AGRICULTURAL MACHINERY USE-MANAGEMENT IN RIVERS STATE

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ABSTRACT

A study on Agricultural Machinery use-management was carried out in Local Government Areas (LGAs) and five (5) Institutions in Rivers State. Questionnaires were administered on respondents in the various institutions, agricultural establishments. Data were collected from farms, owned by either the government or private sectors. Data groups included number of tractors, type, make & model of tractors; status at purchase of equipment; types of operation by tractors; conditions of tractors and implements; hourly engagement of the tractor in a year. The data were analysed using descriptive statistics and the coefficient of rank correlation. The result showed that Rivers State University farm had the highest hourly engagement of 120 hours and 0.001% Coefficient of Variability (CV). Obio-Akpor/ADP had a sum of 88 hours and CV of 19%, SIAT, Ubima Estate and Ikwerre/Vintage Farm LTD had 80 hours and 0.01% CV each while Prison Farm, Elele had 45 hours of 35% CV. On operations, RSU farm was highest (240) followed by Ikwerre/Vintage Farm LTD (19), Prison Farm, Elele (11), Obio-Akpor/ADP and SIAT, Ubima Estate performed 10 different field operation each resulting to CV: 0.23%, 19%, respectively. The finding that hourly engagement of 120 hours of RSU farm indicate the highest obtain when compared with others with respect to standard working hour of 1,000 of a tractor. The Ferguson-models 135 and 240 were the mostly used tractors in Ikwerre/Vintage Farm LTD and SIAT, Ubima Estate had two new model each with average age of 7 years while Obio-Akpo/ADP had one old model of 15 years old. Massey Swaraj-model 978FE and Steyr were operated by other LGAs and institutions all old models. There was significant difference ($P<0.05$: $PV=0.043615$) between hourly engagement and number of operations on the farms. The Rivers State government should assist farmers through the provision of subsidy in hiring/purchase of tractors to ensure mechanization of agriculture in the state.

Keywords: Agricultural Machinery; Machinery use-management; Tractor model; Field operations; Farm Establishments; Agricultural Mechanisation.

INTRODUCTION

The use of a machine to achieve a task or an operation involved in agricultural production is termed as "Agricultural Mechanization". It may also refer to hand tools, animal-drawn implements and power operated equipment used for performing various field operations in the production of agricultural crops (Singh, 2001). Agricultural mechanization has many pros such as reduction in drudgery, improvement of timeliness and efficiency of various agricultural operations, bringing more land under cultivation, providing improved rural living conditions and rapidly advancing the economic growth of a country (Odigboh, 1991). Sources of these farm powers include hand tools, draft animals and mechanically-powered technologies (Rijk, 1999). Simple farm tools such as hoes, cutlasses, spades etc. were all farm equipment that were used in the early stages of man but it's usage came at a cost which comprised fatigue, drudgery and lesser work (Archie, 1980). Due to this effect, it became a

necessity that tools, implements and powered machinery should be essential and major inputs to agricultural production. Hence, the term mechanization is generally used as an overall description of the application of these inputs (Clarke, 2000). Amongst these agricultural machineries that are commonly used is the tractor which will be our main view of analysis.
The farm tractor is an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at low speeds, for the purpose of hauling a machinery or variety of implements used in agricultural production (Lijiedahi et al., 1979). The farm tractor was developed in order to meet man's increasing need for food and raw materials for agro-based industries and for farm operations. Tractors are of different types and their respective usage depends on the type of work to be done but however, the most common tractor that is mainly used is usually an all-purpose type and is applicable to almost all farm operations (Culpin, 1981).This fact above is true mainly because the extent at which any agricultural activity will get to depends largely on the extent to which mechanical power and machinery are employed in order to make labour more productive (Culpin, 1981) because the mechanical power which the tractor provides is a great supplement and improvement on human and animal power (Ikpo, 2005). In Nigeria, tractors are rarely used and hence, their benefits are not harnessed properly and as a result, there is a relative low level usage in farm mechanization. Tractors have vital roles in agricultural production and due to these vital roles it plays in farm mechanization; many researches have been carried out on its usage, care and maintenance. According to Hunt (1977), farm machinery management is actually concerned with the selection, operation, maintenance and replacement of machinery. Hence, the utilization of tractor within the context of machinery management in farm mechanization actually requires proper usage and maintenance for high productivity and profitability because farm tractors and implements are major elements of farm mechanization in Nigeria, just as in most developing countries but these machines have not been fully utilized (Ishola et al., 2004; Ifem and Yohanna, 2005). Therefore, the judicious use of agricultural machnieries that include farm tractors and implements is required by farmers to maximize production with minimum cost (Yohanna, 2004) and hence, it is imperative that tractors and implements be properly utilized at maximum. Considering the vital roles tractor plays to improve agricultural productivity, it becomes a necessity to identify the constraints to its maximum usage and also suggest measures to help improve usage thereby reducing production costs and increasing productivity in agriculture in Rivers State and Nigeria as a country.

