THE USE OF POWER TILLER FOR SAWAH DEVELOPMENT AND SAWAH SYSTEM BASED TECHNOLOGY FOR RICE PRODUCTION IN SUB-SAHARAN AFRICA

ADEMILUYI Y.S., OBALUM S.E., AZOGU I. I, AND WAKATSUKI T.

OBJECTIVES OF THIS STUDY

1. To evaluate the performance of power tiller in Sawah field
1. To determine the extent of reduction drudgeries involved in rice production
3. To Study the effect on soil physical properties
4. To determine the effect of number of passes on paddy yield
5. To determine the cost effectiveness of the use of Power tiller
6. To examine the socio-economy of power tiller use among the Sawah farmers and finally
7. To discuss the future line of action

SAWAH HYPOTHESES

"The pre-requisite of green revolution in West Africa is low-land Sawah eco-technology which improve rice ecology".

"Sustainable rice productivity of low-land Sawah is ten times more than that of upland rice field, if appropriate low-lands are selected, developed and managed".

Wakatsuki et al.(2009)

THE POWER TILLER

The power tiller is a multipurpose hand tractor designed primarily for rotary tilling and other operations on small farms. (Fashola et al. 2007)

Power tiller is the only power driven farm implement that is effectively being used for "Sawah" activities currently in Nigeria and Ghana.

It can carry out the following operations

- Ploughing, Puddling, Levelling and Smoothening. It can also be used for transportation and powering post harvest equipments

ADVANTAGES OF USE OF POWER TILLER

- Less sophisticated
- Less expensive
- Simple to operate
- Ease to maintain
- Adaptability to inland valleys' ecology
- Versatile applicability
- Higher output and less body effort compared to animal traction
- Imparting the desirable structure to the soil for optimum water retention.

DETERMINATION OF SOIL PHYSICAL PROPERTIES

- Effect of power tiller on the monitored Soil physical properties(included soil moisture content, soil penetrometer and shear vane readings were determined in situ).

EFFECT OF PASSES

- This was carried out by dividing a plot of land into 20 sub-plots and completely randomized. The power tiller operation was carried out on the randomized sub-plots.
- The number of passes on each plots was recorded and the physical soil properties were taken both before and after operation, also, the draught required for each operation was determined. The effect of the passes on rice yield was also evaluated.

ADEMILUYI, Y.S, OBALUM S.E.,AZOGU I.I. AND WAKATSUKI T.

DISCUSSIONS
MECHANICAL PROPERTIES

The average values of between 82.1% and 93% were recorded for field efficiencies for the power tiller at all locations(both in Ghana and Nigeria).
It shows that power tiller is very efficient for paddy field operations.

Higher field efficiency of 93.37% was recorded for VST 130DI Shakti compared to 86.9% for K120 Kubota power tiller. This might be due to the higher values of implement draught and fuel consumption recorded for K120 Kubota power tiller.

ADEMILUYI, Y.S, I.I. AZOGU AND T. WAKATSUKI

SOIL PROPERTIES

- The Power Tiller with the attached tillage tool improved the soil moisture content, reduced shear strength and penetration resistance.

- Porosity measured immediately after operation at different depths showed an improvement down the depth (as shown in figures below).

ADEMILUYI, Y.S, OBALUM S.E.,AZOGU I. I,AND WAKATSUKI T.

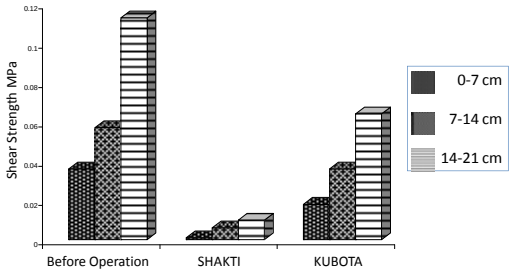
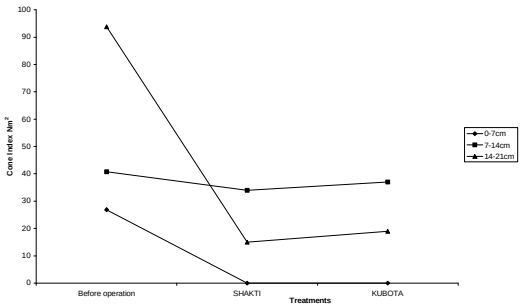


Figure 1: Shear strength before and after tillage operations



Cost Effectiveness of Power Tiller Based Sawah Rice Farming

1. Power Tiller cost:$3000 in Bangkok
   $3000-8000 in Nigeria/Ghana
2. Power Tiller life time:
   10ha sawah development/one power tiller
   25ha-100ha sawah rice farming/one power tiller
3. Paddy yield in sawah: 4-6ton/ha
   Paddy yield in traditional:1-2ton/ha
   Power Tiller cost:
   Sawah development:$500-600/ha
   Sawah rice cultivation:$100-200/ha
   (For the first 5yrs of sawah development:$600-800)
4. Gross revenue and gross cost :
   Sawah based farming : Revenue: $2400-3600/ha,
   Production cost:$500-600/ha
   (For the first 5yrs of sawah development:$1100-1400)
   Traditional farming : Revenue: $600-900/ha,
   Production cost:$200-300ha

