Orchard Heater Smoke Lessened

smokiness of old-style orchard heaters can be reduced by proper operation and maintenance

Robert A. Kepner

Installation of Return-Stack heaters in California citrus orchards offers an eventual solution to the smoke problem.

But immediate replacement of all other types of heaters now in use is impractical both from the growers' standpoint and because of limitations in rate of heater production.

Immediate relief must involve careful and proper operation of the better heaters now in the field until such time as they can be replaced by Return-Stack heaters or by other frost protection devices.

Nearly half of the one million orchard heaters now in use in Los Angeles County are believed to be of the lazy-flame type with 18-inch or 24-inch stacks. These heaters can be operated without excessive smoke but only if they are cleaned frequently.

About one sixth of the heaters in Los Angeles County—coke, generator or pipeline heaters, Kittle or drip-type, and Return-Stack heaters—do not produce appreciable amounts of smoke under normal operating conditions, but the generator and drip-type heaters require a higher grade of oil than do bowl-type heaters. Although some of the remaining one third are combustion-chamber types that are reasonably satisfactory if cleaned frequently and operated at proper burning rates, most of this group produce excessive amounts of smoke under most or all operating conditions. This distribution of types is probably fairly representative of the entire citrus area.

In general, the smoke output of the lazy-flame heaters with 18-inch or 24-inch stacks—which comprise the largest group of heaters now in use—can be kept within reasonable limits but only by proper operation and maintenance. The principal factors which the grower must consider in controlling orchard heater smokiness are:

1. Burning rate.

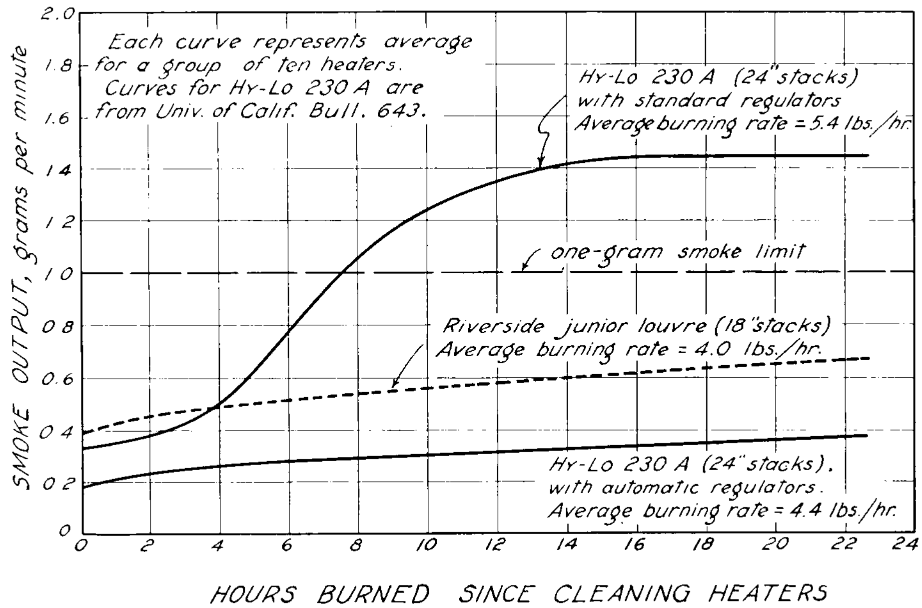
The smoke output even from a clean heater will increase rapidly if the burning rate is allowed to exceed the optimum range for that heater. The top limit for clean heaters in the above group is from one-half to three-fourth gallon per hour, depending upon the particular design involved. Heaters should be checked at least once every two or three hours during the heating period and readjusted, if necessary, in order to keep burning rates uniform and within proper limits.

