

Sound Levels for the Shur Farms Cold Air Drain®
Exploratory Study Report
July 8, 2010

The Problem with Noisy Frost Protection

Noise generated by the operation of agricultural frost protection equipment is a contentious issue in many communities. This is especially true with frost protection equipment (e.g., traditional wind machines) that is generally operated during the night when temperatures are lowest. During calm, quiet nights, the operation of such frost protection equipment may be extremely disruptive to nearby residential areas. Many regions, counties, districts, and cities have already implemented (or are in the process of developing) noise ordinances or best practices to limit noise from activities, such as operating traditional wind machines (e.g., Napa County, California; New Zealand).

Growers who use noisy frost protection equipment are trying to protect their crops from frost damage, but potentially at the expense of their neighbors' health and sanity. Some commonly used frost protection devices, including traditional wind machines, are not just noisy--they are deafening--with decibel levels that have been measured as loud as approximately 90dBA at 126ft (City of Calistoga 2003: N-17). Regular exposure to noise levels above 80dB may be potentially dangerous to a person's hearing and well-being (American Speech-Language-Hearing Association).

A quieter alternative to noisier frost protection methods (e.g., traditional wind machines) is the Shur Farms Cold Air Drain[®]. This report provides the findings from an exploratory study that measured the sound levels of the Shur Farms Cold Air Drain[®] with several power options during operation. The findings from this exploratory study suggest that the Cold Air Drain[®] is quiet enough for use near residential, business, and public areas where substantial noise may be problematic.

Expectations

The operating Cold Air Drain[®] is expected to generate sound levels that are less than traditional wind machines. As this study is exploratory, there were no expectations about the sound level readings for the Cold Air Drain[®] during operation.

Methods & Data

Sound levels for the Cold Air Drain[®] during operation were measured by decibels. The decibel measures sound intensity and is a logarithmic unit, which cannot be added and subtracted like ordinary numbers. An increase of 3dB is a doubling of the "strength" of the sound. An increase of 10dB means the sound is 10 times as loud. For example, 70dB is 10 times as loud as 60dB. All readings used the A-weighted decibels (dBA).

The Cold Air Drain[®] #1550 model was used for decibel level testing. The Cold Air Drain[®] #1550 included creased panels and a heavier base to reduce movement and noise during operation (now standard on all Cold Air Drain[®] units). The power units attached to the Cold Air Drain[®] #1550 were the #H15/AS/5 Honda Power Unit, 15hp with Temperature-Controlled Auto-Start and #HVT20 Honda V-Twin Gasoline Power Unit, 16hp. Decibel readings were taken with the Cold Air Drain[®] operating with each of these engines, since different engines have produce different sound levels.

Sound level testing was conducted at the Shur Farms Frost Protection[®] manufacturing facility in Colton, California on July 8, 2010 between 7:00AM and 10:30AM. Each Cold Air Drain[®] model was tested in the same location at the facility on a level asphalt surface. An aluminum building was located to the north of the testing area and a rail yard was located to the south of the testing area.

The outside temperature was 58°F at start of testing and had risen to 70°F by the completion of the test, with 59% humidity (throughout the testing period). Decibel readings were taken using a Checkmate CM-130 on both the engine side and on the side directly opposite from the engine at a height of 5 feet. The ambient decibel level was measured at 5ft from the unit. Decibel readings were taken from 5ft to 150ft from the Cold Air Drain[®] unit in 10ft increments. Decibel readings at each distance were taken three times to ensure reasonable consistency. The averages of the three readings at each distance are reported in Table 1.

Findings

Table 1 shows the decibel readings by distance for the Cold Air Drain[®] #1550 operating with each power unit. The decibel readings for the power units are highest at 5ft from the engine for both the engine side and the side opposite the engine. From a distance of 5ft, the #H15/AS/5 Honda Power Unit, 15hp with Temperature-Controlled Auto-Start is 85.5dB on the engine side and 81.5dBA opposite the engine. From a distance of 5ft, the #HVT20 Honda V-Twin Gasoline Power Unit, 16hp is 87.5dBA on the engine side and 70.5dBA opposite the engine. As the distance from the Cold Air Drain[®] unit increases, the decibel readings decrease. At the furthest distance (150ft), the #H15/AS/5 Honda Power Unit, 15hp with Temperature- Controlled Auto-Start is 63dBA on the engine side and 60dBA opposite the engine. The #HVT20 Honda V-Twin Gasoline Power Unit, 16hp is 64dBA on the engine side and 60.5dBA opposite the engine at 150 feet. Actual decibel levels may be lower depending on soil type, ground cover, topography, obstructions (e.g., buildings, plants), temperature, and weather conditions when the Cold Air Drain[®] is operated in the field.

Table 1: Decibels (dBA) by Distance (ft) from Cold Air Drain[®] #1550+Power Unit

| Distance (ft) | #H15/AS/5 Honda Power Unit, 15hp with Temp.-Controlled Auto-Start | | #HVT20 Honda V-Twin Gasoline Power Unit, 16hp | |
|---------------|--|---------------|--|---------------|
| | Engine Side | Opposite Side | Engine Side | Opposite Side |
| Ambient | 47-50 | 46.5-48.5 | 46.5-48.5 | 51.5-53.5 |
| 5 | 85.5 | 81.5 | 87.5 | 70.5 |
| 10 | 80.5 | 79.5 | 82 | 70 |
| 20 | 76.5 | 73.5 | 78 | 68 |
| 30 | 74.5 | 72.5 | 75 | 67.5 |
| 40 | 72.5 | 70.5 | 74 | 68 |
| 50 | 71 | 70 | 73 | 68 |
| 60 | 69.5 | 68.5 | 71.5 | 67.5 |
| 70 | 68.5 | 67.5 | 70 | 67 |
| 80 | 67.5 | 66.5 | 69.5 | 66.5 |
| 90 | 67 | 65.5 | 67.5 | 65.6 |
| 100 | 67 | 65 | 67 | 65 |
| 120 | 66 | 63 | 66 | 62.5 |
| 130 | 65 | 62 | 65 | 61.5 |
| 140 | 64 | 61 | 64.5 | 61 |
| 150 | 63 | 60 | 64 | 60.5 |

