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Nebraska Cooperative Extension Service EC 81-708



Noise...

SOUND WITHOUT
VALUE!



Extension work in "Agriculture, Home Economics and subjects
relating thereto," The Cooperative Extension Service, Institute
of Agriculture and Natural Resources, University of Nebraska-Lincoln,
Cooperating with the Counties and the U.S. Department of Agriculture
Sam E. Latta, Director

NOISE...SOUND WITHOUT VALUE

Rollin D. Schnieder
Extension Safety Specialist

Oh, for the peace and quiet of the country! Surely you have heard this statement. How true this was in years gone by! Now, however, the quiet clip-clop of dobbin's hooves has been replaced by the thumping of cylinders and the turning of gears in modern tractors. Noises previously associated with cities have moved into rural areas. Some of the noises are even louder than those we have long associated with urban living.

What do the words sound and noise mean? Some people refer to sound as something pleasant. For example, a number of tones placed together might result in a beautiful symphony. However, if these notes are played too loudly or off key, they might be referred to as noise. One definition of noise is "a weed in the garden of sound."

EFFECTS OF NOISE

One of the problems associated with excessive noise is the potential damage to human hearing. Tractors, harvesters, grinders, choppers, conveyors, chain saws and power mowers are a few of the pieces of equipment contributing to the noise problem on farms and ranches. In the farm home, stereos, dishwashers, and vacuum cleaners are some of the appliances that add to the noise problem.

The human ear is a marvelous device and has tremendous sensitivity. But noise levels have increased so much that many persons have lost much of this audio-sensitivity.

THE EAR

To better understand the nature of sound-induced hearing loss, take a look at the ear, (Fig. 1). Sound comes to us as pulsating waves of air pressure. These travel through the outer ear until they strike the eardrum. The vibration of the eardrum is transmitted by the bones of the middle ear to the cochlea or inner ear.

In the inner ear, vibrations are picked up by some 30,000 hairlike protrusions which in turn signal the auditory nerves to the brain. When the hairs of the cochlea have been stressed too hard for too long, they get weak and no longer respond to the sound. Rest in a quiet place can often restore the system to normal. However, after many hard days, some of the hairs refuse to straighten up and permanent hearing loss is the result.

The ability of the inner ear to recover from fatigue varies between individuals. But, ability to hear high pitched sounds is usually lost long before the understanding of speech is impaired. Young people usually can hear sound from around 20 to 20,000 Hertz (cycles per second).

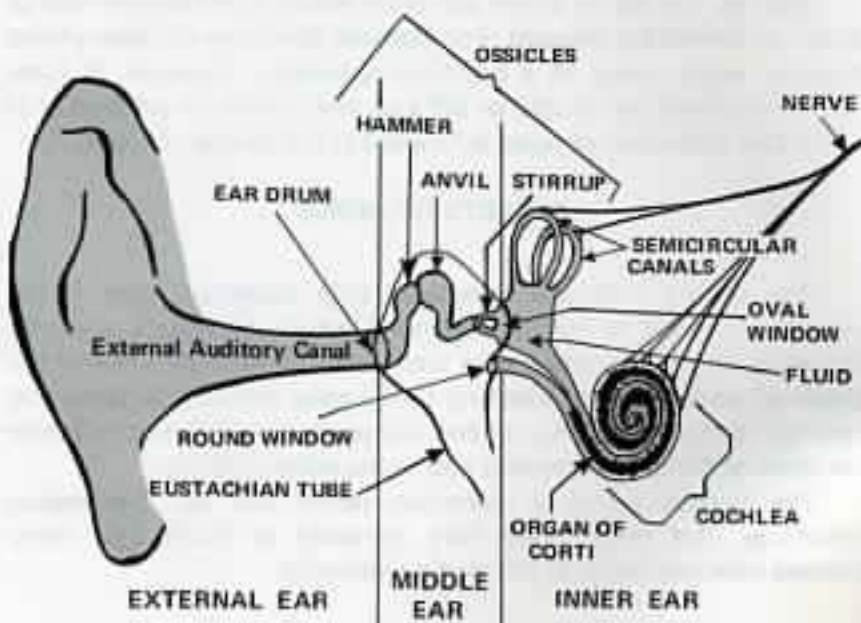


Fig. 1

Noise might also cause physiological effects such as loss of hearing, aural pain, fatigue, nausea, and even reduced muscular control. In extremely noisy work places, it has been possible to relate heart beat change to high noise levels.

Psychological effects such as depression and nervousness are a result of the ear's inability to adjust to sound. The eye has a relatively effective means to adjust to light but the ear can only adjust to sound in a limited manner. This ability weakens and fails as exposure to noise continues. "Getting used" to sound is mostly an adjustment in mental attitude rather than ear compensation, which is achieved only by a loss of sensitivity. Subconscious frustration can result when noise is being endured but the body system cannot adjust to it.

WHY WE LOSE HEARING

While temporary hearing loss may follow short-term exposure to loud noises, normal hearing usually comes back after a rest.

Permanent hearing loss may occur as a result of aging, diseases, injury and exposure to loud noises over an extended period of time.

Sounds intense enough to cause hearing losses may not annoy a person. Actually he might even enjoy them. A farmer driving a tractor may like hearing it lug loudly through some tough spots. Some even like to remove the muffler to get the sound of more "power." In addition to these sounds, there are the sounds of snowmobiles, cycles, target shooting, sports arenas and others. On the other side, there are noises that can be annoying. Many farmers complain about the extremely high noise levels in livestock auction barns.

The now-and-then nature of the noises of these previous situations probably won't bother us too much; however, continuous doses above 90 dBA cause permanent hearing losses. The safe limit is 85 dBA.

SOUND MEASUREMENT

The decibel is a standard method of expressing sound intensity. To avoid working with unwieldy numbers in evaluating sound intensity, a logarithmic scale is used as a unit of measure.

We hear according to a logarithmic scale of intensity. Taking sound pressure levels as a means of comparing loudness, we begin by measuring the average hearing threshold of young people, i.e., the softest sound they can hear in a perfectly quiet room. This we would call one decibel. In this bulletin, we are talking in terms of decibel A scale or dBA.

If we add enough sound to cause a perceptible increase, we have two decibels, and so on up the scale until we reach a point where the sound actually causes discomfort or pain. Pain would be that which we might get from the sound of a jet engine or large siren. This would be about 140 decibels.

