SELECTING THE PROPER SPRAY APPLICATION SYSTEM

By Ron Morris, Assistant Editor

Environmental concern and EPA regulations make it impossible for an applicator to even contemplate a mistake involving chemicals. It is of the utmost importance that a competent applicator select and use the best equipment in a manner consistent with the environment and the pest to be controlled. While equipment varies, there are general guidelines for chosing a rig that will do the job for you.

A sprayer should be designed for the particular use intended. It should be a quality piece of machinery that is easy to fill, operate and clean. There are basically three types of large sprayers.

Low Pressure Boom Sprayers

This type of sprayer is designed to deliver a low to medium volume of spray at approximately 15 to 50 PSI. The advantages include relatively low cost, versatility and a medium to high capacity. They are limited by a low output if high volume is required. Low pressure tends to limit pesticide penetration into the foliage. There has also been some problems with agitation in this type of sprayer.

Hydraulic Sprayers

Hydraulic, or high pressure, sprayers are designed to spray large volumes of material at high pressures. Their advantages include being well built to withstand the higher pressures. They can also be converted to low pressure spraying with the proper pressure regulators.

Air Blast Sprayers

Also called mist sprayers or foggers, these units use a high speed, fan-driven stream of air to produce a fine mist that moves with the air stream. This stream can then be directed to either or both sides as the unit moves forward. Most of these types of sprayers can be adapted to apply either high or low volumes.

Because of the higher pressures used, often as much as 350 psi, good penetration and coverage are advantages gained. There is also low pump pressure. Pumps can move as little as 10 gallons per minute. However, because of the fine mist produced, there is a tendency towards more drift. It is also hard to limit the spray to the target area.

Tanks

A spray tank should have a large opening for filling and cleaning. This is essential for economic use. In addition, the tank should have qualities that will withstand the corrosion of any chemical you might use in it.

The tank should have a good, easily accessible drain. You should be able to quickly flush the tank, pump, lines and nozzles after a day's use. Make sure the gauges can be read easily and quickly.

Pumps, strainers and hoses should be selected with the thought in mind that the tank is only as good as its parts allow it to be.

Pumps should be of adequate strength to supply pressures for all of your spraying needs. They should resist corrosion and abrasion. You should use the right pump with the right material. For example, wettable powder formations will quickly destroy a gear drive pump.

Strainers should protect the working parts of the sprayer to avoid any misapplication due to clogged nozzles. They should be cleaned after each use. Strainers provide a defense against pump and nozzle wear and clogging.

Hoses should have a burst strength greater than any peak operating pressure. They should resist any corrosive effects of the material passing through them.

Be sure you check your pressure gauges often for accuracy.

Three methods for spraying large turf areas; the boom sprayer, the mistblower, and the helicopter. Cost of application is proportional to the application speed. The helicopter is the most expensive but the fastest.

Agitation

Agitation systems have traditionally been limited in their effect. Bypass agitation can be good enough for solutions and emulsions but it is best to use either jet or mechanical agitation for wettable powders. Mechanical agitation has been the best way to assure the best possible agitation. Work is being done on a sparge-line agitation system that is showing much promise. Basically this system picks up material from the bottom of the tank and, by means of a turbine pump, recirculates the material, via aparge-lines, back into the top of the mixture.

Nozzles

The standard nozzle used on boom sprayers is the flat fan with tapered edges. Spaced at regular intervals across the length of the boom, these nozzles provide an overlapping, tapered edge that produces an even spray the length of the boom. These nozzles have degrees of spraying angles that allow variation in their separation width, and boom heighth. For example, a series of 80 degree nozzles

may be spaced at 20 inches with a boom height of 17 to 19 inches while a 65 degree series of nozzle might be spaced at 20 inches with a 21 to 23 inch boom height.

It is usually best to standardize the nozzles on various pieces of equipment, which limits confusion and requires a smaller item inventory.

Manufacturers typically publish charts with their catalogs that describe the various nozzles, their best functions and capacities.