LITERATURE REVIEW

The various researches conducted on the evaluation of agricultural mechanization in Rivers State, drudgery, low production efficiency, under-utilization of mechanical power and the usage of old tractors with a high rate of break-down during operation were reported to have contributed to the low level of mechanization in the State. Hence, there is the need to carry out exclusive evaluations of the machineries available in Rivers State. In fact, two decades of independence, despite the high involvement of the government in agricultural sector, there was a rapid deterioration both in the National and Rivers' State agricultural sector. Food scarcity worsened as a result of the "Oil Boom" which gave rise to the shift of labour from the agricultural sector (Nkakini et al., 2006). This situation proved to be true from the proposed fact that the any country's agriculture that desires to develop must be mechanized (Ukatu, 2005). The level of usage of the tractors should be considered in any good mechanization project (Kolawole, 1972) as this is due to the increased utilization which helps to hold down the cost of mechanization. Maximum utilization is a very vital factor of good productive employment of a farm tractor. Kolawole (1972) reported that 1000 hours annually is the standard usage of tractors and carried out a research on the volume of annual work

tractor usage in the Western part of Nigeria. Lijiedahi et al. (1979) stated that the highest single factor that affects the hourly cost of operation of a tractor is the rate of usage. Thus, it is necessary to maximize the amount of use to save cost while increasing productivity simultaneously. He stated that the size of the farm has been said to be a factor as it has an effect on the volume of the tractor use.

In the same vein, Culpin (1975) stated that tractors that are of high strength usually have their average use ranging between 800-1000 hours annually, which means that the tractors can be used in the mark of 1000 hours annually when properly managed, thereby maximizing productivity and reducing production cost. Kolawole (1972) reported that 1000 hours annually is the standard usage of tractors and carried out a research on the volume of annual work tractor usage in the Western part of Nigeria. Therefore, this work aimed at investigating the extent of tractor and implements utilizations, managements and their status in Rivers State

METHODOLOGY

Description of the study area

Port Harcourt is an important city in the Niger Delta Region of Nigeria and it is the capital of Rivers State in Nigeria. She is known for her high rate of oil and gas activities within the Niger Delta region. Rivers State is located on latitude 5°21'N and longitude 6°57'E. The state has a wide agro-ecological diversity with fishing and farming as the main occupation of the indigenes. Agriculture in the state is predominantly aided by rain as the state is within the tropical rainforest vegetation belt of the country and it receives an annual rainfall of about 270mm and the average temperature of the region is between 25.1°C and 30.3°C and as a result of this characteristics, the soil in the zone is usually moist all year round due to excessive rainfall.

Data collection

For the gathering of data used in this research work, all the relevant agricultural establishments, farms which are owned by either the government or private sectors were considered as data collected from these locations. Below is a map that shows the concise view of the state with its senatorial districts (zones).

Fig. 3a Map of Rivers State Showing the Senatorial District (Zone)

These agricultural establishments which were considered were visited and the necessary information was obtained randomly from relevant personnel. Data for the study were collected using both primary and secondary sources of information.

