 0$]. T_1 had significant influence on emergence rate, vine length, number of leaves, number of branches, number of roots, root length, LAI, tuber length, tuber diameter, tuber weight, number of tuber yield for 2007 experimental year (Table 1&2).

Table 1 : Effect of planting date on growth of three white yams grown at Abeokuta during 2007 cropping season

Factor	Emer. %	Vine length (cm)	No. branch	No. leaves	No. roots	Vine Ø (cm)	Branch length (cm)	Root length (cm)	LAI
Planting season									
T_1	54.6±5.57	137.6±22.9	21.8±2.04	776.3±98.74	24.3±2.33	1.424±0.06	68.7±5.66	32.8±2.58	1.396±0.32
T_2	31.7±4.83	15.3±4.38	15.2±1.92	191.6±29.76	16.2±1.67	1.352±0.05	59.6±5.60	24.5±1.94	0.141±0.04
P	<0.001*	<0.001*	0.017**	<0.001*	0.009*	0.266	0.217	0.016**	<0.001*

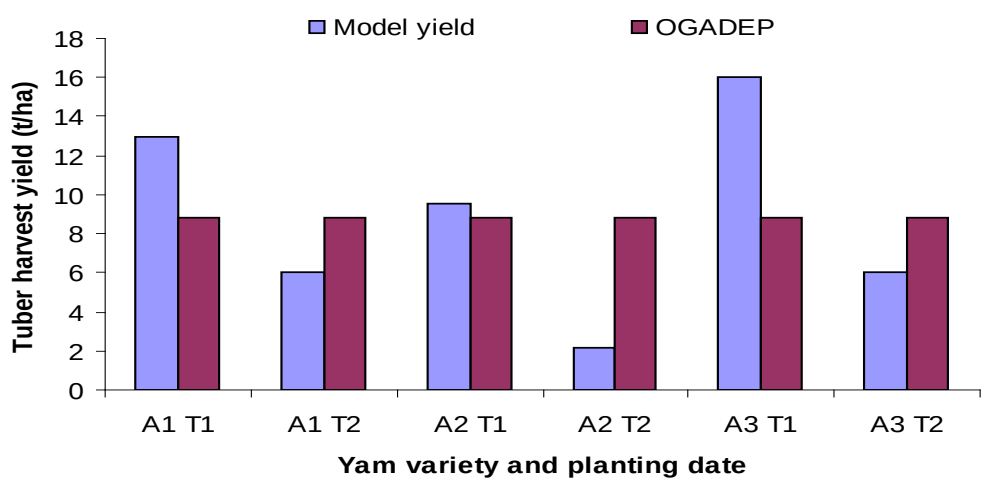
*Significant at P< 0.01 **Significant at P< 0.05

Table 2 : Effect of planting date on yield and yield characteristic of white yams grown at Abeokuta during 2007 cropping season

Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Planting Date					
T_1	30.0±2.73	8.30±0.73	2.60±0.25	1.019±0.13	8.04±1.17
T_2	9.4±2.48	2.59±0.67	0.58±0.16	0.370±0.95	1.42±0.41
P	< 0.001*	< 0.001*	< 0.001*	< 0.001*	< 0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Rainfall variability in 2007 was characterized by late onset of rainfall (i.e. the accumulated difference between P and 0.5PE was very high as shown in Fig. 2.There was prolonged dry spell after planting, during sprouting, emergence period but unbroken succession of wet days at the critical water requirement stage of bulking. These parameters were higher in early planting than late planting. However, the delay in planting using the model date in 2007 experimental year gave a better yield than when the farmer's calendar date (OGADEP) was used as shown in Fig.4 & 5.



Where
T_1= date of 1st planting according to P-PE model
T_2 = date of 2nd planting according to P-PE model
A1,A2,&A3 = Efuru, Ise osi & Oniyere (white yam varities)

Fig. 4 : Effect of planting date on tuber yield of three white yams grown at Abeokuta in 2007 cropping season.