The ability to hear middle and high frequency sounds usually decreases with age. The longer the noise exposure, the greater the damage to the human mechanism. Continued exposure to loud noise can lead to increasing difficulty in hearing normal conversation or even shouted warnings of danger.

PROPERTIES OF NOISE

Some properties of noise are intensity, frequency and duration. The louder the noise, the greater its intensity; high frequency noises may be more damaging to hearing than low frequency noises. Frequency is the number of variations in sound pressure per unit of time expressed in Hertz (Fig. 2).

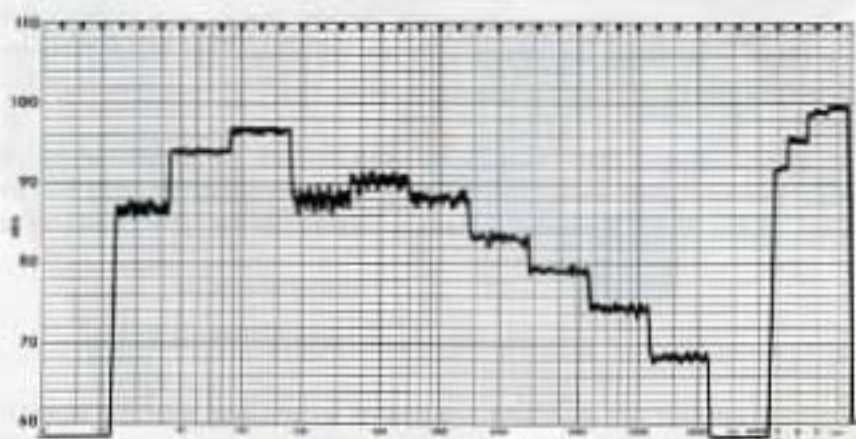


Fig. 2. Frequency range for a tractor.

Distance has an effect on sound pressure or intensity. If you are 5 feet from a noisy machine and you move back to 10 feet, the sound pressure drops to one-fourth of what it was at 5 feet.

MAN AND NOISE

Noise can affect man in several ways. It can have a psychological effect which might startle, annoy or disrupt concentration, relaxation or sleep. People working in noisy environments are more easily confused and make more errors.

Noise might also interfere with communication, thus interfering with job safety and performance.

When looking at any decibel scale, remember that an increase of a few dB represents a considerable increase in sound intensity (Table 1.). This becomes important as we near the ear tolerance limits for continued noise exposure. A few dB one way or the other can make the difference between safe noise levels and those which damage hearing. You can't always rely on your ears to tell you the difference. A damaging noise level may not seem much louder than the acceptable one.

HOW TO CONTROL NOISE

Every noise problem breaks down into three parts: (1) source of sound, (2) path along which the sound energy travels and (3) the ear.

Table 1. Decibel levels of common sounds at typical distance from source.

0	Acute threshold of hearing
15	Average threshold of hearing
20	Whisper
30	Leaves rustling, very soft music
40	Average residence
60	Normal speech, background music
70	Noisy office, inside auto 60 mph
80	Heavy traffic, window air-cond,
85	Inside acoustically insulated protective tractor cab in field
90	OSHA limit - hearing damage on excess exposure to noise above 90 dB
100	Noisy tractor, power mower, ATV, snowmobile, motorcycle, in subway car, chain saw,
120	Thunderclap, jackhammer, basketball crowd, amplified siren (100')

The control of noise at the source is an engineering problem which requires dampening of the noise by modifying or redesigning the source.

Noise reduction along the path can be accomplished in other ways: by not making the noise, by putting shields between you and the noise and by absorbing the noise with some absorbent material.

Noise control at the ear can be accomplished by the use of ear protectors, limiting exposure time or working in a sound-resistant enclosure.

HEARING PROTECTION

Sometimes we cannot control all the noise at its source. In this situation, it might be necessary to have hearing protection. Hearing protection consists primarily of the insert type earplug (Fig. 3) or the earmuff (Fig 4).

The insert type is placed in the ear canal. Materials used are rubber, soft or hard plastic, wax and special fibers such as "Swedish



Fig. 3

Wool." Rubber and plastic types are popular because they are inexpensive and easy to keep clean.

Some people prefer the earplug to be custom-fitted. It does a better job of blocking out the noise and is more comfortable. The earplug has the advantage of being cooler in hot weather.

Earmuffs cover the entire ear. The main advantage of the muff is that it can be taken off and put back on quickly as needed. While they are the most reliable protection available they can cause the wearer discomfort in hot weather.

Wax and "Swedish Wool" inserts are shaped by hand. They should be discarded after one use. Plain cotton is a poor noise suppressor and offers little protection. Neither the earplugs used by swimmers nor hi-fi earphones are suitable noise protectors.

Fortunately, no one needs to suffer hearing damage. If exposure is over 85 dBA, one should consider some type of hearing protection. Some complain that hearing protection will block out all noise. This is not true since the design of protective devices merely reduces the amount of noise reaching the ear.



Fig. 4

SOURCES OF HEARING PROTECTION

Earmuffs and earplugs are available from several sources. Equipment companies, sporting goods stores and ear doctors (otolaryngologists) usually have them available.

OTHER WAYS TO CONSERVE HEARING

There are several ways to conserve hearing. One of the more important ways is to keep the exhaust system in good repair. Many replacement mufflers on the market are better than the original equipment.

When shopping for new equipment, especially new tractors, compare the noise values from the official Nebraska Tractor Tests. The Occupational Safety and Health Act does have a section relating to noise levels (Table 2). Perhaps this will relate to other pieces of farm equipment in the future.

Keep machinery properly maintained and lubricated. Poor maintenance not only makes a machine noisier but also increases wear.

Limit the amount of exposure to noisy items such as chain saws, grinders, etc., unless you are using ear protection. Try to place noisy items such as crop drying equipment away from dwellings and livestock confinement.

Insulate or place noise barriers where you have noisy equipment. If you have a noisy cab, insulate it. Your extension agricultural engineer has information on how this should be done.

Everyone in agriculture should have a hearing test. Studies have shown that agriculturally related noises have caused hearing problems. These tests can be obtained at the University of Nebraska Speech and Hearing Clinic, Tractor Power and Safety Day, Nebraska State Fair, otolaryngologists (ear, nose and throat specialists) and other organizations sponsoring screening tests.