The data from the primary source required questionnaire to obtain information through personal contact, interview and observation. The data obtained from the secondary source were from relevant documents such as e-books, newsletter etc. A concise and good questionnaire which was relevant for the collection of data was prepared and used during this investigation process.

Structure of Questionnaire

The structure of the questionnaire covered the aspects of the investigation. The aspects covered and used to obtain the needed information for the research includes: number of

tractors which are available in a particular location; type, make and model of tractors; status at purchase of equipment; types of operation by tractors; conditions of tractors and implements; hourly engagement of the tractor in a year.

Data analysis

The data obtained from both the primary and secondary sources of information were collated and analysed using descriptive statistics as an index to describe or summarize the characteristics of the observation. The data generated were subjected to percentage analysis. Also the statistical methods of determining the mean, coefficient of variation and the coefficient of rank correlation of the observation were employed as appropriate (Loveday, 1970; Stroud, 2001; Frank et al.,). The mean of observation to know the central tendency or location of the value were calculated.

$$\bar{x} = \frac{\sum x}{n} \quad i.e.\ Mean = \frac{Sum\ of\ observation}{Number\ of\ observations} \qquad 1$$

Where x = observations
n = number of observations
$\bar{x}$ = mean

The coefficient of variation (CV) in percentage to indicate the degree of variability or dispersion of the performance of state and private tractors was calculated as follows:

(i) Calculation of the mean $\bar{x}$ of the set of n values.

(ii) Calculation of the deviation (d) of each of the n values $x_1, x_2 \ldots\ldots x_n$ From the mean and the results squared i.e.

$$(x_1 - \bar{x})^2 ; \quad (x_2 - \bar{x})^2 \ldots\ldots\ldots, \quad (x_n - \bar{x})^2 \qquad 2$$

(iii) The variance which is the average of these results is found.

$$Variance = \frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 \ldots + (x_n - \bar{x})^2}{n} \ i.e \ \frac{\sum (x - \bar{x})^2}{n} \qquad 3$$

(iv) Calculation of the standard deviation is the square root of the variance

$$\text{Standard deviation, } \quad S = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \qquad 4$$

(v) $$CV = 100 (s\sqrt{x}) \qquad \mathbf{5}$$

Coefficient or rank correlation (Spearman's) to examine the direction and degree of relationship between tractors and work output was calculated.

$$r = 1 \frac{6 \sum D^2}{n(n^2 - 1)} \qquad 6$$

Where r = coefficient of rank correlation

D = rank difference

Regression coefficient to indicate how total tractors vary with serviceable tractors was calculated (Loveday, 1970)

$$Cr = \frac{V_{ts}}{S_t} \quad 7$$

Where V_{ts}= Covariance = mean of products of deviation of total and serviceable tractors = $\Sigma d_t d_s/n$

S_t = Standard deviation of total tractors = $\sqrt{\frac{\sum d_t^2}{n}}$ 8

RESULTS AND DISCUSSION

Hourly engagements by LGAs and institutions

The result of table 1 showed that Rivers State University (RSU) farm had the highest hourly engagement of 120 hours and 0% Coefficient Variability (CV) followed by Obio-Akpor/ADP with sum of 88 hours and coefficient of variability (CV) of 19% followed by SIAT, Ubima Estate and Ikwerre/Vintage Farm LTD with 80 hours and 0% CV each while Prison Farm, Elele had the lowest hour of 45 and 35% CV.