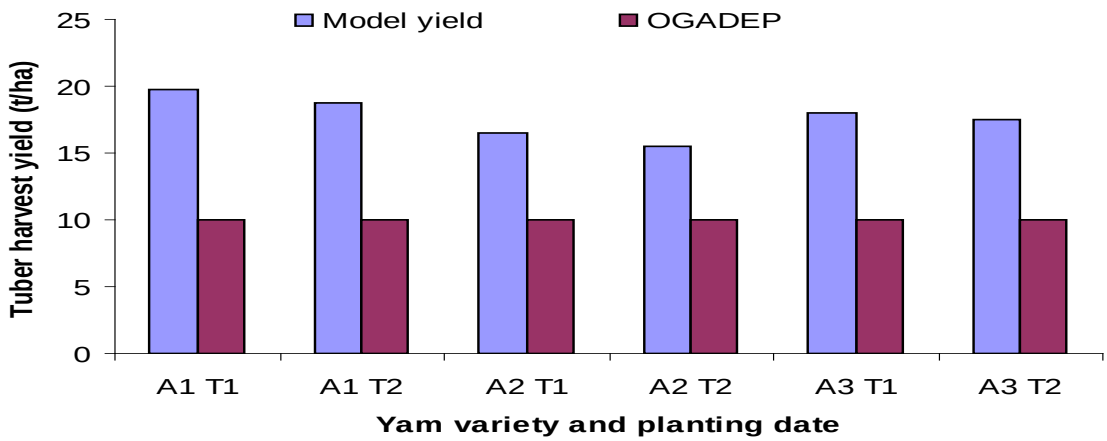


Fig. 5 : Effect of planting date on tuber yield of three white yams grown at Abeokuta in 2008 cropping season.

In 2008 experimental year, early planting was characterized by low accumulated difference between P and 0.5PE which gave no significant difference at P> 0.05 between early planting T_1 and late planting T_2 on the emergence rate, vine length, number of branches, number of roots, vine diameter, root length, branch length, tuber length, tuber diameter, tuber weight, number of tuber and harvest yield (Table 3 & 4). However, for the 2008 experimental year, the P-PE model date of early planting T_1 had significantly influenced number of leaves and LAI. The high leaf area during the early season can be attributed to adequate moisture availability while the high LAI was due to high leaves production and retention of leaves during the early planting than the late planting. The amount of leaf area available during tuber bulking period largely determines tuber yield in yam (Degras, 1993; Enyi, 1972a,b).

Generally, the early planting particularly when the value of accumulated difference between P and 0.5PE were low as in 2008 cropping season was observed to have more yield when compared to early planting of 2007 cropping season that had high accumulated difference between P and 0.5PE which agreed with Bello, (2000). Furthermore, the early planting T_1 when $\Sigma(P\text{-}0.1PE) \leq 0$ was observed to have more yield than late planting T_2 when $\Sigma(P\text{-}0.5PE) \geq 0$ in both experimental years. The high yield from the early planting than the late planting for both experimental years related to the higher LAI which ensures higher bulking rate for a longer period (Osiru *et al.,* 1994) and can also be attributed to phosphorus and mineralized nitrogen which are naturally high during the early rains absorbed by yams during growth (Solubo, 1972 and Okigbo, 1980). While the significant low yield arising from delayed planting until the 9th decade of 2007 experimental year using model and even lower yield when farmer's conventional method (calendar year) was used implied that these natural nutrients were largely unavailable as they might have been lost to leaching. This is more so in view of the fact that the accumulated difference between P and 0.1PE at the 9th decade of 2007 had become significantly high (14-28mm). It is noteworthy that in the case of late onset of rains, farmers may become apprehensive of a planting date that fails to ensure that the crop matures by the end of the rains. Consequently, they may tend to plant immediately after the value of accumulated difference between P and 0.5PE approaches zero in other to avoid possible incidence of drought at critical moisture period of bulking. In the same vein, significant declined in yield occurred when accumulated difference between P and 0.1PE was in excess of 10mm. Thus planting can be done when accumulated difference between P and 0.1PE is less than 10mm (i.e$\Sigma(P\text{-}0.1PE) \leq 10mm$). The implication for the schedule of farm operations for yam cultivation in the area is that land preparation could commence as soon as the accumulated difference between P and 0.1PE approaches zero while mound construction and planting could be done simultaneously immediately. Under no circumstance must farmer delay planting until the accumulated difference exceed 10mm. This schedule is to ensure that adverse effects of high actual water availability are avoided or minimized while, at the same time, precautions are taken against possible shortfall in the duration of the rains, particularly if such an early

