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RESEARCH ARTICLE

EXPERIMENTAL INVESTIGATION ON NOISE POLLUTION CAUSED BY AGRICULTURAL TRACTORS

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ABSTRACT

Noise level in tractors is usually higher than the other commercial vehicles due to its heavy work as well as unbalanced engine. This paper aims to investigate the noise levels of two different tractors namely Mahindra 575 DI and Massey Ferguson 1035 DI experimentally and give suggestions to overcome the noise pollution caused by the agricultural tractors. Sound level meter (Type 2250 hand-held analyser) is used to measure and record the noise levels. Maximum noise level observed in the study is 95.7 dB in Massey Ferguson 1035 DI tractor at the engine speed of 2000 rpm while the minimum noise level observed is 78 dB in Mahindra 575 DI tractor at the engine speed of 500 rpm when the tractors are operating in stationary condition. In moving condition, the maximum noise observed is 88 dB in the 1st gear position of Massey 1035 DI tractor moving at a radius of 5 m from the origin where sound level meter is placed. The minimum noise level recorded in moving condition of tractors is 69 dB in the 4th gear position of Mahindra 575 DI tractor moving at a radius of 15 m from the origin.

INTRODUCTION

Agriculture is an important sector in our country. Due to the vast agricultural land and development in the field of engineering and technology there are many machineries have been introduced nowadays to perform several agricultural tasks. But the most important and unavoidable machinery is a Tractor which is also called as Farm vehicle. By using tractor, tasks like ploughing, tilling and planting etc. have been carried out every day. In tractors, due to its high tractive force and imbalanced engine, noise level is usually higher than other commercial vehicles which directly affect the driver and the farmers near to the tractor.

MATERIALS AND METHODS

Instrument Details

Name: Sound level meter/ Sound level analyzer
Make: Bruel&kjaer
Type: Type 2250 hand-held analyzer

Temperature

IEC 60068-2-1 & IEC 60068-2-2: Environmental testing, cold and Dry Heat
Operating Temperature: -10 to +50 °C (14 to 122 °F) < 0.1dB
Storage Temperature: -25 to +70 °C (-13 to 158 °F)

Weight and Dimensions: 650 g (23 oz) including rechargeable battery 300×93×50 mm (11.8×3.7×1.9″) including pre-amplifier and microphone.

The image of the Sound level meter is shown in the Figure 1.

Figure 1 Sound level meter

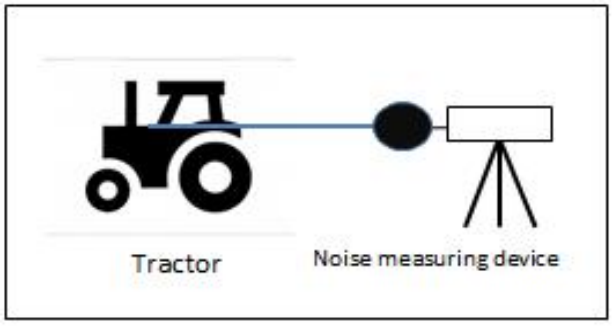

Figure 2 Experimental setup for noise test when tractor is in stationary condition

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Experimental method

Two tractors namely Mahindra 575 DI and Massey Ferguson 1035 DI tractors are subjected to noise test separately with a sound level meter. Noise from the tractors is measured by placing sound level meter at a distance of 2 m according to the standards. The testing setup is represented in the Figure 2. The engine rpm is varied to determine the different noise levels for different engine speeds.

In order to determine the noise level experienced by humans in various distances, the tractor is allowed to move in circular paths of radii 5 m, 10 m and 15 m with the Sound level meter at the origin as shown in Figure 3. In each path the noise level is measured for all gear positions. The images of experimental noise test are shown in Figure 4.

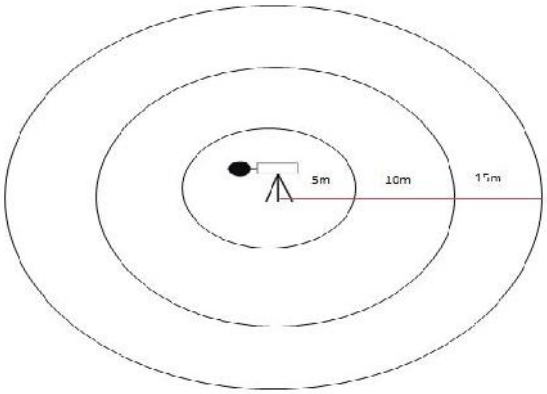

Figure 3 Experimental setup for noise tests at different radii

Figure 4 Images of experimental noise test

RESULTS AND DISCUSSION

The noise levels of both tractors are in the range of 80 to 100 dB as shown in Table 1. Maximum noise observed in the study is 95.7 dB in Massey Ferguson 1035 DI tractor at the engine speed of 2000 rpm while the minimum noise observed is 78 dB in Mahindra 575 DI tractor at the engine speed of 500 rpm when the tractors are operating in stationary condition. Further, Noise levels observed in moving condition of two tractors shown in Tables 2 and 3 indicates that the noise level gets increased with decrease in gear position and distance. Figures Figures 5, 6 and 7 give better understanding of variations in noise level corresponding to engine rpm, gear position and path radii from the origin for two tractors respectively.