Table 1: Hourly engagements by LGAs and institutions

	RSU	Ikwerre/Vintage Farm LTD	Obio-Akpo/ADP	Prison Farm, Elele	SIAT, Ubima Estate
Mean	12	8	8.8	4.5	8
Sum	120	80	88	45	80
Standard Deviation(S.D)	0	0	1.68	1.58	0
Variance	0	0	2.84	2.5	0
Coefficient Variability(C.V)	0.001	0.01	19%	35%	0.23

Different operations of LGAs and institutions

The various operations that were done by the farms include ploughing, slashing, harrowing, ridging, transportation, fertilizer application, planting, harvesting, cultivating and processing. The results of these operations showed that RSU farm was highest having (24) different operations performed followed by Ikwerre/Vintage farm LTD (19), Prison farm, Elele (11), Obio-Akpor/ADP and SIAT, Ubima Estate performed 10 each and CV: 28%, 78%, 0%, 79% and 0% respectively (Table 4.1)

Table 2: Different Operations of LGAs and Institutions

	RSU	Ikwerre/Vintage Farm LTD	Obio-Akpo/ADP	Prison Farm, Elele	SIAT, Ubima Estate
Ploughing	3	2	1	2	1
Slashing	2	1	1	2	1
Harrowing	2	1	1	1	1
Ridging	2	1	1	1	1
Transportation	3	5	1	2	1
Fertilizer Application	3	1	1	1	1
Planting	3	1	1	0	1
Harvesting	2	4	1	0	1
Cultivating	3	2	1	2	1
Processing	1	1	1	0	1
Mean	2.4	1.9	1	1.1	1
Sum	24	19	10	11	10
Standard Deviation	0.69	1.48	0	0.87	0
Variance	0.48	2.1	0	0.76	0
Coefficient Variability (%)	28	78	0	79	0

All activities carried out by farmers in RSU, ploughing to processing 12 hours. In other institutions such as Obio-Akpor/ADP; ploughing and harrowing only 12hours and8hours each of slashing, ridging, transportation, fertilizer application and other operations while others such as Ikwerre/Vintage, SIAT, Obio-Akpor/ADP had 8 hourly average for all the different farm operations. Of all the sampled institutions, Prison Farm, Elele had 4.5hr being the shortest time spent on the farm and the only farm that did not process their produce.

