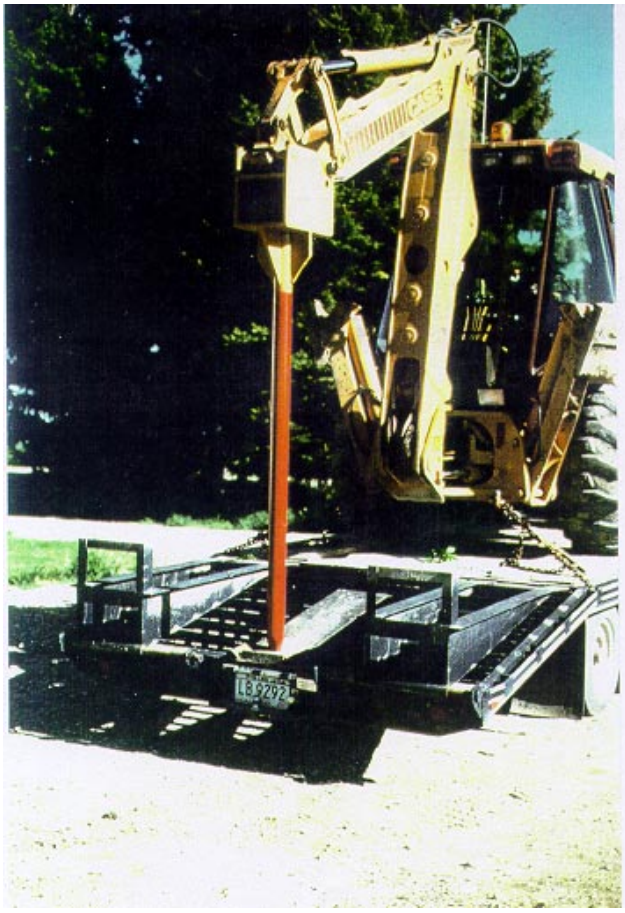
TECHNICAL NOTES

USDA-Natural Resources Conservation Service
Boise, Idaho

TN PLANT MATERIALS NO. 6 JUNE 1994

THE STINGER



A TOOL TO PLANT UNROOTED HARDWOOD CUTTINGS OF WILLOW AND COTTONWOOD SPECIES FOR RIPARIAN OR SHORELINE EROSION CONTROL OR REHABILITATION.

Introduction

Rock riprap has been used throughout the country to control shoreline and channel erosion on lakes, reservoirs, rivers, and streams. In an effort to improve the aesthetics of rock riprap, cut down on the maintenance and replacement of damaged sections of riprap, improve water quality and enhance wildlife habitat, the Interagency Riparian/Wetland Plant Development Project at the USDA-Natural Resources Conservation Service Plant Materials Center, Aberdeen, Idaho has developed a tool called "The Stinger" (Hoag and Short, 1993). The technology is not necessarily new, but many improvements have been made to the basic design to facilitate planting unrooted cuttings into rock riprap or steep cutbanks.

The Stinger was designed and built specifically for planting into rock riprap. In the past, unrooted woody vegetation has been planted into rock riprap, but planting methods have concentrated on inserting the cuttings in the ground first and dumping rock on top of them or planting through riprap with a steel bar or water jet (Schultze and Wilcox 1985). These methods are not very efficient nor have they achieved great success. The Stinger, however, builds on these methods and utilizes the power of a backhoe to plant larger diameter and longer unrooted cuttings than was possible before. The Stinger can plant unrooted cuttings through rock riprap with minimal effort to better stabilize the rock. This method allows the placement of cuttings above the ice layer where they will not be torn out by the force of the ice. The method also improves the aesthetics of riprap.

The Stinger fits on the end of a backhoe arm in place of the bucket. It is constructed by welding a long round bar to a support frame. The support frame is attached to the backhoe arm, using the same pins as the bucket, after the bucket is removed. The upper hydraulic ram on the backhoe arm moves the bar forward and backward so the holes can be punched at almost any angle. See attached specification sheet and drawing for actual design. The entire attachment weights about 900 to 1000 pounds and can be transported either attached to the backhoe arm or in a pickup truck. It was designed to be heavy enough to punch a hole down through the spaces between large rock riprap into moist to wet soil underneath.

Once The Stinger reaches the soil under the rock riprap, it is pushed in deep enough to make a hole that allows the placement of cutting in permanently moist soil.

Planting Methods

The willow or cottonwood pole is inserted part way into the hole. A metal cap is placed over the top of the cutting and the tip of The Stinger is placed on the top of the cap. The backhoe operator then pushes The Stinger down, pushing the cutting into the hole. Only 1 to 5 feet of the cutting

should remain above the rock surface. The majority of the cutting (2/3 to 3/4 of the length) should be in the ground.