Table 3 : Effect of planting date on growth of three white yams grown at Abeokuta during 2008 cropping season

Factor	Emer %	Vine length (cm)	No. branch	No. leaves	No. roots (cm)	Vine Ø (cm)	Branch length (cm)	Root length	LAI
Planting Date									
T_1	74.0±4.13	381±40.29	25.1±2.97	568.1±57.22	29.4±2.82	1.465±0.05	94±9.13	35.5±2.60	1.230±0.17
T_2	68.5±4.6	357±28.03	19.4±2.58	332.6±28.65	21.5±2.19	1.348±0.06	62.7±5.92	28.2±2.02	0.628±0.10
P	0.205	0.424	0.121	<0.001*	0.05**	0.109	0.008*	0.044**	<0.001*

*Significant at P< 0.01 **Significant at P< 0.05

Table 4 : Effect of planting date on yield and yield characteristic of three white yams grown at Abeokuta during the 2008 cropping season

Factor	Tuber length (cm)	Tuber diameter (cm)	Tuber weight (kg)	No of tuber	Harvest yield ton/ha
Planting Date					
T_1	37.7±2.13	11.49±0.644	3.55±0.24	1.133±0.06	12.70±1.16
T_2	34.7±1.56	11.14±0.43	3.13±0.18	1.115±0.03	10.71±1.14
P	0.223	0.575	0.098	0.764	0.043**

*Significant at P< 0.01 **Significant at P< 0.05

onset of the rains is flawed by an abnormal early or sudden cession. In a situation where the onset of the rains is extremely late such that incidence of drought is imminent and the duration of the rains might possibly fall short of 240days (24dacades- growing days of yam), then variety with phenology that synchronize perfectly with the pattern of actual water availability should be selected. Furthermore, apart from the application of mulch immediately after planting to check evaporation and drying out of the plant-soil environment, since leaching of the soil nutrients tends to increase with higher accumulated difference between P and 0.1PE particularly when it is tending towards $\Sigma(P\text{-}0.5PE) = 0$, it implies that for good yield, the use of fertilizer (particularly nitrogen and phosphorous) might be necessary if there is incidence of abnormal heavy and regular downpours immediately after planting. Usually in view of the highly variable nature of rainfall in the climatic region, initial top dressing with 50kg/ha N + 60kg/ha K_2O (Yayock, 1980) fertilizer is quite appropriate.

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Gender Comparison in Production and Productivity of Cocoa Farmers in Ile Oluji Local Government Area of Ondo State, Nigeria

By Ogunniyi, L.T., Ajao, O.A & Adeleke, O.A
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Abstract - The study was conducted in Idanre Local Government Area of Ondo State to analyze the gender and farm technical efficiency of cocoa production(Why the research? Is it to increase productivity or to correct gender issues? State it here). The data were collected from 100 respondents with the use of structured questionnaire, which involved 54 men and 46 women cocoa farmers. The maximum likelihood estimates of frontier model of male farmers showed that only family labour and pesticides were significant while for female farmers, hired labour, insecticides and family size were significant. In addition, the inefficiency model of male cocoa farmers showed that age, education and experience were significant on technical inefficiency while female inefficiency model was significant in education, experience and age of cocoa plant. The technical efficiency showed that a lot can be done to increase the production capacity of both gender in order to make them technically efficient.

GJSFR-D Classification : FOR Code: 070105, 070103

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I. Introduction

Gender is a concept used in social science analysis to look at the role and activities of man and women. Doku (1990) distinguished sex and gender with the definition that sex is a statistics and biological attribute based on natural characteristics and reproductive role while gender is a dynamic, social construction that describes feminine and masculine behavior. The word gender means more than sex. It is culturally ascribed as a role performed by either of the sexes. Aina (2002) viewed the issue of gender as a process by which individuals are born into biological categories of female and male. This could become the social categories of women and men through the acquisition of locally defined attributes of femininity and masculinity. Also, in the recent years, the topic gender especially women participating in the development has become prominent in the literature, democracy and governance. This is due to the establishment of Women In Agriculture (WIA) as a component of Agricultural Development programme (ADP), Better Life for Rural Women Programme (BLP), Family Support Programme (FSP), and Family Economic Advancement Programme (FEAP). It has been pointed out that there is no quantitative and qualitative information about female and female farming in particular (ILO, 1981). Therefore, rural women are usually excluded from development planning. The issue of gender inequality in Nigeria is rooted in the traditional and cultural practices of the society. These include the values and norms that are related to women's reproductive functions that clearly underline gender division of labour (Akanji, 1997). Socio-economic indicators of Nigerian data show that even though women account for forty-nine percent of the population, they only form thirty-nine percent of the total labour force. Most of the women, who are accounted for, in statistics, are found in the agricultural and the informal sector of the national economy.