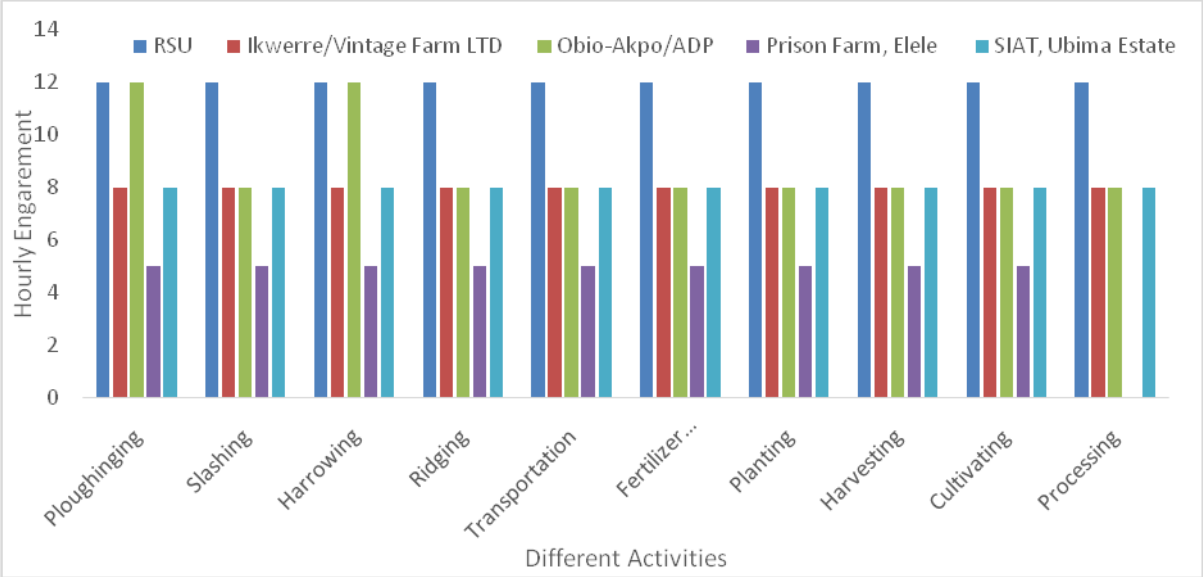

Figure 1: Hourly Engagements by LGAs and Institutions

Different operations of LGAs and institutions

The operations of the institutions and LGAs are done by all except at Prison Farm, Elele where processing is not done. Transportation was highest at Ikwerre/Vintage Farm LTD followed by harvesting, ploughing, and cultivating (Figure 4.1.1). Transportation was frequently used perhaps due to the good road network within the metropolis where farms are accessible by good roads thus facilitating their farming and sale of farm produce; farm enterprise while other LGAs and institutions had poor road and even inaccessible. Other operations such as ploughing, cultivating and harvesting were ancillary to transportation as all these were high in Ikwerre/Vintage Farm LTD (Figure 4.1).

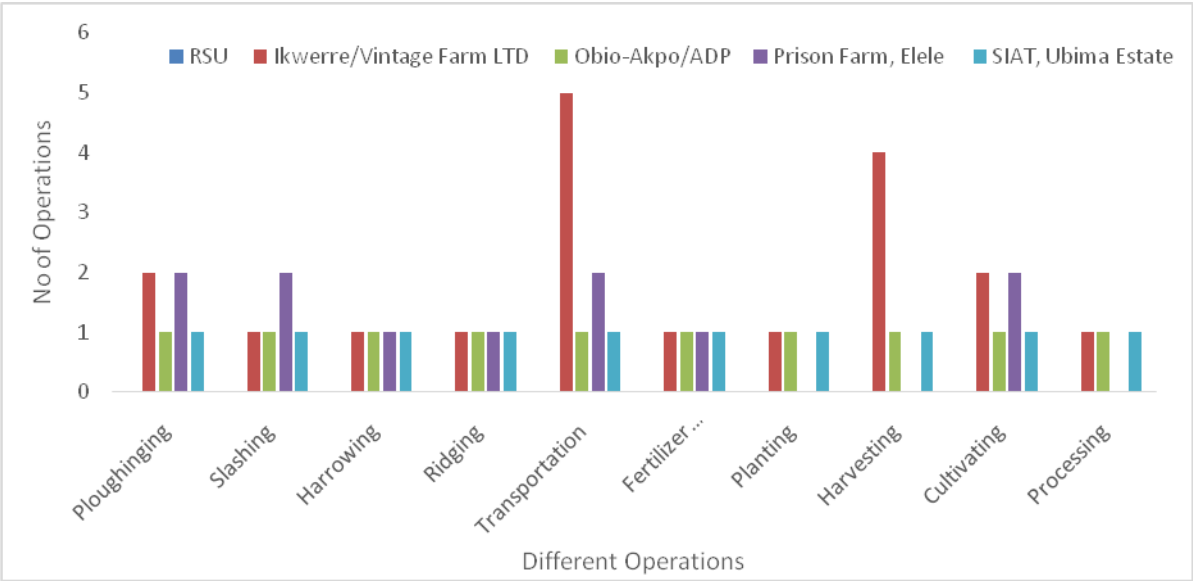

Figure 2: Different Operations of LGAs and Institutions

Different models of machineries used at LGAs and institutions

All the LGAs and institution have at least one tractor but some had two either old or new models with average ages ranging from 7 to 20 years (Table 3). The Ferguson-models 135 and 240were the mostly used tractors in Ikwerre/Vintage Farm LTD and SIAT, Ubima Estate had two new model each with average age of 7 years while Obio-Akpo/ADP had one old model of 15 years old. Massey Swaraj-model 978FE and Steyr are operated by other LGAs and institutions all old models (Table 3).The number of tractors was low; both old and new; old ones had average of 15years while new ones averaged 7years (Table 3).