Hollow-cone type nozzles are often selected for use on boom sprayers when applying pesticides. This type of nozzle produces, as its name indicates, a hollow cone of spary. The pattern is circular with tapered edges and little or no spray in the center. Its main advantage is better foliage coverage. Material is usually applied at higher pressures with this nozzle, assuring even better foliage coverage.

Boomless flooding nozzles are often used to apply liquid fertilizers. This nozzle works at lower pressures than the fan type nozzle and gives a fairly uniform coverage across its width. The wide off-center nozzles are also used in boomless spraying. They can also be used to extend the effective swath width of a boom when attached to the ends.

Many nozzles can be used for spraying more than one type of material. Some general guidelines are: for weed control, select either a regular flat fan, flooding fan or hollow cone; for fungicides, use either a hollow or solid cone; for insecticides, use a regular flat fan, or a hollow or

Mistblowers

by William Burdick, Canterbury Country Club, Beachwood, Ohio

We started mist blow spraying at Canterbury about five years ago and it has developed into our primary means of applying fungicides to fairways.

The equipment we're using is a small, three point hitch mist blower from Myers. We bought this machine in 1972, more or less as an insurance policy, in case during our PGA championship in 1973 we had to get out there and do a fast spray job. We did not buy it to be our primary piece of spray application equipment, although it has turned out that way.

The biggest factor in favor of mist spraying is time saved. With a boom system it was taking us anywhere from a day to a day and a half, with play on the golf course, to spray all our fairways. With the mist blower we've gotten that time down to two and a half hours or five hours, depending upon the method we're using.

Our program at Canterbury is to spray each week, and we do this religiously. We use all chemicals at half rate. We've found this to be very effective since we spray once per week.

The first week we'll spray down the center of the fairway blowing out both sides of the machine. Our fairways average 90-120 ft. wide and we can easily cover that.

The second week, and this is where we came up with five hours as opposed to the two and a half hours, we'll spray one side of the fairway, then back up the other. We're actually getting double coverage that way, still using the chemical at half rate. We also find that there is a benefit because the machine has a boom directly underneath the tractor.

If we have to operate in a wind of more than six miles per hour we're losing a great deal of effectiveness. The operator can, however, become accustomed to using the wind to some advantage.

Morning applications are of benefit because of the dew. We're using 20 gallons per acre so we like to spray in the early morning when we have dew cover. I can't honestly say we've seen any noticeable difference in the amount of control between spraying on mornings when we do or don't have dew.

One of the disadvantages of this early morning application is the noise level. The fan on the sprayer plus the high tractor rpm that's needed are loud. We've had few complaints but if you have close neighbors or apartment buildings, I'm sure that this could be a problem.

An advantage of mist spraying is that the machine can be operated in almost any kind of weather condition. If you have a very wet situation you don't have to drive on the fairway — you can drive down the sides. This has saved us many times. In a pythium situation, we can get out there after any kind of rain storm, doing no damage to the fine turf, and still getting a beautiful application of chemical.

I think the mist blower is pretty much goof-proof. We've had no trouble at all with calibration. All you have to do is know your ground speed and pump pressure and the nozzle size takes care of the rest.

It's also a very low maintenance piece of equipment. I think the biggest problem, or the thing that you have to watch the closest, is nozzle size and wear, because you're operating at about 350 lbs. of pressure.

We were using brass tee-jet nozzles and found that we could only spray 18 holes of fairways about twice before changing nozzles. Since then we've changed to the same round steel nozzle that we use in the blower manifold and we only have to change those about twice a season.

There are many different types of stainless steel and hardened steel nozzles that can be used. It becomes a systematic thing to know exactly how much chemical we're going to use on an 18 hole fairway application. For example, if we don't have that extra 10 gallons left over to spray the practice tee area, we know it's time to change those nozzles.

Unlike boom spraying, where you're operating at low pressure nozzle clogging is not a problem.

