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Evaluation of Rechargeable Sprayers for Tree-Marking Paint

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INTRODUCTION

Improvements in rechargeable batteries in recent years may provide an opportunity to develop a rechargeable sprayer system for tree-marking paint. There are garden-type sprayers on the market that advertise that they produce up to 60 pounds per square inch (psi) and can spray up to 40 gallons on a single charge. These sprayers are designed for spraying garden or agricultural chemicals, usually in water.

If a rechargeable sprayer were available for paint, it could provide an alternative method that could prevent wrist problems that may occur when using the manually pumped “paint guns” that have been used for years. They could also provide a viable alternative in situations where carbon dioxide may not be readily available for use with the newly developed pressurized backpack sprayers (plastic or stainless steel types).

AVAILABILITY

A search was done to see if rechargeable paint sprayers were currently available and, if not, what was available that might be adapted for applying tree-marking paint. There were no rechargeable sprayers found that were marketed for spraying paint. This is not unreasonable when one considers that paint is usually applied in highly uniform films that may be difficult to duplicate with this type of sprayer. However, tree marking does not require this level of quality.

There are several rechargeable sprayers on the market. They vary in size, weight, capacity, and portability. The largest sizes have large capacities and are wheeled. The available sprayers are made of plastic and designed for light duty home and garden use. They may not be appropriate for extended field use. They probably would not withstand rugged field applications. If the sprayer systems can handle paint, then the rechargeable battery and pump system may be able to be adapted to the backpack sprayer units currently in use. Evaluation was limited to units of a size that would be portable in the woods. This would keep the weight at a reasonable range for carrying for extended periods in the field.

Figure 1. Backpack sprayer.

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Three different size sprayers were evaluated. The quantities and pressures (psi) identified below are the manufacturers' claims based on typical liquids that would be used in the sprayers. Capability when using with paint would differ.

Flow Pro Model 421. This model has the following characteristics:

- Unit designed to carry on the back. Shoulder straps supplied.
- Empty weight: 7.2 pounds.
- Tank capacity: 4 gallons.
- 16 gallons on one charge.
- 25 to 30 psi.
- Lead acid 12-volt battery.
- Weight of battery: 2.5 pounds.

Figure 2. Hand-carry model.

Flow Pro Model 417. This model has the following characteristics:

- Unit carried in one hand and spray wand in the other. Shoulder strap included.
- Empty weight: 4.3 pounds.
- Tank capacity: 1.32 gallons.
- 40 gallons on one charge.
- 60 psi.
- Lead acid 12-volt battery.
- Battery weight: 1.8 pounds.
- Pump weight: 0.5 pounds.

Figure 3. Handheld model (one-hand carry and operation).

Saint-Gobain Calmar PS2001. This model is under development by the company.

- Similar in size to paint guns currently used.
- Empty weight: 0.75 pounds.
- Tank capacity: approximately one quart.
- One-half gallon on one charge.
- Nickel-cadmium battery.

These sprayers all were designed to spray water, cleaning supplies, or lawn and garden chemicals. Tree-marking paint has a much higher viscosity, which would reduce the volume delivered with one charge of the battery and could make it difficult to deliver the paint at all.

INITIAL TESTING

All of the units were fully charged and tested with water. Sprayers 1 and 2 have similar wands and spray tips to those used on other backpack tree-marking units. The tip is adjustable from stream to spray. Set on stream, these two units delivered a steady stream of water. Sprayer 3 has two settings, either spray or stream. On the spray setting, the unit delivered a mist. On the stream setting, it delivered a steady stream but it was very small—approximately pin size. All three sprayers were filled with water and run until empty.

Water-based tree-marking paint was tested in each of the sprayers. Sprayers 1 and 2 were able to spray a stream of paint approximately 15 feet. Effective maximum marking distance is estimated to be 6 to 8 feet from the tree. Sprayer 3 was not able to spray an adequate stream of paint. The nozzle aperture was enlarged. Sprayer 3 then was able to deliver a stream of paint in excess of 10 feet. The maximum effective marking distance is estimated to be 4 to 5 feet. With the aperture tested, the amount of paint delivered may be marginally acceptable.

It was determined that all three sprayers could, at least, push water-based paint through the system. The next question is whether the equipment can hold up to extended use.

EXTENDED TESTING - SPRAYER 2

Sprayer 2 was chosen for extended testing at San Dimas Technology and Development Center (SDTDC) of the Forest Service, U.S. Department of Agriculture. This sprayer is a lighter weight system (than sprayer 1). If it can be used for a day without a recharge, it would be the more useful of the two (less weight) in the field.

For sprayer 2, extended testing included:

- Continuous operation on one charge.
- Cleanup and storage for 48-plus hours before reusing.
- Intermittent use where unit sits with paint and then is reused.
- Evaluation for blockage.