It is a good idea to get a test even if you think you do not have a problem since the hearing test can reveal early signs of hearing loss.

In 1970, the University of Nebraska Tractor Testing Laboratory included a noise level test as part of the official Nebraska Test. The test included a bystander level test which is a requirement for tractors sold on the European market. The 100, 75, and 50% load

Table 2. Permissible noise-exposure times.

<i>A-weighted sound level (slow response) *</i>	<i>Exposure (hrs-min)</i>
85 dB	16-0
86	13-56
87	12-7
88	10-33
89	9-11
90	8-0
91	6-58
92	6-4
93	5-17
94	4-36
95	4-0
96	3-29
97	3-2
98	2-33
99	2-18
100	2-0
101	1-44
102	1-31
103	1-18
104	1-9
105	1-0
106	0-52
107	0-46
108	0-40
109	0-34
110	0-30
111	0-26
112	0-23
113	0-20
114	0-17
115	0-15
Over 115	None

Exposure to impulsive or impact noise should not exceed 140 dBA peak sound pressure level.

**Sound level meters, which measure sound pressure in decibels, have several "scales", usually A, B and C. The A-scale, commonly used for general noise measurement, corresponds to the response of the human ear which is less efficient at picking up low sounds below 500 cycles than the middle and high tones up to 8,000 cycles.*

gives the noise levels at full throttle at those loads (Fig. 5). A new test at part throttle and 50% pull was added shortly after the test started. Table 3 shows results of noise testing, Nebraska Tractor Testing Laboratory, University of Nebraska. Note the lower readings from the first test in 1970 to those in succeeding years. Much of this has resulted from refinement in cab design and improved insulation.

A great deal of credit should go to the manufacturers for the outstanding job they are doing in reducing the noise levels on tractors. A lot of advancement has been made over the last few years; more is promised in the future.

A great deal has been learned about problems relating to noise. For example, we know what noise is, the agricultural equipment producing it, and the damaging effects it causes to the hearing mechanism.*

The noise level on new equipment is being reduced; however, this does not affect much of the equipment that is in use today. The task of hearing conservation is up to you. You can conserve the hearing you have by getting a hearing test and using proper ear protectors.



Fig. 5

*A study by Schneider and Sullivan at the University of Nebraska in 1979 helped to pinpoint the noise producing equipment on the farmstead.

Table 3. Nebraska tractor test summary of sound test results 1970-1980 (dBA).

Tractor name	Test No.	Bystander sound level	Max. available power	75% of pull	50% of pull	50% of pull (reduced engine speed)
Case 970 Manual Dsl.	1034	90.0	94.0	94.5	94.5	91.0
Case 1070 Manual Dsl.	1035	89.5	95.0	94.5	95.5	—
Case 1070 P. S. Dsl.	1036	89.5	95.0	94.0	96.0	—
Case 970 P. S. Dsl.	1037	89.5	93.0	95.0	95.5	93.5
Case 970 P. S. Gas	1038	85.5	91.5	91.5	89.5	—
Case 970 Manual Gas	1039	86.0	92.0	92.0	90.5	—
Oliver 1855 Dsl.	1040	86.5	93.5	95.0	94.0	—
Oliver 1655 Dsl.	1041	88.0	98.5	99.0	97.0	—
Oliver 1655 Gas	1042	85.0	97.0	96.0	95.5	—
Allis-Chalmers 175 Dsl.	1043	86.0	93.0	93.0	92.0	—
Allis-Chalmers 185 Dsl.	1044	88.5	94.5	96.0	94.5	90.5
Int'l 826 Dsl.w/cab	1045	88.0	95.0	96.0	97.0	90.0
Int'l 826 Hydro. Dsl. w/cab	1046	89.0	99.5	98.0	95.5	94.0
Int'l 1026 Hydro. Dsl. w/cab	1047	88.0	97.5	95.5	93.5	95.5
Int'l 1456 Dsl. w/cab	1048	86.4	93.0	92.0	91.5	93.0
Massey-Ferguson MF 1150 Dsl.	1049	91.4	99.0	98.5	98.5	99.0
John Deere 4320 Dsl. 2/cab	1050	88.4	92.0	92.5	92.5	90.0
Ford 3000 Gas 6-Speed	1051	81.5	100.0	99.0	96.0	93.5
Ford 3000 Dsl. 6-Speed	1052	84.8	99.5	97.5	96.0	93.5
Ford 2000 Dsl. 6-Speed	1053	86.9	100.0	98.5	96.5	94.5
Ford 2000 Gas 6-Speed	1054	81.3	98.5	96.5	93.5	—
Oliver 1955 Dsl.	1055	87.3	95.5	95.5	95.5	91.0
Oliver 1755 Gas	1056	86.0	94.0	94.0	94.0	91.5
Oliver 1755 Dsl.	1057	92.5	97.5	96.5	96.0	92.5
Case 770 P.S. Dsl.	1058	88.4	93.5	94.0	94.0	89.5
Case 870 P.S. Gas	1059	84.4	92.5	90.5	89.0	88.0

Table 3. (Cont.)

<i>Tractor name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Case 870 Manual Gas	1060	84.4	91.5	90.0	88.5	87.0
Case 770 Manual Gas	1061	83.5	89.5	89.0	88.5	—
Case 1170 Dsl. w/cab	1062	89.0	89.5	91.0	90.0	89.0
John Deere 7020 Dsl. w/cab	1063	87.0	97.0	96.0	96.5	92.5
John Deere 4620 P.S. Dsl. w/cab	1064	86.7	94.5	95.0	96.5	92.5
Allis-Chalmers 210 Dsl.	1065	90.5	97.0	97.5	97.5	92.5
Case 1070 P.S. Dsl. w/cab	1066	89.8	90.5	92.5	91.0	88.0
Case 1070 Man Dsl. w/cab	1067	90.0	88.5	89.0	90.5	89.0
Case 970 P.S. Dsl. w/cab	1068	89.0	91.0	91.0	90.5	90.0
Minn. Moline G1350 Dsl.	1069	86.6	99.0	98.0	97.0	92.0
Minn. Mo. A4T-1600 Dsl. w/cab	1070	94.2	87.5	87.0	86.0	85.0
Kubota L210 Dsl.	1071	80.0	96.5	95.5	95.5	—
Kubota L260 Dsl.	1072	83.0	99.0	97.5	96.0	90.0
John Deere 4620 S. R. Dsl. w/cab	1073	86.2	93.0	93.0	93.4	92.0
Deutz 8006 Dsl.	1074	84.6	98.5	98.0	96.5	93.5
Deutz 4006 Dsl.	1075	81.0	94.0	93.5	91.5	88.5
Case 870 P.S. Dsl. w/cab	1076	86.5	88.0	88.5	89.5	87.5
Case 870 Man. Dsl. w/cab	1077	87.0	88.0	88.5	89.5	89.5
Case 970 Man. Dsl. w/cab	1078	88.5	88.0	88.5	88.5	88.0
Steiger Bearcat w/cab	1079	92.5	89.5	90.5	91.5	86.0
Int. 1466 w/cab deluxe	1080	85.5	88.5	87.0	87.5	85.0
Int. 1086 w/cab deluxe	1081	86.0	85.5	86.5	87.0	85.0

Table 3. (cont.)