Discussion

The sound levels at 5ft from each power unit on the engine side are comparable to the sound level for city traffic from inside a car (see Table 2). The sound levels at 5ft from each power unit on the side opposite of the engine are comparable to the levels of a telephone dial tone (see Table 2). At a distance of 100-150ft, the sound levels for both the engine side and opposite the engine approximate the sound level range for a normal conversation from 3-5ft (see Table 2). This exploratory study suggests that the sound levels for the Cold Air Drain[®] #1550 with each power unit at each distance increment may be significantly quieter than traditional wind machines at the same distance.

Table 2: Decibels (dB) for Common Sounds

| Sound | Decibels (dB) |
|------------------------------|---------------|
| Normal Breathing | 10 |
| Rustling Leaves | 20 |
| Whisper Quiet Library | 30 |
| Refrigerator Humming | 40 |
| TV (home level) at 3ft | 60 |
| Electric Shaver | 60 |
| Piano Practice | 60-70 |
| Normal Conversation at 3-5ft | 60-70 |
| Vacuum Cleaner | 70 |
| Telephone Dial Tone | 80 |
| City Traffic (inside car) | 85 |
| Train Whistle at 500ft | 90 |
| Subway Train at 200ft | 95 |
| Power Mower at 3ft | 107 |
| Chainsaw at 3ft | 110 |
| Pneumatic Riveter at 4ft | 125 |
| Shotgun Firing | 130 |
| Jet Engine at 150ft | 140 |

Although the findings suggest that the Cold Air Drain[®] may be quieter than traditional wind machines, there are some important limitations to this study. The first and most important limitation to this exploratory study is that sound levels were not measured directly for traditional wind machines. There were few reports from which the sound levels for traditional wind machines came that were referenced in this study. Within the limited literature on wind machines (aside from the protection effects literature), many of the sound levels reported for traditional wind machines did not disclose the specifications for the wind machines or did not provide the distances at which the decibel readings were taken. Thus, only reports that provided a more complete explanation of the sound levels for traditional wind machines were used for comparison to the Cold Air Drain[®] sound levels.

The second limitation is the location where sound level testing for the Cold Air Drain[®] was conducted. Due to the exploratory nature of this study, the Shur Farms Frost Protection[®] manufacturing facility provided an accessible initial testing site. Decibel readings were taken on the asphalt surface in close proximity to buildings with an active rail yard immediately behind the testing site. Sound waves generated by the operating Cold Air Drain[®] may have bounced off of the buildings, railroad tracks, and the pavement, which may have artificially inflated the

decibel readings. Decibel readings may have been lower if the Cold Air Drain[®] was operated in an open field on a soil surface. Additionally, some of the decibel readings may have been inflated due to passing trains on nearby railroad tracks. Although sound level readings were taken when trains were not near the testing site, passing trains in the region can be heard for several miles.

Finally, this exploratory study does not closely approximate real environments in which the Cold Air Drain[®] would generally be operated. The Cold Air Drain[®] is used to protect crops against frost damage during clear, cold nights with no wind. The outside temperature on the testing day was significantly higher than would be the case during a radiation frost night. Furthermore, the Cold Air Drain[®] generally operates in a relatively open area on an uneven soil surface among plants and vegetation, which may lower the sound levels of the Cold Air Drain[®] during operation. This exploratory study was conducted to obtain baseline decibel measures for the Cold Air Drain[®], and specific ways that sound level studies may be improved and enhanced. Future studies will be designed to more closely approximate the actual operating environment for the Cold Air Drain[®]. Further studies may also take into account pitch, which may also be important for assessing the perceived “noisiness” of frost protection devices.

Conclusion

Sound levels for the Cold Air Drain[®] during operation were measured in this exploratory study. Decibel readings were taken during the operation of the Cold Air Drain[®] #1550 with the #H15/AS/5 Honda Power Unit, 15hp with Temperature -Controlled Auto-Start and #HVT20 Honda V-Twin Gasoline Power Unit, 16hp at the Shur Farms Frost Protection[®] manufacturing facility. This exploratory study suggested that the Cold Air Drain[®] #1550 with each power option may be significantly quieter than traditional wind machines. Several limitations of this study were also discussed.

References

- American Speech-Language-Hearing Association. “Noise and Hearing Loss”. Online. 15 September 2010. <http://www.asha.org/public/hearing/disorders/noise.htm>.
- City of Calistoga. 2003. "2003 General Plan: Noise Element." Online. 17 July 2010. www.ci.calistoga.ca.us/Modules/ShowDocument.aspx?documentid=559.
- Chasin, Marshall. "Decibel (Loudness) Comparison Chart." Aud(C), FAAA, Center for Human Performance and Health. Ontario, Canada. Online. 17 July 2010. www.gcaudio.com/resources/howtos/loudness.html.*
- National Institute on Deafness and Other Communication Disorders. (1990) "Common Sounds." National Institutes of Health. Bethesda, Maryland 20892. Online. 17 July 2010. http://www.nidcd.nih.gov/health/education/teachers/common_sounds.asp.

*There were some conflicting readings. In many cases the authors did not specify at what distance the readings were taken. When there were several readings, the higher reading was chosen.