Continuous Operation

The battery is capable of pumping paint continuously for 4 hours. This should easily exceed the actual spray time for 1 day of field use marking trees.

Cleanup and Storage

After each use the sprayer was cleaned. This included rinsing the tank, cleaning the filters, and running water through the system until it ran clear. The sprayer was then left for at least 48 hours (simulating storage over the weekend).

The sprayer was then started again. At first it did not spray paint, but after a couple of minutes it picked up the paint and sprayed acceptably. In each subsequent use, the sprayer had a harder time with initial paint pickup, and the paint flow appeared to diminish a little more each time. These tests lasted about 4 hours each. On the sixth test, the sprayer would not pick up paint in the first 15 minutes. The sprayer was cleaned and oiled. The pump was taken apart and cleaned. After the sprayer was reassembled and started, it sprayed paint for the remainder of the charge but the flow was weak. After the sixth test, the sprayer would no longer spray paint, even after a thorough cleaning.

The sprayer was taken apart and examined. The apparent reason for failure to pump was wear. The pump is a simple unit made of two plastic parts (the impeller and the housing). Either one or both of these parts had worn to the point where they were no longer a snug fit. At first the impeller had difficulty creating enough partial vacuum to pull the paint to the pump. This worsened as the pump was used, until it failed.

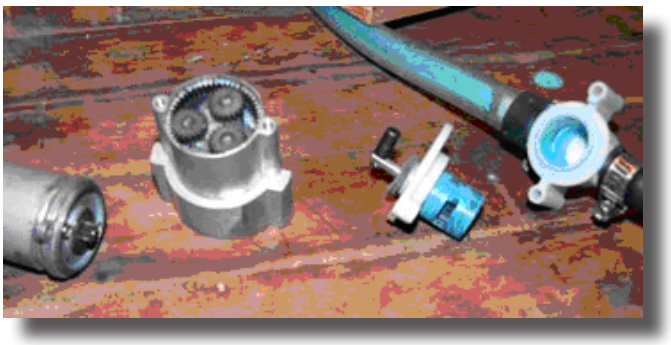

Figure 4. Motor, gear drive, impeller, and housing of pump tested.

Intermittent Use

The sprayer was tested by running the sprayer with paint for 1 hour and letting sit for 1 hour. This was repeated over 8 hours. Other than initial startup, where there was a delay in paint uptake, the sprayer ran acceptably. It operated the whole test period on one charge. This indicates that it would not be necessary to clean the sprayer during short periods of downtime, such as a lunch break.

Evaluation of blockage

The sprayer has a fine filter at the end of the uptake hose and a medium filter before the spray tip. Early testing showed that the fine filter would clog within 15 minutes. This filter was removed and the sprayer worked well afterwards. The sprayer did not clog in any of the subsequent testing. However, when the sprayer was cleaned it usually had some residue trapped by the filter at the spray tip. If this sprayer were to be used to spray marking paint, the paint should be run through a filter when filling the tank.

Sprayer 3 is a prototype being developed by the manufacturer. The manufacturer was contacted and agreed to test our paint in their system. Paint was supplied to the manufacturer for testing. Results of manufacturer testing showed that the sprayer could not draw up the rain-resistant paint due to viscosity. The unit could draw the water-based paint but had a 21-second prime time. The unit, as manufactured, is not capable of providing the proper spray pattern. The manufacturer did not conduct extended testing of the unit. However, the pump is of similar design, though smaller, than the other two sprayers. With extended use, the unit is anticipated to fail as described below for sprayer 2.

SUMMARY

As acquired, the sprayers would not last very long using tree-marking paint. The pumps would fail after a few days of use, and the entire unit might not be sturdy enough for extended field use, particularly sprayer 3.

The backpack paint systems currently use CO2 to pressurize the system. It would be possible to replace the CO2 pressurizing system with the rechargeable battery and pump. A search was undertaken to find a pump that could withstand potential wear from the paint.

A source of high quality pumps was found that could possibly be used for paint. These are high-precision pumps used in scientific/medical equipment. They cost several hundred dollars and may not withstand field use. Due to cost and potential maintenance problems, these pumps were not tested.

Alternative

An air pump/compressor may be able to be powered by the rechargeable battery to provide a pressurized system. The pump could be regulated to automatically maintain a range of pressure in the system. This would be convenient for areas where CO2 is difficult or time consuming to acquire. It also may be used where there is a concern for the safe use of CO2 at high pressures.

Further evaluation of this alternative is planned.

SDTDC's national publications are available on the Internet at http://www.fs.fed.us/eng/pubs/

Forest Service and U.S. Department of the Interior, Bureau of Land Management employees also can view videos, CDs, and SDTDC's individual project pages on their internal computer network at http://fsweb.sdtdc.wo.fs.fed.us/

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