Furthermore, majority of the population of African countries, including Nigeria, lived in rural areas before independence. This indicates that more than seventy percent of the rural population depended wholly on smallholder agriculture for food and income (Akanji, 1999). The labor force used in farming during those times are household members which comprise of men, women and their children. As a result of this, rural smallholder agriculture remains the major power house for rural growth and livelihood improvement before the emergence of petroleum. So farmers are afraid of the high labour requirements of commercialization of smallholder agriculture and uncertainty of markets from agricultural outputs. Therefore, very few farmers grow high value crops, which are marketed through lucrative marketing boards.

According to Akanji (1999), cash crop farming like cocoa and tea are major occupation of men in African countries including Nigeria. She confirmed that in Ondo women participated State and that they always involved their children in all the tasks where women labour was extremely important in small holder agriculture. Technical efficiency relates to the degree in which a farmer produces the maximum feasible output from a given bundle of inputs (an output oriented measure), or uses the minimum feasible level of inputs to produce a given level of output (an input oriented measure), (Coelli *et al*, 2002).

The level of technical efficiency of a particular farmer is characterized by the relationship between observed productions and potential production (Greene, 1993). The measurement of firm specific technical efficiency is based upon deviations from efficient production frontier. If a farmer's actual production point lies on the frontier it is perfectly efficient. If it lie below

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the frontier then it is technically inefficient, with the ratio of the actual to the potential production defining the level of efficiency of the individual farmer (Ogundele and Okoruwa, 2003).

Therefore, this study is aimed at analyzing the effect of gender and technical efficiency on cocoa production in Idanre local government area of Ondo State. Specifically, the objectives of this study are to examine the cost and return to cocoa production, determine the technical efficiency of the cocoa farmers, and to examine the relationship between the socio-economic characteristics of gender and technical efficiency of cocoa farmers.

The following Hypotheses were tested in its null form;

- There is no significant difference between socio-economic characteristics of male and female owned farms in cocoa production.
- There is no significant difference in the levels of inputs used between male and female owned farms.
- There is no significant difference in the technical efficiencies of male and female owned farms,
- Inefficiency effects are absent from the model.

II. Materials and Methods

The study was carried out in Idanre Local Government Area of Ondo State. Primary data were collected from the respondent using a well structured questionnaire and interview schedule.

The study employed multi-stage random sampling technique for the selection of respondents. The first stage involved random selection of five out of ten wards. Second stages involved the random selection of two villages in each ward. The third stage involved random selection of ten people (male and female) from each village making a total of one hundred cocoa farmers (forty six female and fifty four male). The selection was based on the proportion of male and female registered farmers at the state Agricultural Development Programme (ADP).

The data collected were analyzed using descriptive statistics, budgetary technique and stochastic frontier production function.

The stochastic frontier model for cocoa production in Idanre Local Government Area is defined explicitly as

$$LnQ_1 = \beta_0 + \beta_1 lnx_1 + \beta_2 lnx_2 + \beta_3 lnx_3 + \beta_4 lnx_4 + \beta_5 lnx_5 + \beta_6 lnx_6 + V_i - U_i$$

Where

Q is the total output in tonnes.
X_1 = family labour in man-days.
X_2 = hired labour in man-days
X_3 = pesticides used in litres
X_4 = insecticides used in litres
X_5 = amount of fertilizer used in Kg.
X_6 = area of land cultivated

The β's are unknown parameters to be estimated.
The V_i are assumed to be independent and identically distributed random error having $N(o,\sigma v^2)$ and
The U_i are non-negative random variable called technical efficiency in effect, which are assume to be independently distributed such that U_i is defined by truncation (at zero) of normal distribution with mean, u_i, variance σ^2 where u_i is defined by

$$u_i = \delta o + \delta_1(Age) + \delta_2(Edu) + \delta_3(Exp) + \delta_4(Aop) + \delta_5(ext)$$

Where
Age is the Age of the farm owners.
Edu is Year of education of the farmers
Exp represents Year of experience in cocoa production.
Aop is Age of plant
Ext represents Frequency of extension visit

The stochastic frontier production was run separately for male and female farmers.