The mist blower solved the problem of disease control in rough areas around our greens where it's just too tight to get any kind of boom spray equipment in. We can go up around the green very easily and we do this about three times a year. If we get into a situation where we can't get on the green or tee to spray with our regular equipment, we can give it enough of a shot with the mist blower to hold until the weather dries up.

We used to find that leaves were a problem on the fairway. A lot of times we were putting more chemical on the leaves than we were on the grass. We didn't have time to get out and clean them up before we sprayed. With the most blower there was enough air blast to get the fungicide to the turf.

One of the primary things you must do is to be sure your operator has the proper protective clothing. We require they wear a rubber suit and respirator. We also require them to take a shower as soon as they are finished spraying. WTT solid cone; to minimize drift use either a flooding fan or whirl-chamber hollow cone and keep operating pressures low (below 30 ps.).

Nozzles are made from many different materials. The best buy is the cheapest that will withstand your use of it. Brass is the most inexpensive, but also wears the quickest. If you are using an abrasive material, brass will not last long. Stainless steel is more expensive, but will resist corrosion and abrasion, especially if hardened. Plastic also resists corrosion and abrasion, but tends to swell when exposed to some solvents. Aluminum resists some corrosive materials but is easily corroded by some fertilizers. Tungsten carbide and ceramic nozzles are highly resistant to corrosion and abrasion, but are also expensive.

Nozzles should periodically be checked for uniformity of application. This can be accomplished by allowing each nozzle to fill a calibrated jar in a specified time. A nozzle should be replaced if its flow is 5% more or less than the average.

A good way to check nozzle pattern is to spray water over a stretch of asphalt. Watch for streaks as you increase speed or the spray dries. Replace any nozzle that has a faulty pattern. Nozzles should never be cleaned with any material that is as hard as, or harder, than the material of the nozzle. A toothpick works best.

Sprayer Calibration

There are many ways to calibrate a sprayer. Some are more difficult than others and some are downright abstract. One of the simplest methods is to fill the spray tanks and spray for a specified distance. Then measure, in gallons, the amount it takes to refill the tank.

Determine the total square feet in the test area by multiplying the spray width by the length of the area. A simple ratio can be set up and the total square feet one tank will spray can be calculated.

For example: If your spray width is 10 feet and you spray for 1000 feet, your test area is 10 feet X 1000 feet, or 10,000 square feet. If it took 10 gallons to spray that area, you set up a ratio as follows:

$$\frac{\text{10 gallons to refill spray tank after one pass}}{\text{10,000 square foot test area}} \quad \text{Equals} \quad \frac{\text{100 gallons in a full spray tank}}{\text{unknown area that a full tank will cover}}$$

Then: **100** gallons in a full tank X **10,000** square foot test area or **1,000,000** gallons square feet equals **10** gallons to refill the tank times the unknown area. Dividing **1,000,000** gallons square feet by **10** gallons gives and unknown area equal to **100,000** square feet. If you wish to have this number in acres divide by 43,560 square feet per acre. This gives a total of **2.3** acres. Then if you want to know how many gallons you are spraying per acre divide the number of gallons a tank will hold by the number of acres you have calculated it will spray. In this case it is **100** gallons divided by **2.3** acres or **43.5** gallons per acre.

Its all as simple as supplying your own figures for the underlined numbers above and carrying thru the problem.

Mixing chemicals

Following Environmental Protection Agency regulations is the first law of mixing pesticides in any spray tank. According to the EPA regulations, a mixture is handled as if it were a new pesticide. If the label does not indicate a combination, then one should not be prepared.

There are, however, other aspects of tank mixing that should be considered also. Incompatibility of chemicals is a common problem. Incompatibility can be the result of a reaction between the components of a mixture, or it may be caused mechanically, as with flocculation, or one chemical can be absorbed and treated preferentially by the carrier of another. In any case, the properties of the chemicals are altered and you risk loosing effectiveness, or worse yet, plant damage.

Wettable powders are generally well adopted for use in mixes. Emulsions may cause flocculation. The application of pesticides as solutions can cause some problems. The fact that the compound is water soluble often increases the chances of a reaction when mixed with other compounds.