Tractor name	Test No.	Bystander sound level	Max. available power	75% of pull	50% of pull	50% of pull (reduced engine speed)
Int. 966 w/cab deluxe	1082	88.5	85.5	87.0	88.0	83.5
Int. 1066 Hydro, w/cab dlx	1083	90.0	91.5	89.5	90.5	88.0
John Deere 2030 Gas	1084	84.0	94.5	94.5	94.5	88.5
John Deere 2030 Dsl.	1085	86.5	97.0	97.0	96.5	90.5
Massey Ferguson 1500 w/cab	1086	91.0	84.5	88.5	88.5	83.5
Massey Ferguson 1800 w/cab	1087	92.0	88.5	89.5	90.5	83.5
Case 770 Manual Dsl. w/cab	1088	87.0	86.5	88.5	88.5	87.5
Case 770 P.S., Dsl. w/cab	1089	85.5	86.5	88.0	87.5	85.0
Deutz D60 06 Dsl	1091	87.5	96.0	96.0	93.5	90.5
Deutz D130 06 Dsl	1092	88.0	98.0	97.0	96.0	95.5
Ford 7000 Dsl.	1093	88.5	96.5	97.0	97.5	94.0
Int'l 766 Gas w/cab	1094	84.5	85.0	86.0	84.5	85.5
Int'l 966 Hydro Dsl. w/cab	1095	92.0	89.0	90.0	87.5	86.0
Int'l 454 Gas	1096	80.0	93.0	92.0	92.0	91.0
Int'l 454 Dsl	1097	84.5	94.5	94.5	93.5	92.0
Int'l Utility 574 Gas	1098	81.5	93.5	94.5	92.0	90.0
Int'l Utility 574 Dsl.	1099	86.0	95.0	96.5	95.0	88.0
John Deere 6030 Dsl. w/cab	1100	86.0	87.0	86.5	86.5	85.0
John Deere 7530 Dsl. w/cab	1101	85.0	88.0	87.5	88.5	85.0
Case 1370 Dsl w/cab	1102	90.0	88.0	89.0	88.0	82.5
Case 1270 Dsl. w/cab	1103	89.0	88.0	88.5	88.0	85.5
Deutz D55 06 Dsl.	1104	85.5	95.5	95.5	94.5	90.5
Deutz D100 06 Dsl.	1105	89.5	100.5	99.5	100.0	94.5
Satoh S650-G Gas	1106	83.0	96.5	95.5	95.0	—

(Table 3. (Cont.)

<i>Tractor name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Long R9500						
Special Dsl.	1107	89.5	97.5	99.0	98.5	92.5
Long U445 Dsl.	1108	85.5	101.5	98.5	96.5	92.0
Long U550 Dsl.	1109	87.0	98.5	96.0	95.0	91.0
John Deere 4430 Q. R.						
Dsl. w/cab	1110	87.5	82.5	82.5	82.0	82.0
John Deere 4030 Q. R.						
Dsl. w/cab	1111	90.5	82.0	83.5	83.0	79.5
John Deere 4230						
Q. R. Dsl. w/cab	1112	91.0	83.0	82.5	81.5	81.0
John Deere 4630 P.S.						
Dsl. w/cab	1113	88.5	82.5	83.0	83.0	82.0
Case 2470 Dsl.						
w/cab	1114	90.0	83.0	85.0	83.5	82.0
Int'l 354 Gas	1115	82.5	90.5	91.0	89.5	87.0
Int'l 4166 Dsl.						
w/cab	1116	89.5	89.5	89.0	89.0	92.0
Int'l 766 Dsl. w/cab	1117	91.0	89.0	88.5	88.5	85.5
Int'l 1468 Dsl.						
w/cab	1118	91.5	91.5	92.5	92.0	88.5
Allis-Chalmers 7030						
Dsl. w/cab	1119	88.0	79.5	79.5	79.5	77.0
Allis-Chalmers 7050						
Dsl. w/cab	1120	89.5	79.5	80.5	80.0	76.0
Ford 8600 Dsl. w/cab	1121	85.5	82.5	82.0	85.0	82.0
Ford 9600 Dsl. w/cab	1122	84.5	84.0	85.0	85.0	82.5
Int'l 986 Dsl. w/cab	1123	92.0	88.5	89.0	88.5	87.5
Int'l 1086 Dsl. w/cab	1124	86.5	88.0	88.5	88.5	89.5
Int'l 1466 Dsl. w/cab	1125	87.7	91.0	93.5	91.0	89.5
Int'l 464 Gas	1126	81.0	95.0	95.0	93.5	91.5
Int'l 464 Dsl.	1127	85.0	99.5	98.5	98.5	92.5
Int'l 674 Gas	1128	82.0	98.0	100.0	98.0	91.5
Int'l 674 Dsl.	1129	87.0	101.0	100.0	99.5	92.5
Deutz D 13006						
Dsl. w/cab	1130	84.5	92.0	89.0	88.5	87.0
Deutz D 4506 Dsl.	1131	85.5	93.0	93.5	92.0	91.5