Table 3: Different Models of Machineries Used at LGAs and Institution

				Bought		
LGA/Institution	**Make**	**Model**	**No of Tractors**	**Old**	**New**	**Average Age (years)**
RSU	Swaraj	978 FE	1	0	1	8
Ikwerre/Vintage Farm LTD	Massey Ferguson	240	2	0	2	7
Obio-Akpo/ADP	Swaraj	978 FE	1	1	0	15
	Massey Ferguson	135	1	1	0	15
	Steyr	0	1	1	0	20
Prison Farm, Elele	Fiat	70.56	2	0	2	10
	Marshal	0	2	2	0	15
SIAT, Ubima Estate	Massey Ferguson	135	2	0	2	8
	Fiat	8066(T)	2	0	2	8

Regression of hourly engagements on number of tractors of LGAs and institutions

There was significant difference at $P<0.05$: *PV*=0.043615 between hourly engagement and number of operations on the farms (Table 4).

Table 4: ANOVA of Regression of Hourly Engagement on Number of Operations

	Df	SS	MS	F	P-value	Significance F
Regression	5	1891.513	378.3025	5.888359	0.043615	0.0013
Residual	3	963.6875	321.2292			
Total	8	2855.2				

The figure 4 shows regression of hourly engagement on number of tractors indicating a direct and positive regression coefficient (r^2=0.5000): the higher the number of tractors the higher the number of hours spent (120, 88 and 80hrs) in RSU, Obio-Akpor/ADP, SIAT, Ubima Estate and Ikwerre/Vintage Farm LTD though the slope was negative (-0.4) (Figure 4). The negative slope (-4) was because opposite direction of the slope of the fall from 88 hourly engagements of Obio-Akpor/ADP to 45 hours of Prison Farm, Elele; this observed trend is opposite the normal linear graph slope.

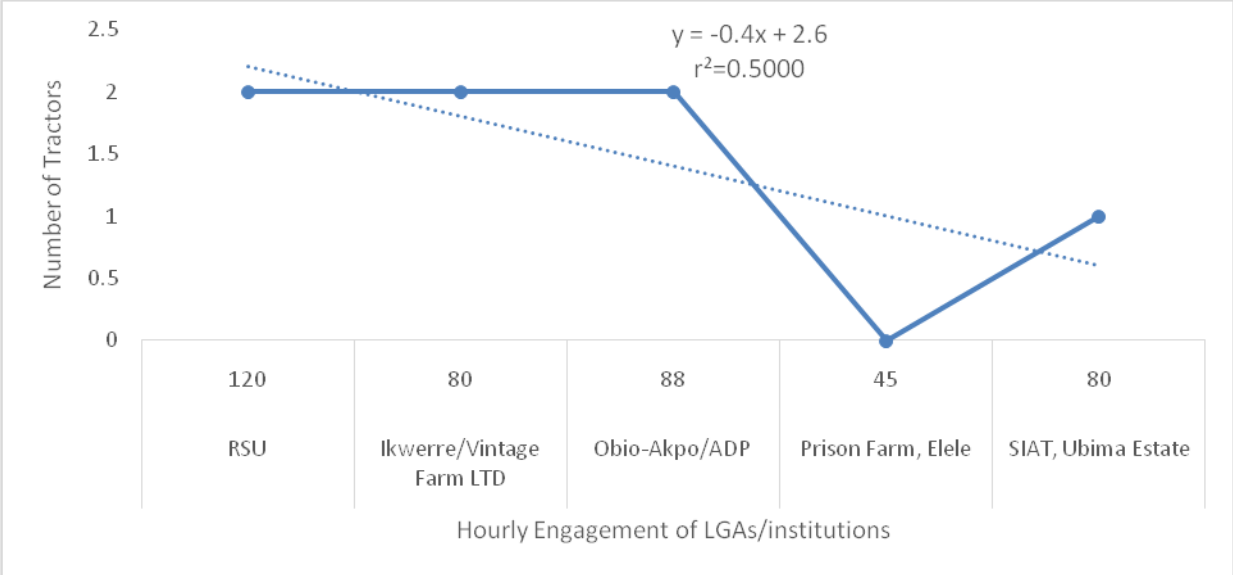

Figure 3: Regression of Hourly Engagements on Number of Tractors of LGAs and Institutions

This finding that the hourly engagement of 120 hours for RSU farm, Obio-Akpor/ADP and SIAT, Ubima Estate of 88 hours and Ikwerre/Vintage Farm LTD with 80 hours is far below the findings of Kolawole (1972) who reported 1000 hours annually as the standard usage of tractors and the low hourly engagement were caused by factors such as seasonality of work, partial nature of farm mechanization, frequent tractor and implement breakdown, unavailability of spare parts for the machine. This works agrees with Kolawole (1972) as the various agricultural operations depend on seasons of farming and lack or minimal usage of tractors in the various LGAs and institutions.

