



WATER RAKES

Rich Robertson, Acting Fire Program Assistant

Mark Zavala, Civil Engineering Student

BACKGROUND

The San Dimas Technology and Development Center (SDTDC) was asked to fieldtest two water rakes, the Hydro-Rake and the Rhines Rake. A water rake is a tool for firefighters to use during mopup. Field acceptance of the tool depends heavily on such factors as location, the type of vegetation, terrain, personal preference, and tool-use training.

SDTDC's Hydro-Rake Evaluation (figure 1)

- Length is good for mopup, but too long for stowing.
- Stiff tines penetrate deep duff and can move smoldering timber.
- One spray pattern is available.
- Water sprays on tine tips, which is preferable.
- Flowrate of 10-gallons-per-minute is too high. Water must be conserved in many firefighting situations.
- Lower-flowrate nozzles are available at hardware stores.
- Nozzle opening is large enough to close partially without affecting flowrate.
- It is not recommended for digging fireline as suggested by the manufacturer, mainly a mopup tool, not an initial attack tool.
- Swivel installed at the rear of the rake lets firefighters maneuver the rake during mopup without hose interference.
- It works well as a mopup tool in both brush and bare soil. However, it is easier to pull forward than push backward.

- Nozzle drips with the shutoff valve in the off position.
- It is most effective in pine needles and light fuels.

Hydro-Rake Specifications

Weight: 7 pounds

Length: 61 inches

Width at tines: 6 inches

Tine depth: 4 inches

Flowrate: 10-gallons-per-minute nozzle (other nozzle sizes are available).

Spray pattern: 180 degrees

Field Personnel Suggestions

During mopup operations, hot embers from the downed woody material need to be removed. The Hydro-Rake has no scraping surface. Field personnel suggested that grinding 50-degree edges on both outer tines would provide scraping ability for the rake. However, the material used in the manufacturing of the tines requires the tines to be hand-filed. Storage is another problem. A possible solution is to separate the rake at midsection to shorten and store it more easily.



Figure 1—Hydro-Rake.

SDTDC’s Rhines Rake Evaluation (figure 2)

- It can only scratch the surface of the ground. The rake cannot reach to extinguish smoldering roots.
- It cannot expose hotspots.
- Sliding action of the rake often seizes during field use. Because dirt adheres to lubricants, silicone spray and grease are not recommended.
- It works well in duff and needles when the ground litter is shallow.
- Only one spray pattern is available.
- Negotiating small rocks is possible with flexible tines.
- It is difficult for the firefighter to mix dirt and burning embers together because the rake can only be used with a pulling motion.

Rhines Rake Specifications

Weight: 3 pounds (4 pounds when modified)
 Length: 63 inches (collapses to 53 inches)
 Width at tines: 17.5 inches
 Number of tines: 15
 Spray pattern: 90 degrees



Figure 2—Rhines Rake.

Field Personnel Suggestions

The water on/off efficiency was greatly improved when using the replacement ball valve from the modification kit. The rake-to-hose attachment is accomplished more quickly and with greater ease when using the swivel attachment from the kit.

Adding an elbow fitting from the kit to distribute hose weight makes the rake easier to use and decreases operator fatigue. It is recommended that the tines be made of hardened steel. The existing tines are malleable and can bend with only modest force. Adding the modification kit (figure 3) provides optimum mopup performance.



Figure 3—Rhines Rake modifications.

Rhines Rake Modification Kit

<u>Parts list</u>	<u>Approximate cost (\$)</u>
(1) 3/4-inch elbow	1.80
(1) 3/4-inch plastic close nipple	0.43
(1) 3/4-inch full-port ball valve, NPT 400 psi	11.00
(1) 3/4-inch plastic close nipple	0.43
(1) 3/4-inch NPT double female garden hose adapter	1.70

For further information on either of these rakes, contact the SDTDC fire program leader at 909-599-1267.

About the Authors:

Mark Zavala

Mark has an associate degree in business and is currently working on a bachelor of science degree in civil engineering at California State Polytechnic University, Pomona. Mark has worked for SDTDC in the fire program for the past 3-1/2 years.

Rich Robertson

Rich was detailed to SDTDC from the Eldorado National Forest in May 2003. Rich is a forester. He has been a timber sale administrator/sale preparation officer, recreation planner, survey technician, lands officer/realty specialist, and a hotshot firefighter.

Information contained in this document has been developed for the guidance of employees of the U.S. Department of Agriculture (USDA) Forest Service, its contractors, and cooperating Federal and State agencies. The USDA Forest Service assumes no responsibility for the interpretation or use of this information by other than its own employees. The use of trade, firm, or corporation names is for the information and convenience of the reader. Such use does not constitute an official evaluation, conclusion, recommendation, endorsement, or approval of any product or service to the exclusion of others that may be suitable.



The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.