III. Results and Discussions

a) *Mean Values of Input and Yield by Sex*

From table 1, the mean yield was 4.87 tonnes for all the farmers. However, further disaggregating revealed that male farmers made 5.79 tonnes while their female counterparts made 3.79 tonnes. Farm size of male was 13.17ha as against 11.78ha recorded among the female farmers. Overall average farm size for all the farmers was 12.5ha. Hence the female farmers cultivate less than the average farm size of the male farmers.

In the use of family labour, the female farmers were highly discriminated against. Thus, the female farmers committed the average of 51man-days of family labour while their male counterpart recorded an average use of 98 man-days. The average man-days of family labour was 77 man-days for all the farmers. A different situation was observed in the case of hired labour. The male farmer recorded 164 man-days while the female counterpart recorded 287 man-days. In the use of fertilizer, the average use of 92kg was recorded among the female farmers. This is less than the half of the average of 200kg recorded by all the farmers. The male farmers, however, recorded an average of 123.5kg in terms of pesticides and insecticides, male farmers use 4.47litre and 5.8litres of pesticide and insecticide respectively as against 1.74litres and 4.35litre recorded by the female farmers. The overall average was 2.69litres of pesticides and 5.13litres of insecticides.

b) *Maximum Likelihood Estimate of Frontier Model*

i. *Maximum Likelihood Estimate of Frontier Model for Male Farmers*

From Table 3, family labour and Pesticides contribute significantly to the output of cocoa in the study area. The coefficients of the variables represent their corresponding elasticities in Cobb-Douglas function. The coefficients of all the inputs is less than one indicating that cocoa production is inelastic to changes in inputs.

The analysis of the technical inefficiency effect model shows that all the variables have the expected signs and only Age, education and experience have significant effect on the level of technical inefficiency. The negative coefficient for age variable implies that the older farmers are less technically inefficient than the younger farmers. The negative coefficient for education implies that farmers with more years of education tend to be less inefficient. Years of experience also have a negative coefficient, indicating that farmers with more experience tend to be less inefficient.

The estimate for the gamma- parameter is 0.70, which means that the inefficiency effects are highly significant in the analysis of the output of the farmers.

ii. *Frequency Distribution of Technical Efficiency of Male Farmers*

The frequency distribution of technical efficiency presented in Table 5 Shows that about 48% of the male farmers had their technical efficiency below 0.5 or 50%, which indicates that there is much opportunity to increase technical efficiency of these farmers. The average technical efficiency of 0.52 shows that, given the level of technology of male farmers, a lot can be done to increase their productivity.

iii. *Maximum likelihood estimate of frontier model for female farmers*

The result of the maximum likelihood estimates of female farmers in Table 5 shows that hired labour, insecticide and farm size were significant and all carried appropriate signs except insecticides. In terms of elasticity, output was found to be inelastic with respect to all the inputs.

The result of the inefficiency effects model shows that only three of the variables are correctly signed and three variables are statistically significant (education, experience and Age of plant). The coefficient of education is negative implying that this factor led to decrease in technical inefficiency of female cocoa farmers. The coefficient of experience is positive indicating that farmers with more experience tend to be more inefficient. The coefficient of age of plant is positive indicating that the older the cocoa plantation is, the more the level of technical inefficiency.

The estimated value of gamma parameter is 0.99 indicating that 99% of total variation in cocoa output is due to differences in technical inefficiency.

iv. *Frequency distribution of technical efficiency of female cocoa farmers.*

The frequency distribution of female cocoa farmers based on their technical efficiency from the Stochastic Frontier Model (Table6) reveals that the predicted farm specific technical efficiencies ranged between 0.03 and 1.00 with a mean of 0.21. Thus in the short run, there is a scope for increasing cocoa production by about 79% by adopting the technology and techniques used by the best practiced farmers. The table also shows that 97.8% of the female cocoa farmers have technical efficiency less than 0.5 and just 2.2% had technical efficiency of 1. This implies that only 1 female cocoa farmer was technically efficient.