The Stinger can plant 3 to 6 inch diameter by 4 to 12 feet long unrooted willow and cottonwood cuttings directly through riprap. This size cutting has had excellent establishment success when two key planting guidelines are followed:

First, the cuttings should be planted deep enough to be in permanently moist soil.

Second, the cutting tops should extended 1 to 5 feet above the high water level.

For reservoirs used for irrigation purposes, cuttings should be planted one vertical foot below the high waterline in the spring of the year for best results. Plant the cuttings when the water level has dropped two vertical feet or more below the high waterline. If plantings are planned on reservoirs that are operated differently, care should be taken to ensure the cuttings are in moist soil during the growing season, but not inundated longer than 1 month. Once established, cuttings can be inundated for longer periods of time.

If shoreline erosion control is the primary purpose of the planting, always plant in layers using different types of willow and/or cottonwood species. Shrub-type willows should be planted first and tree-type willows or cottonwoods should be planted further up the bank. The shrub-type willows intercept the wave first and absorb some of its erosive energy. Shrub-type willows have more flexible stems that will bend and not break. Tree-type willows or cottonwoods have less flexible stems, but have deeper root systems and larger trunk diameters that can withstand more wave energy (Hoag 1993).

If the planting site has been riprapped, plant one row of shrub-type willows about 4 to 6 feet apart and one row of tree-type willows or cottonwoods about 5 to 8 feet up the bank on a 10 to 12 feet spacing. The spacing depends on the type of maintenance that is planned for the planting site. Plant at wider spacings if equipment will be used to pull rock riprap back up the bank as part of a regular maintenance schedule.

If the planting site has not been riprapped and has a vertical slope, which is common in riparian corridors, plant each layer with a narrower spacing and the cuttings closer together to provide better protection for the exposed soil. Shrub-type willows have been planted as close as 1 to 2 feet apart, while the tree-type willows have been planted as close as 5 to 6 feet apart.

The primary limiting factor for establishing cuttings is moisture. The key to good establishment is placing the cuttings into permanently moist soil where competition from the roots of the surrounding vegetations is significantly decreased (Hoag et al. 1991).

When planting unrooted cuttings into rock riprap, vertical cutbanks, or eroded streambanks, insert them at a 45° angle to the water surface. This will protect the cuttings from damage caused when the bank above the cutting sloughs off and crashing down onto the stem. This sloughing

can cause a vertically planted cutting to break off. This technique also reduces the damage the cutting could sustain from heavy wave action, floating debris, or floating ice chunks.

A maintenance schedule is very important for the first 2 years following the planting. Dead cuttings should be replaced as soon as possible to prevent holes in the vegetative "armor" that could allow excessive wave energy through to impact the shoreline. The longer the period between planting and replacement, the higher the potential erosion hazard to the shoreline or streambank.

References

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The Interagency Riparian/Wetland Plant Development Project is sponsored and funded by: USDA Natural Resources Conservation Service (Idaho & Utah), USDI Bureau of Land Management, USDI Bureau of Reclamation, US Fish and Wildlife Service, US Forest Service, Idaho Fish and Game, Idaho Dept. of Transportation, and Idaho Power Co.

"THE STINGER" DESIGN SPECIFICATIONS

SHAFT

1) Cold rolled round steel bar.
2) 8 feet long including attachment area.
3) Total length for punching holes is 7 feet.
4) Business end of the bar is pointed and hardfaced with electric welding rod.
5) The bar is 3.5 inches in diameter.

MAINFRAME

1) The mainframe attaches "The Stinger" to a backhoe.

   NOTE: This particular design is for a backhoe that has a quick coupler hitch which allows for quick and easy removal of the bucket (usually found on CASE backhoes). Some modification to the design will be necessary for a backhoe that does not have a quick coupler attachment.

1) Mainframe is manufactured from 3/4 inch steel plate.
2) Mainframe is designed to support the bar and to provide a point of attachment for the main hydraulic of the backhoe. This allows the bar to move back and forth so it can punch a hole into a vertical bank at almost 90°.
3) Dimensions of mainframe are 15.5 inches tall (parallel to Bar) by 16.5 inches wide by 10 inches deep.
4) The heavy materials called for in this design are necessary because of the heavy torque and pressure that is exerted on the bar as it is pushed into the rock rip-rap and the soil underneath it. Lighter materials can be used if the planting site is coarse soil with no rock rip-rap.