Table 1 Noise levels of different tractors in stationary condition

Noise levels of different tractors in stationary condition			
S.no	rpm	Noise (dB)	
		For Mahindra 575 DI	For Massey Ferguson 1035 DI
1	500	78	82.4
2	750	80	84.2
3	1000	80.7	87.4
4	1250	83.1	88.8
5	1500	86.1	91.7
6	1750	88.4	93.8
7	2000	89.9	95.7

Table 2 Noise levels of Mahindra 575 DI tractor in moving condition

Noise levels of Mahindra 575 DI tractor in moving condition		
S.no	Gear position	Noise (dB)
Radius of 5 m path from the origin		
1	1	82.4
2	2	81.1
3	3	75.7
4	4	75
Radius of 10 m path from the origin		
1	1	75
2	2	77
3	3	73
4	4	73.2
Radius of 15 m path from the origin		
1	1	71
2	2	72
3	3	73.2
4	4	69

Table 3 Noise levels of Massey Ferguson 1035 DI tractor in moving condition

Noise levels of Massey Ferguson 1035 DI tractor in moving condition		
S.no	Gear position	Noise (dB)
Radius of 5 m path from the origin		
1	1	88
2	2	86
3	3	81.2
Radius of 10 m path from the origin		
1	1	81.8
2	2	80.7
3	3	76.9
Radius of 15 m path from the origin		
1	1	77.7
2	2	76.5
3	3	76

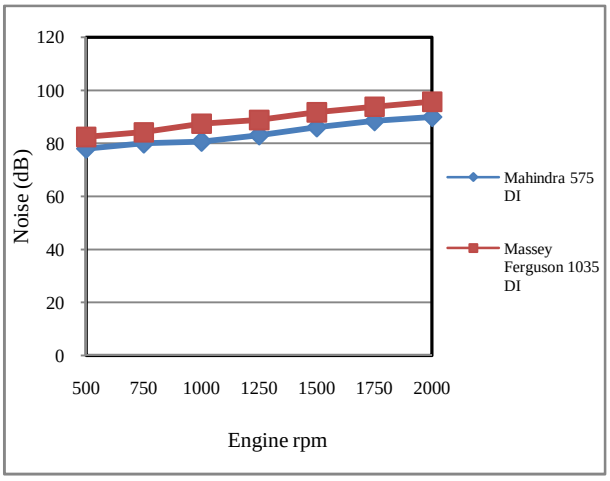

Figure 5 Noise levels of different tractors in stationary condition

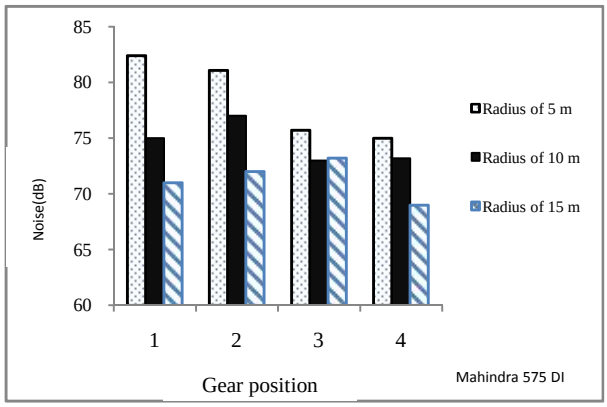

Figure 6 Noise levels of Mahindra 575 DI tractor in moving condition

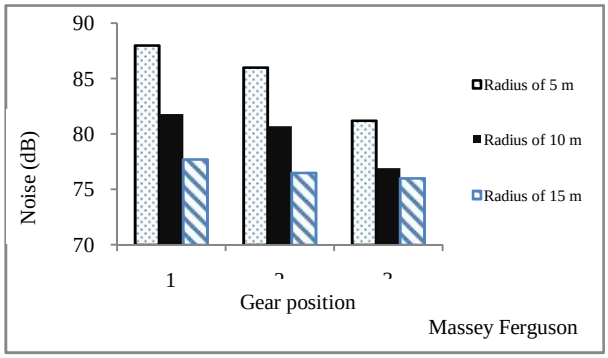

Figure 7 Noise levels of Massey 1035 DI tractor in moving condition

CONCLUSION

The experimental noise test results ensure that the driver and the farmers working near the tractor around 15m of radius are at a risk of temporary or permanent hearing loss due to the continuous hearing of 80 to 100 dB noise levels. To overcome this problem hearing protection is necessary for the driver as well as the farmers working near the tractors. Further, the noise exposure from the engine area can be reduced by using sound absorbing materials in some parts surrounding the engine area.

Engine hood is one of those parts through which the noise exposure from the engine surroundings can be reduced by changing its material from low carbon steel to any other suitable sound absorbing materials.

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