It is possible to overcome in compatibility problems by the use of a proper adjuvant. Improper use of an adjuvant however, can also cause damage. Adjuvants can also eliminate the selectivity of herbicides thus causing plant injury.

It is possible to pre-check the stability and compatibility of various chemicals. By using conversion figures, determine the amount of chemical needed to mix one pint of chemical spray mixture. Mix one pint in a quart jar, using the same procedures you would if it was the spray tank. Put a lid on the jar and shake until the mixture is well dispersed.

If the materials remain in suspension for a reasonable period of time or if they are easily redispersed by shaking, good agitation in the spray tank will ensure even spray coverage.

If, however, the chemicals rapidly settle to the bottom of the jar or form a messy precipitate, further testing with an adjuvant is necessary.

Prepare the same mixture in a second jar and add approximately ⅓ teaspoon of the proper adjuvant (check with your dealer first). Again, shake and observe the results. If they are not satisfactory, you may continue testing by altering the amount of adjuvant or changing to a different one. If the results remain unsatisfactory, do not attempt to use that mixture in your spray tank.

Alkaline Hydrolysis

Alkaline hydrolysis is the process whereby a chemical mixed with water of sufficient alkalinity undergoes a reaction that destroys that chemical's effectiveness. In many areas of the U.S. the water has sufficient alkalinity to cause such a reaction.

If you suspect your water, it is best to have the pH determined by a testing laboratory using a pH meter. Standard litmus paper and color strips may often be off as much as one or two pH units.

If the water pH is higher than 7.5, it is enough to affect some pesticides. In general, insecticides are affected more severely than are fungicides or herbicides. Carbamates and organophosphates are broken down more rapidly than are chlorinated hydrocarbons.

Adjuvants, again, are the answer. Sold specifically for this purpose, they can lower the pH of your water into the more acceptable 4-6 pH range. Consult your pesticide dealer for a compatible adjuvant for this purpose.

Fungicides containing copper would not have the water adjust for pH. The acidity may cause enough copper to solubilize that it will cause plant injury. Sprays containing lime should not be acidified for obvious reasons.

Disposal of Pesticide Containers.

EPA regulations call for no pesticide related materials to be disposed of by open dumping, open burning (except small quantities of combustible containers not in excess of 50 pounds, or those emptied in a single work day — whichever is less and which did not originally contain organic forms of mercury, lead, cadmium, arsenic, beryllium or selenium), or water dumping.

However, it is interesting that the EPA would state in its publication that "Since adequate disposal sites and the necessary facilities are not readily available nationwide, and since significant information gaps exist which make it infeasible to write specific criteria for certain disposal methods; and procedures, prescriptive regulations requiring specific methods of disposal should not be insured at this time. The Agency has, however, elected to issue prohibitionary regulations to limit and constrain the worst acts listed above."

WTT

Helicopter spraying

by Charles H. Tadge, Mayfield Country Club, South Euclid, Ohio

We've been using an aerial program at Mayfield, primarily for fungicide application, for the past eight years.

Shortly after moving to Mayfield in 1967 it became evident to me that a regular, preventative fungicide program was necessary since our turf was a combination of bentgrass and *Poa annua*, the greater portion being poa.

Mayfield was built on very rugged terrain. There are numerous steep slopes on the fairways. This makes pulling tractor drawn spray rigs very difficult. In those early years we were cursed — we're always cursed with poorly drained heavy clay soils — but in those early years we seemed to be cursed with perpetual wet weather. This really made spraying and even mowing difficult to accomplish without damaging the turf surface.

Our three primary fungal problems were and continue to be Helminthesporium leaf spot, dollarspot, and snow mold.

We tried substituting a boomjet spray rig for our regular boom rig. This gave us better coverage and consequently fewer passes on the fairway and fewer tracks, but still it was more susceptible to wind drift and not quite as exact, and it still didn't completely eliminate the problem of traversing the hills and subsequent marking of the surface.

In 1969, we became aware of a helicopter spraying service that was available in northern Ohio. Several courses were using their services and opinions were varied but mostly favorable.