CAP

1) The cap is made of 2 pieces of steel pipe welded together end to end with a separator plate between them. The diameter of the top piece should be slightly bigger than the diameter of The Stinger bar. The diameter of the bottom part of the cap is based on the size of the cuttings that will be planted. The pieces should be about 10-12 inches long.
2) Handles are welded on to the sides of the pipe at the welding point. The handles are used by the worker to move the cap from one place to the next and to place the cap on top of the cutting.

NOTE: The potential designs of a custom-made Stinger are not limited to these specifications. A skilled machine shop or welder should be able to manufacture a similar tool that is specifically designed to fit on available equipment and heavy enough for conditions found on a typical planting site.

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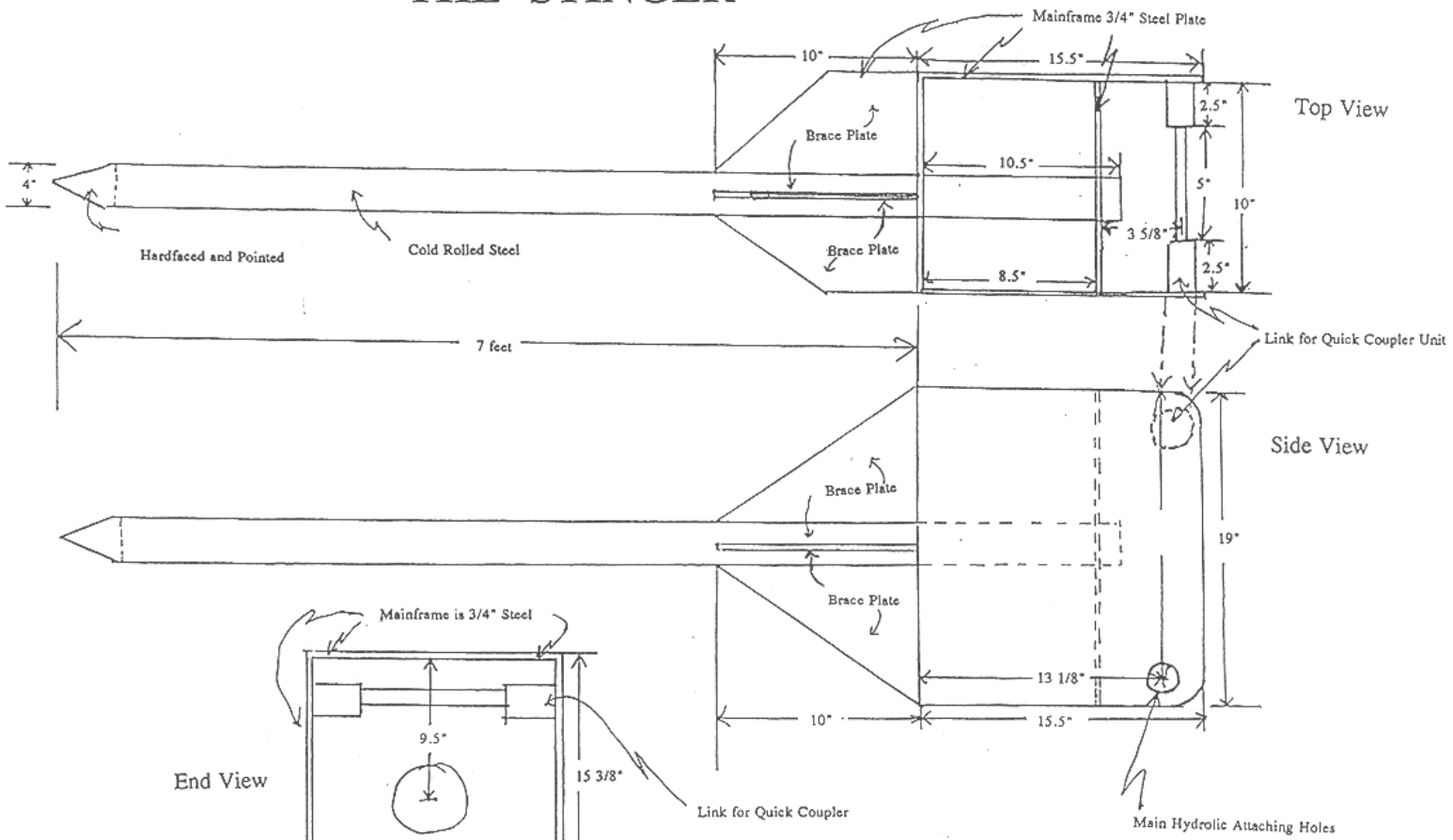

Built for a Case Backhoe with quick coupler unit Measurements for main hydrolic attachment holes and top link quick coupler unit will vary for different backhoes.

Backhoes that do not have a quick coupler unit: link is replaced with a removeable pin

Estimated Cost = $1250.00