The low usage of tractors in the LGAs and institutions were partly due to the above factors but Lijiedahi *et al.*, (1979) who stated that the highest single factor that affects the hourly cost of operation of a tractor is the rate of usage, tractor usage increases as the farm size increases: size of the farm has been said to be a factor as it has an effect on the volume of the tractor use and that the usage of tractors differs with respect to the type of agriculture. Though, most agricultural machines possess only a short working season and hence cannot be fully utilized on small size farms that have the farming area or size of job to be very small (Culpin,1975). According to Culpin, (1975) strength of tractors is high with average use ranging between 800-1000 hours annually and this means that the tractors can be used in the mark of 1000 hours annually when properly managed, thereby maximizing productivity and reducing production cost and it is far much easier to achieve better tractor utilization on large farms compared to that on the small farms because it has been reported that tractor studies based on their use have shown that the average use of a tractor is within the range of 700-800 hours annually for large farms but this value is usually lesser for small farms. The level of tractor utilization and performance are negatively affected by poor maintenance culture, lack or poor storage facilities, calibre of machinery operators, ineffective supervision and lack of necessary equipment and accessories. These problems to maintenance of agricultural machinery including tractors are finance, wrong placement of operators/personnel, lack of well-equipped workshop and bad working condition to the personnel in charge (Adigun and Ishola, 2004). Igoni (2004) identified the ineffective maintenance; lack of effective supervision of tractors and the attitude of government are all factors that gave rise to the

frequent breakdown of the agricultural machineries, the lack of professionals that could operate the available machines beside the tillage and poor utility of tractors. On the contrary, tractor efficiency depends on the quality of its operation, maintenance and repair Ahamad and Kumar (1996) and Ogunlade *et al*., (2004). The efficiency also depends on the its maintenance and the effectiveness of a tractor's working system does not only depend on the design properties and production (Adegunloye,1996). The solutions to poor maintenance is suggested by Offiong and Okokon (2003) that a planned maintenance programme should be carried out in order to reduce the rate of tractor breakdowns. Maximum utilization is a very vital factor in agriculture output and so farm tractor usage should be encouraged. So hence, it is then a necessity to maximize the amount of use to save cost while increasing productivity simultaneously. The direct and positive relationship between hourly engagement and number of tractors: the higher the number of tractors the higher the number of hours spent (120, 88 and 80hrs) in RSU, Obio-Akpor/ADP, SIAT, Ubima Estate and Ikwerre/Vintage Farm LTD and so the productivity of food as Rivers State University (RSU) was among the institution with high output which agrees with Kolawole (1972) that a good level of utilization of tractors increases productivity and reduces the cost of production since some costs like machinery cost and wages for operators and supervisors would remain relatively the same independent of use. In order to boost productivity and reduce the mechanization cost thereby increasing the income of the farmers and government as well as making food available for the citizens of the country through agricultural machinery use-management by increasing rate of tractor utilization in Rivers State thus create the regime and practice of maximum tractor usage in the State.

CONCLUSION

The level of usage and hourly engagement of tractors on farms of the sampled institutions was very low while some institutions like Rivers State University (RSU), Ikwerre/Vintage farms were involved in all the operations, others such as Prison Farm, Elele did not process farm produce. The hourly engagement of 120 indicates the highest when compare with others in respect to standard working hours of 1,000 of a tractor. Though, the tractor model differed, the number of tractors thirty (30) was low; both old and news; old ones had average of 15years while new ones averaged 7years. There should be agricultural machinery (tractors) hiring workshops in all LGAs of Rivers State

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