Table 2. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Massey-Ferg. 1105						
Dsl. w/cab	1132	87.0	85.0	82.5	83.0	81.0
Massey-Ferg. 1085						
Dsl. w/cab	1133	87.5	85.0	83.5	82.5	79.5
Massey-Ferg. 1155						
Dsl. w/cab	1134	91.5	84.5	84.5	85.0	87.5
Massey-Ferg. 1135						
Dsl. w/cab	1135	86.5	82.5	82.5	82.5	80.5
David Brown 995 Dsl.	1136	85.5	97.0	96.0	95.5	92.5
David Brown 885 Dsl.	1137	83.5	95.5	94.5	93.5	91.0
David Brown 1212 Dsl.	1138	89.0	98.0	97.5	97.0	94.5
Belarus MTZ 80						
Dsl. w/cab	1139	88.0	86.5	86.5	86.5	84.5
Oliver 2255 Dsl.						
w/cab	1140	91.5	88.0	89.0	87.0	84.5
Minn. Moline G1355						
Dsl. w/cab	1141	89.5	87.0	87.0	86.0	83.0
David Brown 1210 Dsl.	1142	89.0	98.0	98.0	97.5	95.0
David Brown 885 Gas	1143	80.5	96.5	94.5	93.0	91.0
David Brown 990 Dsl.	1144	88.5	97.0	96.0	95.0	93.0
Kubota L225 Dsl.	1145	80.5	93.5	93.0	91.5	90.0
John Deere 830 Dsl.	1146	85.5	97.0	97.0	96.5	92.5
John Deere 1530						
Dsl.	1147	86.5	97.0	96.5	97.5	92.5
Case 1370 Dsl.						
w/cab	1148	88.5	81.0	81.5	84.5	79.5
Case 870 Manual						
Dsl. w/cab	1149	87.0	83.0	84.0	85.0	84.0
Case 870 P.S. Dsl.						
w/cab	1150	86.5	82.0	84.0	83.5	82.0
Int'l 666 Dsl.	1151	89.5	93.0	94.5	94.5	91.0
Int'l 666 Gas	1152	80.0	91.5	93.0	91.0	89.0
Int'l 4366 Turbo						
Dsl. w/cab	1153	93.0	84.5	86.0	86.0	82.5
Int'l Hydro 70 Gas	1154	89.0	100.0	98.0	96.5	92.5
Int'l Hydro 70 Dsl.	1155	91.5	99.5	97.0	97.0	92.0
Allis-Chalmers 175						
Gas	1156	80.5	91.0	91.0	88.0	87.5
John Deere 2630 Dsl.	1157	87.0	97.5	97.0	96.5	90.5
Int'l Hydro 100 Dsl.						
w/cab	1158	90.0	89.5	91.5	89.5	87.5

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
White Field Boss						
4-150 Dsl. w/cab	1159	91.5	81.0	81.0	81.0	81.0
Case 1270 Dsl. w/cab	1160	88.5	82.5	83.0	83.0	80.5
Minneapolis-Moline						
G955 Dsl. w/cab	1161	86.5	94.5	95.0	93.5	91.0
Steiger Bearcat II						
Dsl. w/cab	1162	93.5	86.5	86.5	85.0	81.5
Long 900 Dsl.	1163	90.0	100.0	100.0	98.5	95.5
Case 2670 Dsl. w/cab	1165	90.0	84.5	83.5	83.0	82.5
Allis-Chalmers 7040						
Dsl. w/cab	1166	89.0	78.0	78.5	79.0	76.0
Allis-Chalmers 7060						
Dsl. w/cab	1167	88.0	78.5	78.5	79.0	76.5
Allis-Chalmers 7080						
Dsl. w/cab	1168	91.0	81.5	83.0	83.5	79.0
Steiger Tiger II						
Dsl. w/cab	1169	98.0	87.0	86.0	85.5	82.0
Steiger Cougar II						
Dsl. w/cab	1170	96.0	80.0	81.5	82.5	76.0
Massey-Ferg. MF285						
Dsl. Std. MP	1171	89.0	98.5	97.5	96.5	93.5
Massey-Ferg. MF1505						
Dsl. w/cab 4W	1172	92.5	85.5	85.5	85.5	83.5
Massey-Ferg. MF1805						
Dsl. w/cab 4W	1173	93.0	86.5	86.5	86.5	82.5
Int'l 1566						
Turbo Dsl. w/cab	1174	87.5	90.0	88.5	87.5	87.0
Int'l 1568						
Dsl. w/cab	1175	90.0	91.5	90.0	91.0	89.0
Leyland 255 Dsl.						
w/cab	1176	82.5	97.5	97.5	97.5	96.0
Leyland 245 Dsl.						
w/cab	1177	83.5	100.0	99.5	98.5	97.0
Leyland 2100 Dsl.						
w/cab	1178	90.5	93.5	91.5	90.5	88.5
John Deere 8430 Dsl.						
w/cab 4W	1179	87.0	80.0	80.5	82.0	77.0
John Deere 8630 Dsl.						
w/cab 4W	1180	88.5	81.5	82.5	82.5	79.0
White Field Boss						
2-105 Dsl. w/cab	1181	87.5	88.5	88.5	87.5	88.0

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
White Field Boss 2-150 Dsl w/cab	1182	89.0	91.0	90.0	90.5	90.5
Belarus 250 Dsl. w/cab	1183	82.5	87.5	85.0	85.0	85.5
White Field Boss 4-180 Dsl. w/cab 4W	1184	95.5	81.5	83.5	82.5	82.5
Same Panter 4WD Dsl. w/cab	1185	88.0	96.5	96.0	97.0	92.5
Same Buffalo 4WD Dsl.	1186	88.0	95.5	97.5	97.5	95.0
Massey-Ferg. MF 235 Dsl.	1187	91.0	98.5	98.5	97.0	96.0
Massey-Ferg. MF 265 Dsl.	1188	87.5	95.5	96.0	96.0	93.0
Massey-Ferg. MF 255 Dsl.	1189	85.0	95.5	95.5	94.0	90.5
Massey-Ferg. MF 255 Gasoline	1190	85.0	95.0	94.0	93.0	91.5
John Deere 2040 Dsl.	1191	87.0	97.0	96.5	96.5	92.5
John Deere 2240 Dsl.	1192	88.0	97.5	98.0	97.5	92.0
Massey-Ferg. MF 275 Dsl.	1193	89.0	97.5	98.5	96.5	92.0
Massey-Ferg. MF 235 Gas	1194	84.5	97.5	94.5	92.5	92.5
Allis-Chalmers 7000 P.S. Dsl. w/cab	1195	88.5	79.5	79.0	79.5	78.0
Allis-Chalmers 7040 P.S. Dsl. w/cab	1196	89.5	79.5	79.0	79.0	76.5
Allis-Chalmers 7060 P.S. Dsl. w/cab	1197	89.5	79.5	80.0	80.0	79.5
Kubota L 285 Dsl.	1198	79.0	91.0	89.5	88.0	85.5
Yanmar YM 240 Dsl.	1199	78.0	90.5	88.5	88.5	84.5
Belarus T 25A Dsl. w/cab	1200	85.5	89.5	88.0	89.0	88.0
Ford 5600 Dsl. 8-Speed	1201	88.5	96.0	96.5	96.5	92.5
Ford 4100 Dsl., 8-Speed	1202	88.0	96.0	97.5	95.5	93.5

Table 3. (Cont.)