c) *Test of Hypotheses*

In this section the four hypotheses stated is tested and inference made on the basis of the result. Two samples T-test for equality of means were used to test the entire stated hypotheses.

i. *t-test for input used between male and female cocoa farmers*

The test for equality of means for the various inputs between male and female cocoa farmers in Table 7 shows that there was no significant difference in the estimated means for farm size, fertilizer, pesticide and insecticide while there is a significant difference in the estimated mean for family labour and hired labour. Thus, while the null hypothesis 1 hold true for farm size, fertilizers, pesticides and insecticide and should be accepted, it does not for the use of other inputs such as family labour and hired labour and therefore should be rejected.

ii. *t-test for socio-economic variable between male and female cocoa farmers*

The test for equality of means in Table 8 reveals that while there was no significant difference in the estimated mean for age, education, experience and extension visit between male and female cocoa farmers, the equalities of mean for family size was highly significant. Analysis of the socio-economic variables between male and female farmers indicated that there were no significant differences in the estimated mean age, education, experience and extension visit. Hence, hypothesis 2 holds true for them and should be accepted. The hypothesis is however rejected for family size as the result indicates a high level of significant difference for this variable between male and female farmers.

iii. *test for technical efficiency.*

The result of the T- test for equality of mean between Male and female farmers'(Table9) shows that there was significant difference between the means of technical efficiency of male and female farmers. Thus hypothesis 3, which says there is no significant difference in technical efficiency between male and female farmers, should be rejected.

iv. *Generalized livelihood- ratio tests of hypothesis for parameters of stochastic frontier production function for Cocoa Farm*

The null hypothesis, that the technical inefficiency effects are not present in the model is expressed by H0: $\infty = 0$.

This hypothesis is rejected for male and female cocoa farmers, while it is accepted for all the farmers. Hence, the average response function is not an adequate representation of the data for male and female farmers while it is for all the cocoa farmers (Table 10).

IV. Conclusion

The study reveals that most of the cocoa producers are not technically efficient which implies a lot can be done to increase their productivity. It is also discovered that most of the cocoa producers are old people which means young ones are not encouraged and adequately trained into cocoa production. Also, most of the producers were not educated which not only make interaction difficult between extension agent and farmer but also makes them receptive to taking risk. It also makes it easy for fake chemicals to be sold to the farmers.

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Table 1 : an Values of Input and Yield by Sex.

	Male-Owned Farm			Female-Owned farm		
Farm Variable	Mean	SD	CV	Mean	SD	CV
Output (tonnes)	5.78	4.625	0.799	3.79	4.325	1.141
Farm size	13.17	8.17	0.620	11.78	7.37	0.626
Family Labour	98.06	62.659	0.639	50.67	41.42	0.817
Hired Labour	164.19	53.80	0.327	287.01	134.30	0.468
Fertilizer	123.50	90.00	0.729	92.00	56.50	0.614
Pesticide	4.47	3.43	0.767	1.74	1.29	0.741
Insecticide	5.80	5.18	0.893	4.35	3.23	0.743

Source : Computed from Field Data, 2005.

Table 2 : Maximum likelihood estimates of frontier model for male farmers.

Variables	Coefficient Standard	Error	t-ratio
General Model Constant	0.37	0.71	0.52
Family labour	0.26	0.12	2.12*
Hired labour	0.09	0.11	0.86
Pesticides	0.37	0.12	3.11*
Insecticides	0.03	0.08	0.39
Fertilizer	0.02	0.02	1.06
Farm size	0.03	0.11	0.30
Inefficiency Model Constant	4.54	1.19	3.82*
Age	-0.04	0.01	-2.82*
Education	-0.49	0.14	-3.52*
Experience	-0.02	0.007	-2.30*
Age of plant	-0.009	0.04	-0.26
Extension visit	-0.02	0.28	-0.09
Variance Parameter			
Sigma-squared	0.22	0.06	3.68*
Gamma	0.70	0.36	1.96*

Source: Computed from Field Data, 2005
**Significant*

Table 3 : Frequency Distribution of Technical Efficiency among Male farmers

Range of Technical Efficiency	Frequency	Percentage
<5.0	26	48
5.0-5.9	8	14.8
6.0-6.9	6	11.1
7.0-7.9	7	13.0
8.0-8.9	6	11.1
9.0-9.9	1	1.9
Total	54	100

Source : Computed from Field Data, 2005

Table 4 : Maximum Likelihood Estimates of Frontier Model for Female Farmers.

