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ASSESSMENT OF THE NOISE LEVEL GENERATED DURING PLOUGHING AND HARROWING OPERATIONS IN IBADAN NIGERIA

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ABSTRACT

In an attempt to meet the food demand by the ever increasing human population, the use of machines in the performance of agricultural operations is increasingly being emphasized. Two of the most common operations for which machines are used on the farm are ploughing and harrowing. Tractor operators who perform these functions are known to spend long period of time working with the machines and various implements which generate substantial noise. Exposure to excessive noise could be harmful to human health if not regulated. The focus of this study was to investigate the level of noise to which tractor operators are exposed during ploughing and harrowing operations using MF260 and MF 265 tractors the noise level generated varied from 88.6 to 89.4dBA for ploughing and 86.5 to 88.4 dBA for harrowing. These levels are more than the recommended level of 85dB which indicate that the operators are under threat from noise and precautionary measures are desirable. A good maintenance culture especially the lubrication of parts to reduce noise, the use of ear protector such as ear muffs and plugs and cabins on tractors are recommended as ways by which the noise exposure could be minimized.

Keywords: noise level, tractor, land preparation, plough, harrow.

1. INTRODUCTION

Sound can be defined as the outcome of vibrations produced by a body composed of frequencies within the range of hearing and of a level or intensity sufficiently strong to be heard and when the level becomes uninteresting to the listener, it is described as noise (Anonymous, 2012). Noise is part of life in that virtually all human and many non-human activities are accompanied with its generation. Noise is measured in decibel, the louder the noise the higher the decibel. Noise in practice is relative because the level is not necessarily an indication of its repulsiveness but rather that is decided by the receiver. While a loud sound in a dancing hall may not be noise since it interests the listeners, a mere whisper will be noise to an individual sleeping because he is disturbed. In most cases, the noise in an environment tends to increase with time as the volume of noise generating activities increases. Celem and Arin (2003) reported that environmental noise in the United States increases by 1dB annually while in Ankara, the capital city of Turkey, an increase in environmental noise of 8 - 10 dB was recorded over a nine year period.

Noise studies have been of great concern to researchers because of the various negative impacts it has on human beings and livestock. Although hearing loss is the most clearly measurable health hazard, noise is also linked to other physiological and psychological problems. It annoys, awakens, angers and frustrates people. It disrupts communication and individual thoughts; and affects performance capability (Baryeh, *et al.*, 2003). These noise effects reduce productivity and make life uninteresting. Because of its role as food provider and source of employment, many people are engaged in various agricultural activities which in the course of performing their duties are exposed to noise especially from the tractors which are generally noisy machines and commonly employed in many farm mechanization activities. Desirous to minimize the negative impact of occupational noise, many codes and standards have specified the levels of noise and durations over which workers should be exposed with 85dB for 8 hours being commonly set for agricultural operations. This limit is however hardly met in practice as revealed by many field studies.

Mehmet and Ilker (2004) reported that large machineries such as tractors which is an indispensable farm machine emits noise in the range level of 80 to 150 dB depending on the activity the equipment is engaged in and the level is higher when used with implements.

Broeste *et al.* (1989) tested 31 tractors for noise at ear elevation in the driver seat and reported that only one tractor produced less than 85dB at full throttle.

Meghan *et al.* (2005) from a survey on impact of noise on farmers, found that as many as 92% of the farmers surveyed were potential victims of induced noise hearing loss. They concluded that noise was a major health hazards which should be given due attention.

Baryeh *et al.* (2003) reported that 82% of 53 tractor operators interviewed recognized noise as one of the major hazards they were exposed to. The noise prevented them from hearing other sounds creating dangerous situations since they may not be able to hear warnings during emergency periods. The situation was worsened by the refusal of some operators to wear ear protection devices as this would cut off completely other sounds that may be important such as those indicating machine problems.

Kumar *et al.* (2005) carried out noise measurements in various agricultural equipment and machines in India and observed that Tractor noise levels used on Indian farms exceeded the recommended safe limits by Occupational and Safety Health Administration (OSHA) and NIOSH prescribed standards for safe noise levels. In the past, the Nigerian agricultural system was predominantly subsistence depending on manual labour but in order to meet up with increasing population, farm mechanization was introduced. Technologies such as feed mills, tractors, combine harvesters, ventilation fans and irrigation machines were introduced into farming. These technologies while in operation on farms generate a lot of noise the effects of which is usually ignored as in many developing countries. The implication of this is that by and large, the farm employees may be dying gradually and this must be arrested. Effective noise attenuation programmes can only be designed with adequate information on the level of noise generated and there is a dearth of this information for many agricultural operations in Nigeria at present. There is need to establish the level of noise generated and to compare with standards so that appropriate measures aimed at promoting the welfare of the farm workers can be taken. This gap is what this study attempted to fill, taking the case study of ploughing and harrowing which are major farm mechanization activities.

2. MATERIALS AND METHODS

(a) Experimental site

The site used for this research was the University of Ibadan Teaching and Research farm. The size of the experimental plot was 60.96 x 30.48 meters with grassland vegetation. The soil type was loamy and the topography was almost level.