Tractor Name	Test No.	By-stander Sound Level	Maximum Available Power	75% of Pull	50% of Pull	50% of pull (reduced engine speed)
Ford 3600 Dsl., 6-Speed	1203	87.5	94.0	93.5	93.0	90.0
Ford 2600 Dsl., 6-Speed	1204	87.5	94.5	94.0	94.5	91.0
Ford 2600 Gas, 6-Speed	1206	78.0	92.0	90.0	89.5	87.0
Ford 2600 Gas, 8-Speed	1207	76.0	91.5	90.5	89.5	87.5
Ford 3600 Gas, 6-Speed	1208	80.0	91.5	91.5	90.0	88.5
Case 1410 Manual Dsl. (David Brown 1410 Synchromesh)	1209	86.0	97.0	96.0	94.5	92.5
Case 1410 P.S. Dsl. (David Brown 1412 Hydra-shift)	1210	86.0	95.0	94.5	94.5	90.5
Case MB 4/94 4WD Dsl. w/cab	1211	85.5	86.5	86.0	88.0	82.5
White Field Boss 2-70 Dsl.	1212	90.5	100.5	99.0	99.0	97.0
White Field Boss 2-85 Dsl. w/cab	1213	89.5	85.5	84.5	84.5	83.5
Massey-Ferg. 230 Dsl.	1214	84.5	96.0	95.0	94.0	90.0
Massey-Ferg. 230 Gas Int'l 4588 4WD Dsl. w/cab	1215	81.0	92.5	91.0	90.0	87.0
Ford 6600 Dsl., 8-Speed	1216	100.5	82.0	82.0	82.0	79.0
Case 1570 Dsl. w/cab	1217	90.5	96.5	96.5	96.5	92.0
Deutz 6206 Dsl. w/canopy	1218	90.0	84.5	84.5	84.0	81.5
Deutz 6806 Dsl., w/canopy	1219	86.5	99.0	99.0	96.0	91.5
Ford 3600 Dsl., 8-Speed w/cab	1220	89.5	99.0	99.5	98.5	93.0
Ford 2600 Dsl., 8-Speed w/cab	1221	85.0	82.5	83.5	83.5	81.5
Ford 4600 Dsl., 8-Speed w/cab	1222	88.0	82.0	81.0	81.5	80.0
Ford 6600 Dsl., 16-Speed w/cab	1223	90.5	84.0	83.0	84.0	83.5
Ford 7600 Dsl., 16-Speed w/cab	1224	90.5	82.0	83.5	85.5	80.0
	1225	86.0	84.5	85.0	84.5	80.5

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Ford 3600 Gas, 8-Speed w/cab	1226	80.5	80.5	80.5	80.5	77.5
Ford 5600 Dsl., 16-Speed w/cab	1227	88.0	82.5	83.5	84.5	80.5
Ford 1600 Dsl., 9-Speed	1228	81.5	95.5	93.0	92.5	88.5
Allis-Chalmers 7580 4WD Dsl. w/cab	1229	92.5	79.0	79.5	78.0	76.0
Allis-Chalmers 5040 Dsl.	1230	89.0	96.5	95.5	95.5	90.5
White 2-50 Field Boss Diesel	1231	87.0	99.5	98.5	97.0	95.0
White 2-60 Field Boss Diesel	1232	88.0	98.5	96.0	96.0	92.5
Steiger Cougar III ST-310 Diesel w/cab	1233	103.0	80.0	80.5	81.5	78.5
Steiger Panther III ST-310 Diesel w/cab	1235	105.0	81.0	81.0	83.0	79.0
Steiger Panther III ST-325 Diesel w/cab	1236	101.0	80.5	80.5	80.0	77.0
Steiger Wildcat III ST-210 & RC-210 Diesel w/cab	1237	92.0	84.0	86.0	85.0	81.0
Steiger Cougar III ST-270 Diesel w/cab	1238	100.0	80.0	80.0	80.5	77.0
Steiger III ST-250 Diesel w/cab	1239	99.0	78.5	79.0	81.0	76.5
Allis-Chalmers 5050 Diesel	1240	89.5	99.5	98.0	96.5	93.5
Case 2870 Diesel w/cab	1241	92.0	82.0	81.5	82.0	79.0
Ford 7700 Diesel, 16-Speed w/cab	1242	86.5	83.5	84.0	83.5	83.5
Ford 9700 Diesel, 16-Speed w/cab	1243	89.0	81.5	82.5	83.0	80.0
Ford 6700 Diesel, 16-Speed w/cab	1244	87.0	82.0	83.0	83.0	82.0
Ford 8700 Diesel, 16-Speed w/cab	1245	89.0	81.0	82.5	82.0	79.5
Steiger Bearcat III ST-220 Diesel w/cab	1246	90.5	79.0	81.5	80.5	76.5
International 1086 Diesel w/cab	1247	86.0	78.5	78.5	80.5	77.0

Table 3. (Cont.)