SOCIO-ECONOMY

- **The probit model captures or best describe the relationship-the socio-economic characteristics of farmers and the probability of using power tiller(since the chi-square test carried out shows that it was sig. at 1% level)**
- **Summary from socio-economic table shows that 8 variables are significant, i.e., Age(t=2.75)Education level(t=2.79),Membership of farmer grp(t=2.52),Farm size(t=2.02),Land tenure(t=1.82),Practicesawah(t=3.38),Location/ distance of sawah plot(t=-2.14) and Cost of power tiller(t=-2.36).**

ADEMILUYI, Y.S, I.I. AZOGU AND T. WAKATSUKI

Probit Model Output from SPSS 16.0

Table 1: Chi-square goodness of fit

		Chi-Square	df	Sig.	P
Probit	Pearson Goodness-of-fit test	126.335	193	0.967	0.000

Table 2: Regression Coefficients for the Probit Model

Parameter			Estimate	Std. error	T	Sig.	P
Probit	Intercept		-2.53420	0.15497	-16.3526	4.200	.000
	Variables	Age	2.00198	0.00262	2.75536	.980	.000
		Education	2.01452	0.01824	2.79609	.988	.000
		*Farmer group membership	*2.04330	0.08351	2.51850	.970	.000
		Farm size	2.00028	0.01378	2.02012	.804	.001
		Farming experience	0.00286	0.00223	1.28510	.453	.071
		Land tenure	1.02840	0.03485	1.81503	.592	.003
		Tenure period	0.00878	0.02157	0.40716	.135	.130
		Household size involved in farming	0.00203	0.00864	0.23510	.023	.231
		Practice sawah	0.44803	0.13235	3.38529	1.140	.000
		Length of sawah practice	0.01233	0.01659	0.74370	.231	.082
		Location of sawah	-0.04775	0.02233	-2.13832	.812	.002
		Cost of use	-2.01225	0.03395	-2.36091	.832	.001

Note: T is the ratio of Estimate to Std. Error (i.e Estimate/Std. Error)

ADEMILUYI, Y.S, I.I. AZOGU AND T. WAKATSUKI

(Discussion Continue)

EFFECT OF PASSAGE OF POWER TILLER ON PADDY YIELD

- The analysis for the yield showed that there is an increase in the yield (ton/ha) as the number of passes increases from one through four. The analysis was significant at 5% level. The yield output for pass one through three are relatively the same statistically. Four passes however, gave higher yield(5ton/ha) and was significantly different from the yield output of all other passes. Therefore, we conclude that four passes of SHAKTI power tiller give the best output when it comes to yield in ton/ha.

ADEMILUYI, Y.S, I.I. AZOGU AND T. WAKATSUKI

EFFECT OF PASSAGE OF SHAKTI POWER TILLERS ON PADDY YIELD

	YIELDS (MASS/AREA)					
NO OF PASSES	1	2	3	4	5	MEAN
1 PASS	2.5	2.5	2.5	2.5	2.5	2.5
2 PASSES	3.0	2.5	3.5	3.5	3.5	3.2
3 PASSES	3.5	3.5	4.5	4.5	3.5	3.9
4 PASSES	3.5	5.0	6.0	5.5	5.0	5.0

conclusion

1. The use of power tiller make it possible for farmers to develop Sawah by themselves instead of relying on Government or Donor .With this we have left the research stage to dissemination level. It cost about $1500-3,500 to developed an hectare of Sawah field, whereas it cost up to$20,000-30,000 by Donor agent.
2. The rice cultivation and development comes together without any time lag in our Sawah technology approach in both countries of study[Nigeria and Ghana].
3. Because of farmers developed by themselves it makes sawah management ease.

4.Power Tillers are considered appropriate alternative for most farmers in developing countries like Nigeria and Ghana given their common average size of farm and economic situation.

CONCLUSION

- The effects of socio-economic characteristics of the farmers on the probability of using power tillers shows that the availability and cost of purchase of power tiller determine to great extent the use among the rice farmers.
- As the adoption of sawah rice production technology spreads among farmers in Nigeria and Ghana, the consequent effect of socio-economic characteristics on the use of power tiller a major component should be given adequate attention.
- Passage of power tiller has significant effect on the paddy yield with the lowest yield of 3.2ton/ha and highest yield of 5.0ton/ha recorded at one pass and four passes respectively

1. FUTURE WORKS

- INTEGRATION OF SAWAH TECHNOLOGY INTO NATIONAL FADAMA III PROGRAMME IN NIGERIA

This shall be divided into three stages viz;

1. Establishment of Demonstration Sawah sites
In the six geo-political zones and FCT[NE,NW,SE,SS,SW,NC and FCT]

2.Establishment of Sawah Demonstration sites at selected locations in each of the 36 states

3.Establishment of Sawah Demonstration sites in each of the 641 LGAs,covered[out 774LGAs] by the Fadama III programme.

4.Nigeria has the largest potential rice area in Sub-Saharan Africa with Area of above one-third of the total Rice area in Sub-Saharan Africa[3million hectares of rice area].We believed with this spread Sawah will Soon become household name in Nigeria and SSA with the expected high yield Of atleast 4ton/ha.