2. Air leakage around covers and bowls.

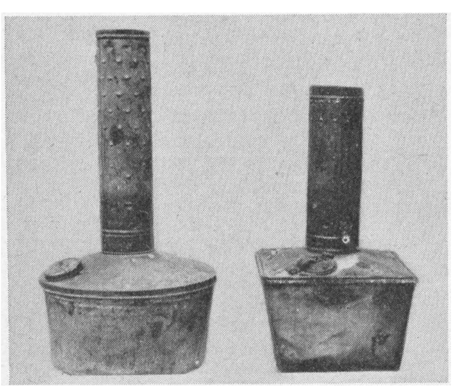
Covers, regulators and stacks which become bent or otherwise damaged so they do not fit tightly should be repaired or discarded. Air leakage into the bowl increases soot accumulations and smokiness, besides making it difficult to control burning rates accurately.

3. Soot accumulation.

The rate of soot formation in Return-Stack heaters is very low but soot accumulations build up rapidly in lazy-flame heaters and in most other bowl types. Soot accumulations, particularly in the stacks, contribute directly to smokiness. Other effects of the soot are decreased burning rates due to partial or complete clogging of air passages and increased amounts of sludge residue formed by soot falling into the oil in the bowls.



Relation of smokiness to hours operated since cleaning heaters. The increase in smoke output is closely related to the accumulations of soot in the heater, particularly to those in the stacks.



***Left:* Lazy-flame heater with standard regulator and 24-inch stack. *Right:* Lazy-flame heater with 18-inch stack and square bowl.**

Test Results

The results from extensive tests of three kinds of heaters are presented in the accompanying graph. These results are undoubtedly typical of similar heaters not tested.

The dotted curve is for Riverside Junior Louvre heaters with internal chimneys, while the other two are for Hy-Lo 230A heaters with two different types of draft regulators as illustrated in the photographs.

The so-called automatic regulator has a thermostat which, within two or three minutes after the heater is lighted, automatically reduces the excess starting draft to a predetermined operating value. This feature, which is the only automatic part of the regulator, eliminates the follow-up man in lighting.

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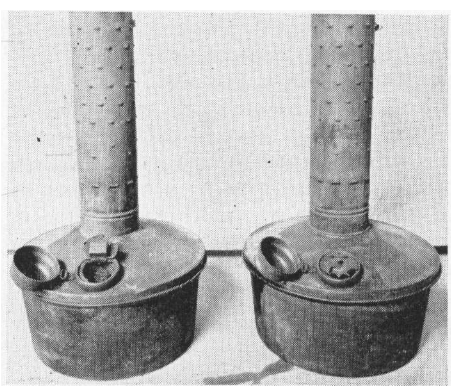
The graph shows that during the first 10 hours after cleaning—a period representing only one night of fairly heavy firing—the smoke output increased by 50% for two of the kinds tested and increased fourfold with the third kind.

The curve for the Hy-Lo 230A with standard regulator indicates no further increase in smokiness after about 15 hours of operation. This limit, which is well over one gram per minute, occurs only because soot accumulations during this time build up to the maximum amount that will adhere to the covers and stacks. After this point has been reached, the soot falls into the bowl to contribute to the sludge residue or is carried away by the stack gases as fast as it is formed.

The superiority of automatic regulators over standard regulators, as indicated by the lower and upper curves on the smoke graph, may result in part from the automatic control of the starting draft. More probably, however, it is due to improved design of the regulating device. The introduction of air through the smaller regulating holes, the reduction of air leakage around the edges of the regulator, and the uniform burning rates obtainable with this device are all factors which tend to reduce the soot accumulations and the corresponding smokiness.



Two views of automatic regulator. *Left,* regulator is open, ready for lighting. Thermostat is in the small housing visible on the regulator plate. *Right,* plate has been closed by hand immediately after lighting, but thermostat holds it up off of seat during two- to three-minute warming-up period.

Besides the advantages of the automatic regulator which have already been mentioned—elimination of the follow-up man, less increase in smokiness over a given period of time, and more uniform burning rates within a group of heaters—lazy-flame heaters equipped with this device are easier to extinguish because of the tight-fitting cover over the regulator parts.