International 1586 Diesel w/cab	1248	87.5	78.5	79.0	79.0	79.5
John Deere 2840 Diesel	1249	88.5	95.0	94.5	94.5	90.5
Massey Ferguson 255 Diesel 12 Speed	1250	88.00	96.0	96.0	94.5	92.0
Massey Ferguson 245 Diesel	1251	86.0	97.0	96.5	96.5	92.0
Massey Ferguson 245 Gasoline	1252	81.0	95.5	95.5	94.5	93.5
International 886 Diesel w/cab	1254	90.0	80.0	81.0	81.0	79.0
International 986 Diesel w/cab	1255	89.5	80.0	81.0	81.5	81.0
International 4386 Diesel w/cab	1256	96.5	82.0	82.0	82.5	78.0
International Hydro 186 Diesel w/cab	1257	92.5	82.5	83.0	82.5	80.5
Massey-Ferguson 2805 Diesel 24 Speed w/cab	1258	94.5	81.0	81.0	81.0	78.5
Allis-Chalmers 7020 Power Shift Diesel w/cab	1259	89.5	78.0	78.5	77.0	76.5
Allis-Chalmers 7020 Power Director Diesel w/cab	1260	89.0	77.5	77.0	76.5	74.5
Allis-Chalmers 7045 Power Director Diesel w/cab	1261	88.5	78.0	77.5	76.5	74.0
Allis-Chalmers 8550 Diesel w/cab	1262	94.5	84.5	85.0	84.5	80.5
John Deere 4840 Diesel w/cab	1263	90.0	80.0	79.0	79.5	75.5
John Deere 4640 Diesel w/cab	1264	88.0	77.5	77.5	77.5	77.0
John Deere 4440 Diesel w/cab	1265	88.0	78.0	78.0	79.0	75.5
John Deere 4240 Diesel w/cab	1266	92.0	79.5	79.0	78.5	75.5
John Deere 4040 Diesel w/cab	1267	92.0	79.5	79.0	79.0	76.5

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available Power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
SAME Tiger 100 Diesel w/cab	1268	90.5	89.5	90.5	90.5	84.5
Lamborghini 1056 Diesel w/cab	1269	91	88	89.5	89.5	82.5
Allis Chalmers 5020 Diesel w/o cab	1270	79	94.5	92.5	90.5	90.5
Allis Chalmers 5030 Diesel w/o cab	1271	82	94	92.5	91	88
Steiger Bearcat III Diesel w/cab	1272	99.5	80.5	80	80	76.5
Steiger Cougar III Diesel w/o cab	1273	100.5	78.5	78	77.5	75.5
Steiger Panther III Diesel w/cab	1274	102	80.5	79.5	80.5	77
White 2-135 Diesel w/cab	1275	88.5	80	80.5	80	79.5
White 2-155 Diesel w/cab	1276	87.5	80.5	79.5	80	79.5
International Harvester 284 Gas. w/o cab	1277	79.5	94	93.5	90	90.5
Massey Ferguson 2775 Diesel w/cab	1278	96	81.5	82	81	80.5
John Deere 850 Diesel w/o cab	1280	77	89	88.5	88	83.5
John Deere 950 Diesel w/o cab	1281	77	89	89	88.5	85.5
Steiger Tiger III Diesel w/cab	1282	96	76.5	76.5	76.5	75
Kubota L245 Diesel w/o cab	1283	80	95.5	93.5	91	89.5
Kubota L245 Diesel w/o cab	1284	80	92.5	91.5	91.5	87.5
Kubota L185 w/o cab	1285	79	93.5	95	90	87.5
Kubota L185 Diesel w/o cab	1286	79	91	90.5	89	85.5
White 2-180 Diesel w/cab	1287	93.5	81	82.5	83.5	79
Ford FW 30 Diesel w/cab	1288	95.5	76.5	77.5	78	74.5
Ford FW 60 Diesel w/cab	1289	100.5	80.5	81	79.5	78
Ford FW 40 Diesel w/cab	1290	96	79	80.5	81	76
Ford FW 20 Diesel w/cab	1291	92.5	76	77.5	77	74
Fiat 580 Diesel w/cab	1282	92.5	85	84.5	84	80
Fiat 420 Diesel w/o cab	1293	88	98	95.5	94.5	91.5
Fiat 780 Diesel w/cab	1294	89.5	84	84	83.5	81
J.I. Case 2090 Diesel w/cab	1295	88.5	78	77.5	78	73
J.I. Case 2290 Diesel w/o cab	1296	87	86	85.5	87	84.5
J.I. Case 2290 Diesel w/cab	1297	89	78	76.5	76	74
Long 360 Diesel w/o cab	1298	88	100	98	97	91.5
Ford TW 30 Diesel w/cab	1299	90.5	80	82	81.5	78.5

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available Power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Ford TW 20 Diesel w/cab	1300	89.5	81.5	82	82	80
Ford TW 10 Diesel w/cab	1301	89.5	81.5	82.5	83	82
J.I. Case 2390 Diesel w/cab	1302	87	78.5	77	77	74.5
J.I. Case 2590 Diesel w/cab	1303	87.5	77	77	76.5	75
J.I. Case 2090 Diesel w/cab	1304	89.5	77	76	77.5	76
Deutz DX 90 Diesel w/cab	1305	89	81.5	81	80	78
Deutz DX 110 Diesel w/cab	1306	89	82.5	82.5	82	77.5
Deutz DX 160 Diesel w/cab	1307	86	80.5	80.5	79.5	78.5
Atlas Chalmers 7045 Diesel w/cab	1308	88	76	76.5	76.5	73.5
Massey Ferguson 2675 Diesel w/cab 24 speed	1309	91	81.5	83	82	79
Massey Ferguson 2705 Diesel w/cab 24 speed	1310	88.5	81.5	83.5	83	83
Massey Ferguson 2745 Diesel w/cab 24 speed	1311	96	86	87	85	82
International Harvester 484 Diesel w/o cab	1312	84	96.5	86	97	84
International Harvester 584 Diesel w/o cab	1313	85	96.5	96	96.5	94
International Harvester 684 Diesel w/o cab	1314	86	97	97.5	97	93.5
International Harvester 784 Diesel w/o cab	1315	87	97.5	97.5	97.5	94.5
International Harvester Hydro 84 Diesel Hydrostatic	1316	88	99	98.5	99.5	95.5
International Harvester 4786 Diesel w/cab	1317	95.5	82.5	81	80.5	76.5
White 4-210 Diesel w/cab	1318	93	78.5	81	81.5	79.5
International Harvester 3388 Diesel w/cab	1319	87	78	78.5	78	75.5
International Harvester 3588 Diesel w/cab	1320	88.5	78.5	79	78.5	76
Massey Ferguson 2675 Diesel w/cab 8 speed	1321	90.5	79	82	82.5	79
Massey Ferguson 2705 Diesel w/cab 8 speed	1322	89	80.5	80	80	79
John Deere 8440 Quad-Range Diesel w/cab	1323	88	79	79	78	76
John Deere 8640 Diesel Quad-Range w/cab	1324	90	81	80	80.5	76
Ford 1700 Diesel w/o cab	1325	81.5	95.5	93.5	93	87.5
Ford 1900 Diesel w/o cab	1326	82	94.5	92.5	92.5	87.5
John Deere 1050 Diesel w/o cab	1327	79.5	89	89.5	89	86.5