Variable	Coefficient	Standard error	t-ratio
General Model			
Constant	0.90	0.99	0.91
Family labour	0.07	0.22	-0.30
Hired labour	0.96	0.24	3.96*
Pesticide	0.14	0.42	0.34
Insecticide	-0.49	0.23	-2.14*
Fertilizer	0.46	0.49	0.95
Farm size	0.42	0.12	3.47*
Inefficiency Model			
Constant	1.94	0.42	4.65
Age	-0.006	0.009	-0.59
Education	-0.09	0.04	-2.19
Experience	0.02	0.008	2.58*
Age of plant	0.09	0.05	2.50*
Extension visit	-0.25	0.28	-0.89
Variance Parameter			
Sigma-squared	0.45	0.09	5.20*
Gamma	0.99	0.0000	2.62*

Source: Computed from Field Data, 2005
**- Significant*

Table 5 : Frequency Distribution of Technical Efficiency of female Cocoa farmers

Range of T E	Frequency	Percentages
<50	45	97.8
5.0-5.9	0	
6.0-6.9	0	
7.0-7.9	0	
8.0-8.9	0	
9.0-9.9	0	
1.00	1	2.2
Total	46	100

Source : Computed from Field Data, 2005

Table 6 : t-test for input use between male and female Cocoa farmers

Input Used	T	Degree of Freedom	Mean of Difference	Standard Error Difference	Decision
Family labour	3.724	98	37.056	34.262	Reject HO
Hired labour	3.453	98	4.031	5.509	Reject HO
Farm size	0.888	98	3.326	6.696	Accept HO
Fertilizer	0.724	98	3.32	2.059	Accept HO
Pesticides	1.551	98	1.22	1.907	Accept HO
Insecticide	1.641	98	1.449	4.058	Accept HO

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 7 : t-test for socio-economic variable between male and female cocoa farmers

Socio-economics Variable	T	Degree of Freedom	Mean Difference	Standard Error Difference	Decision
Age	1.395	98	3.720	2.270	Accept Ho
Education	1.395	98	3.720	2.270	Accept Ho
Experience	1.102	98	3.252	8.008	Accept Ho
Extension visit	1.421	98	0.100	0.266	Accept Ho
Family Size	4.197	98	5.569	8.134	Reject Ho

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 8 : t-test for technical efficiency between male and female cocoa farmers.

Technical Efficiency	T	Degree of Freedom	Mean Difference	Standard error Difference	Decision
Male& female	7.00	98	0.292	0.13	Reject

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

Table 9 : Generalized Likelihood–Ratio Test of Hypothesis for Parameters of the Stochastic Frontier Production Function for Cocoa Farms.

Null Hypothesis	λ	Critical Value	Decision
Male	30.107	14.067	Reject Ho
Female	18.206	14.067	Reject Ho
All farmers	2.810	14.067	Accept Ho

Source ; Computed from the Field Survey Data, 2005
Significant level = 5%

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Manuscript submission is a systematic procedure and little preparation is required beyond having all parts of your manuscript in a given format and a computer with an Internet connection and a Web browser. Full help and instructions are provided on-screen. As an author, you will be prompted for login and manuscript details as Field of Paper and then to upload your manuscript file(s) according to the instructions.

To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

4. MANUSCRIPT'S CATEGORY

Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Abstract, used in Original Papers and Reviews:

Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

The Editorial Board and Global Journals Inc. (US) recommend the use of a tool such as Reference Manager for reference management and formatting.

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Tables: Tables should be few in number, cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g. Table 4, a self-explanatory caption and be on a separate sheet. Vertical lines should not be used.

Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

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Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

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Upon approval of a paper for publication, the manuscript will be forwarded to the dean, who is responsible for the publication of the Global Journals Inc. (US).

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the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

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3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

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11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

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16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

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19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. **Think technically:** Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be

sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page

- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

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The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to

shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
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- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
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- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

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- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
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- Explain materials individually only if the study is so complex that it saves liberty this way.
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- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

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- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

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- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.

- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
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