It is evident from the results indicated by the graph, as well as from general field observations, that frequent cleaning of even the better lazy-flame heaters is absolutely essential if smoke outputs are to be kept at a minimum. These heaters should not be operated for more than 10 to 12 hours without cleaning; some of them, such as the Hy-Lo 230A with standard regulator, require even more frequent cleaning.

Cleaning Heaters

The simple cylindrical stacks of the lazy-flame heaters are readily cleaned by running a wire brush through them, but the stack should first be removed in order to avoid pushing the soot deposits into the bowl.

When heaters are equipped with internal chimneys—which extend downward from the stack opening inside of the bowl—covers can be cleaned only after removal. This should be done after every 25 to 30 hours of operation. Whether or not the covers are removed, the openings in the chimney should be cleaned with a stick or brush at the time the stacks are cleaned. Most combustion-chamber heaters are more difficult to clean because the stacks and combustion chambers need to be disassembled. However, these heaters need to be cleaned just as frequently as the lazy-flame types.

If heaters do not have internal chimneys, the covers should be cleaned while the stacks are off by reaching through the stack opening with a scoop or ladle with which the soot may be scraped off, caught and most of it removed from the bowl. Downdraft tubes may need cleaning occasionally, as smokiness is increased if the slots become plugged with soot.

Since the sludge residue formed in the bowls cannot normally be burned by lazy-flame or other ordinary bowl-type heaters, it decreases the effective fuel capacity of the bowls and hence must be disposed of from time to time. The amount of sludge formed depends somewhat upon the characteristics of the fuel and to a great extent upon the quantity of soot which is allowed to fall into the bowl. In general, the sludge accumulations will amount to 5% to 8% of the total quantity of oil burned, which means that after a heater has been operated for 50 to 60 hours at one-half gallon per hour, the accumulated sludge will have reduced the effective bowl capacity by about two gallons, as well as wasting considerable amounts of oil.

The sludge can be burned in special heaters or in Return-Stack heaters. Otherwise, it must be hauled from the orchard and dumped in a dry wash or other suitable place or burned at some central location.

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WORMS

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tions may occur in any of the prune-growing areas of California.

Regular seasonal spray programs are not required for these pests as they may be present one year but not the following year.

Control

There is one spray which will control all the possible pests that can attack prunes.

Bud moth and orange tortrix may be controlled with a jacket spray of either DDD at two pounds per 100 gallons of water, or parathion at 1½ pounds of 25% material per 100 gallons of water. This jacket spray should be followed with a June spray of the same materials.

If bud moth alone is the problem, the dosage of parathion can be reduced from 1½ to one pound per 100 gallons. The jacket spray of either material will control fruit tree leaf roller as well as tussock moth, canker-worm, and tent caterpillar which may be present.

Twig borer may be controlled with a petal fall spray of DDT, two pounds per 100 gallons of water. This spray should not be delayed until late jacket as the twig borers pupate during this period and control may not be obtained.

A petal fall application of DDT will also control fruit tree leaf roller. If the petal fall spray is missed, twig borer can be controlled in May with a spray of basic lead arsenate four pounds per 100 gallons of water.

The May spray should be timed to the emergence of the second brood of twig borer, which is evidenced by wilted twigs. This twig wilting is not distinct on prunes, so the spray should be timed with the May spray applied to peaches and almonds for twig borer control.

The third generation of twig borer in prunes may be checked by the use of a 30–70 lead arsenate sulfur dust, but considerable damage will have already occurred by this date. In addition, the broods become overlapping later in the season, and complete control is not possible.

Codling moth, since it is a minor pest of prunes, should be handled as it occurs. If it is necessary to treat for codling moth on prunes in May, a spray of four pounds of basic lead arsenate per 100 gallons of water should be used, with timing dependent upon bait pan catches. DDT could be used, but there is a possibility of spider mite build-up if DDT is used that late in the season.

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