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available Power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
J.I. Case 4490 Diesel w/cab	1328	84	77.5	77.5	77.5	77.5
J.I. Case 4690 Diesel w/cab	1329	86	78	78	77.5	76
J.I. Case 4890 Diesel w/cab	1330	88.5	77.5	78	77	76
Versatile 555 Diesel w/cab (12850RPM)	1331	89	82.5	82.5	80	79.5
Versatile 875 Diesel w/cab (2100RPM)	1332	91	82	82.5	82.5	81.5
Belarus 1500 Diesel w/cab	1333	94.5	87	86.5	86.5	83.5
Belarus 7100 Diesel w/cab	1334	94	90.5	90	91	88
Versatile 895 Diesel 12 speed w/cab	1335	91	83.5	84	83	81.5
International 886 Diesel 10 speed w/cab	1336	92	96	96.5	95.5	94
International Hydro 86 Diesel Hydrostatic w/cab	1337	90.5	98	97.5	96	95
International 886 Diesel 16 speed w/cab	1338	88	80	79	79.5	80
Leyland 482 Diesel Also Leyland 282 w/cab	1340	90.5	86	86.5	87.5	80
Leyland 472 Diesel Also Leyland 272 Diesel 9 speed w/cab	1341	87.5	84.5	91	85.5	80
Massey Ferguson 4800 Diesel 18 speed Also 12 speed w/cab	1342	94	82	81.5	81.5	80
Massey Ferguson 4840 Diesel 18 speed Also 12 speed w/cab	1343	95.5	84.5	86	85.6	80
Massey Ferguson 4880 Diesel 18 speed Also 12 speed w/cab	1344	91.5	81.5	83	83.5	80.5
Alis Chalmers 7010 Power Director Diesel 20 speed w/cab	1345	87.5	77.5	77.5	76.5	75
Alis Chalmers 7010 Power Shift Diesel 12 speed w/cab	1346	88	78	77.5	77	75
Satoh Mitsubishi Station S750 DD Also S750 D 9 speed w/cab	1347	84.5	98	97	98.5	92.5
Kubota M4500DT Diesel Also Kubota M4500 Diesel 16 speed w/cab	1348	79.5	90.5	90	90	88
Kubota M7500DT Diesel Also Kubota M7500 Diesel 16 speed w/cab	1349	89	96	95.5	94	90

Table 3. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available Power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
John Deere 2040 Diesel 8 speed w/cab	1350	85.5	95.5	95	95	91
John Deere 2940 Diesel 16 speed w/cab	1351	86.5	94	93	93	88.5
Hesston Fiat 680 DT Diesel Also Hesston Fiat 680 Diesel 8 speed w/cab	1352	87	83	81.5	81.5	78.5
Hesston Fiat 980 DT-5 Diesel Also Hesston Fiat 980-5 Diesel 12 speed w/cab	1353	88.5	87.5	85.5	84	80
Hesston Fiat 980 DT Diesel Also Hesston Fiat 980 Diesel 16 speed w/cab	1354	86.5	86.5	84	82	82
Steiger PTA-325 Diesel 10 speed w/cab	1355	100	75.5	75.5	75.5	75.5
Versatile 835 Diesel 12 speed w/cab	1356	89	81.5	83	83	78
John Deere 4440 Power Shift Diesel 8 speed w/cab	1357	87	77	77	77.5	74.5
w/cab		85	83.5	93	93	89
John Deere 4640 Power Shift Diesel 8 speed w/cab	1358	87.5	77	78	77.5	75.5
w/cab		86.5	94.5	95	96	90
John Deere 4040 Syncro Range Diesel 8 speed w/cab	1359	89	95.5	96.5	94	90
John Deere 4040 Power Shift Diesel 8 speed w/cab	1360	90.5	78	77.5	77	75.5
w/cab		90.5	95.5	95.5	95.5	90
John Deere 4240 Syncro Range Diesel 8 speed w/cab	1361	90.5	96	96	96.5	91
John Deere 4240 Power Shift Diesel 8 speed w/cab	1362	91	79	78	78	74.5
w/cab		89.5	96.5	96.5	96.5	92
Massey Ferguson MF205 Diesel 6 speed w/cab	1363	77.5	93.5	95	94	89.5
Massey Ferguson MF205-4 Diesel 6 speed w/cab	1364	77	95.5	94	94.5	92
Massey Ferguson MF210 Diesel 12 speed w/cab	1365	79.5	95	93	91.5	91.5
Massey Ferguson MF210-4 Diesel 12 speed w/cab	1366	78	94	92.5	91	90

Table 2. (Cont.)

<i>Tractor Name</i>	<i>Test No.</i>	<i>Bystander sound level</i>	<i>Max. available Power</i>	<i>75% of pull</i>	<i>50% of pull</i>	<i>50% of pull (reduced engine speed)</i>
Massey Ferguson MF220 Diesel 12 speed w/cab	1367	79.5	93.5	93.5	92	90
Massey Ferguson MF220-4 Diesel 12 speed w/cab	1368	79	92.5	91.5	93	89.5
Kubota M550DT Diesel Also Kubota M5500 Diesel 16 speed w/cab	1369	83.5	94	94	93	90.5
Kubota L295 DT Diesel Also Kubota L295 Diesel 8 speed w/cab	1370	81.5	95.5	94	91.5	89.5
Kubota L305 DT Diesel Also Kubota L305 Diesel 8 speed w/cab	1371	81.5	93.5	91.5	91.5	89.5
Kubota L345 DT Diesel Also L345 6 speed Diesel w/cab	1372	82.5	93	92	91.5	89
White Isaki 2-30 Diesel 8 speed w/cab	1373	83	96.5	94.5	93.5	89
White Isaki 2-35 Diesel 8 speed w/cab	1374	82.5	96.5	94	92	89
White 4-175 Field Boss Diesel 18 speed w/cab	1375	94	81	81	80.5	77.5
International 884 Rowcrop Diesel 16 speed w/cab	1376	88.5	98	99	98.5	94.5
International 3788 Diesel 12 speed w/cab	1377	88.5	80.5	80.5	80.5	78.5