During the winter of 1969-70, we found that snow mold incidence on our fairways was quite severe, despite treatment the previous fall. On the first of March snow coverage melted, but the snow mold fungi were still active. With more cold weather and snow very probable, it was imperative that we treat the fairways. Ground conditions were such that we couldn't drive on the course with anything so arrangements were made for the helicopter to come in and spray our fairways. This was done on March 3, 1970.

We were so impressed with the apparent coverage and speed of completion that we decided to try a complete program in 1970. That year they charged us $160 per application and we furnished the chemicals. As might be expected, next year the price rose to $240 per spray. Due to both price increase and the unavailability of the helicopter on a few occasions when we needed it, we only used the spray two times in 1971.

After carefully analyzing the relative cost, we felt we could still justify aerial spraying and we went back to a complete program in 1972. We have continued the service on a regular basis since 1972 with an average of about eight sprays per year.

We don't rely 100 percent on the aerial spray program. Like any course we've got perennial trouble spots where disease, particularly dollar spot, seems to persist, so periodically we'll touch up these areas as needed with our boom spray.

We're presently the only course in northern Ohio that's using an aerial spray program on a regular basis. Several courses have used the service occasionally for spraying fungicides. Two courses have been sprayed for grubs and report good control. They have also sprayed one course for broadleaf weeds on fairways with good success. Usually once a summer we've had Mayfield sprayed for control of mosquitos.

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Helicopter

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Probably the greatest single factor in the success of an aerial application is the effective performance of the pilot. We've been fortunate to have the same pilot over the past several years. He learned to fly in the service, had quite a bit of experience in Vietnam, and is very capable and conscientious. Last winter he became the owner of the company.

Actual spraying time involved at Mayfield has been about an hour, with an equal amount of time needed for filling and mixing chemicals. The helicopter is calibrated for an application of five gallons per acre at 35 miles per hour. Effective swath is 40 feet. Droplet size is very fine. Proper droplet size is very important to take advantage of the rotor wake and also to minimize drift.

Naturally, wind is a very significant factor. We try to spray when the wind is five miles per hour or less.

The helicopter is like a giant airblast machine. Several million cubic feet of air are moved rearward and downward during flight. When flown at heights of less than 10 feet, the rotor wake effectively drives the material into the foliage. Swath width increases as height above the ground increases, but drift potential also increases.

There are curls formed at the ends of the rotor wake called vortices that disappear last into the foliage, presenting a reliable, visible indication of swath width at air speeds of less than 35 miles per hour.

The helicopter's maneuverability and agility to work in close spaces is a paramount asset. We found that pocketed greens may get too much material if the helicopter backs into the pocket and then sprays out from a standstill position. This can be eliminated by coming in over the trees and suddenly dropping down to the surface to be sprayed. You have to have a good pilot for this. Some pilots don't want to use this technique.

The cost for spraying is presently $300 per application. An analysis has shown that spraying with our equipment would cost between $170 and $200 per application. This includes wages, payroll taxes, gasoline, equipment maintenance, and depreciation. This still falls short of the $300 price we pay for aerial spraying, but there are other factors to consider. It frees a key employee and tractor to perform other tasks. No ruts, soil compaction, or tire spins ever occur, no matter how wet the soil surface may be. When adverse weather threatens and fungal diseases are active or imminent, the spraying can be accomplished very quickly.

The prime question which must be asked is how much is it worth to have all the fairways and greens sprayed in one hour with no tractor sprayer interfering with the golfers or other maintenance operations. We feel these factors justify the added cost for aerial spray.

Another factor that might be worth considering for some courses would be the use of EPA restricted chemicals. If the course personnel were not certified to apply these chemicals, the helicopter service could be contracted to perform the function. All hazards inherent with the handling of the materials could be born by the aerial spraying applicator.

In conclusion, aerial spraying by helicopter may not be the ultimate answer. It may not fill everyone's needs, but at Mayfield we are well satisfied with the results we have experienced. WTT