(b) Machines and equipment

The activities of interest in this study were ploughing and harrowing and in order to accomplish these, two tractors, Massey Ferguson 260 and 265, a disc plough and tandem harrow used for teaching and research by the Department of Agricultural and Environmental Engineering of the University of Ibadan were used.

The noise level was measured using a digital sound level meter, model 407768, 5-digit LCD display. The noise level meter consists of a microphone, electronic circuits and a readout display with a measuring range from 35-130dB. The meter was calibrated before usage.

(c) Field preparation

Preparatory to the test, the experimental plot was divided into four equal lanes each measuring 7.7m in width and 60.96 in length and labeled lanes 1 to 4. The lanes were appropriately demarcated with pegs to serve as guides during operation.

(d) Field test

The plough was coupled onto the MF 265 tractor and the ambient noise recorded. The tractor was then started and engaged in gear 1, high which is commonly used for land preparation to commence the ploughing operation with a researcher seated on the rear wheel cover behind the operator holding the noise level meter to record noise as the operation progresses (Figure-1).

Figure-1. Recording of noise levels during land preparation.

While the operation progresses, noise levels were recorded behind the tractor driver's ear and the surroundings. The tractor made a total of four runs in order to cover the entire lane. During each of the four runs, five noise levels were taken making a total of 20 readings which were then averaged. Upon the completion of the first lane, the plough was removed and coupled on to the MF 265 tractor to plough the second lane using the same procedure. MF 260 was used in ploughing lane 3 while the last lane was ploughed with MF 265.

The harrowing was carried out the third day after ploughing; using the MF 260 on lanes 1 and 3 while the lanes 2 and 4 was harrowed with MF 265. The recording of noise level was the same as for the ploughing.

3. RESULTS AND DISCUSSIONS

The ambient or background noise was 52.7 dB while the noise levels measured for the various operations using the two tractors are summarized in Table-1.

Table-1. Summary of noise levels.

Operation	Tractor	Average noise level in dB	
		Driver's ear	Driver surrounding
Ploughing	MF 265	89.2 ± 2.1	88.5 ± 2.5
Ploughing	MF 260	89 ± 2.1	88 ± 2
Harrowing	MF 265	88.3 ± 1.6	88 ± 3.6
Harrowing	MF 260	87.4 ± 3.3	86.8 ± 2.5

(a) Level of noise generated

The mean noise levels generated during the various operations ranged between 86.8 and 89.2 but the Occupational and Safety Health Administration (OSHA) stipulates 85 dB for 8 hours of exposure as the safe limit for farm operations. The implications of these results is that operators would be exposed to danger even at these levels within the eight hours working period and the situation would be aggravated if the exposure period is longer than 8 hours. For most Tractor Hiring Units in Nigeria, in both the private own establishments and the Ministry of Agriculture in many states most tractor operator's work for about 10hours/day. While the private owners take advantage of the higher demand to work for as much time as possible, in the government establishment where the official working period is 8 hours, the operators work extra hours to make money for themselves. Tractor operators are therefore exposed to danger arising from their operations. It is not only the operators that are at risk but even those around the working area assisting the operator may also be at risk and there is need to attenuate the situation. The noise level was also observed to vary with operation.

(b) Noise variation with operation

Two different operations, ploughing and harrowing were carried out during this study. The results show that higher noise levels were generated during ploughing than harrowing in both tractors. The primary function of either the plough or harrow is to pulverize the soil and the soil compaction would determine the tractor force required to accomplish this. A relationship exists between the tractor pull and noise generated and since the natural soil on which the plough is used is more compact, a greater pull is required during ploughing than harrowing when the soil is already loosened. This explains why the noise level generated during harrowing was lower than for plouging.

The tractors used in this study were reported to be older than 15 years and there is no regular maintenance unless when a problem surfaces. This observation is not different from the practice with both government and private owned tractors in many parts of Nigeria as reported by Mijinyawa and Kisaku (2006). The age and non-regularity of maintenance are contributing factors to noise generation and loose parts wobble during operation increasing noise levels. (Anonymous, 2009)

4. CONCLUSIONS AND RECOMMENDATIONS

A study of noise levels generated during land preparation reveals that during ploughing operations as much as 89dB can be recorded while during harrowing the level is lower but still as much as 88dB. These noise levels are beyond the specifications by the OSHA implying that tractor operators in many situations are exposed to noise hazards. Expectedly harrowing recorded lower noise level, the soil having been loosen by the ploughing acrtion. Age and lack of maintenance are contributing factors to the level of noise generated. There is need to attenuate the situation for the health and safety of the operators towards which the following recommendations are made:

a) Since it appears a little bit difficult to reduce the noise level, efforts should be made to reduce the exposure period. This is achievable by regulating the period an operator is allowed access to the tractor such that even if he wants to cheat by working beyond the time employer has decided, he cannot have the tractor to work with.
b) Operators of tractors with cabins are exposed to less noise but which unfortunately are not common in the pool of most tractor hiring units in Nigeria. The introduction of tractors with cabin in to the farming system should be considered.
c) Noise reduction devices such as ear muffs could contribute to solving the problem. Operators should be educated on their use and encouraged to use them.
d) Nigeria is in general a dumping ground for equipment that is obsolete. Tractor operators and users should endeavor to acquire tractors that are still field worthy and imbibe the idea of a regular maintenance culture as these will to a large extent reduce noise generation.

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