EQUIPMENT FOR REVEGETATING DISTURBED LANDS

Richard G. Hallman

ABSTRACT: Federal land managers find themselves caught between new mining laws that require complete restoration and the difficulty of establishing plant growth in the arid area where mining is occurring. The Bureau of Land Management funded the Forest Service Missoula Equipment Development Center to develop equipment for revegetation. Six equipment systems were developed.

INTRODUCTION

When surface mining for coal in the West began in earnest, about 10 years ago, it became apparent that many techniques developed over the years for improving range habitat were unsuited to revegetate mined land. Surface mining mixes soil profiles, alters surface and ground hydrology, and removes all vegetation. Clearly, new equipment and techniques were needed to restore this land.

The Bureau of Land Management (BLM) of the Department of the Interior (USDI) was the logical Government agency to tackle the problem. About 80 percent of strippable coal in the West is Federally owned, and the BLM manages most of the land where the coal is found. The BLM, along with the office of Surface Mining, another USDI agency, is responsible for determining the revegetation potential of these lands.

Federal and State mining laws require that restored vegetation equal what existed before mining. Fortunately, coal seams in the West often are thick; seams of 20 feet and more are not unusual. So revenue from mining deposits of that magnitude makes it economically feasible for operators to do the reveqetation job that is required.

As part of its effort to develop new revegetation techniques, the BLM turned to the USDA Forest Service Missoula Equipment Development Center (MEDC). MEDC and its sister Center at San Dimas, Calif., were the only equipment development organizations involved in rangeland improvement activities.

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In 1975 MEDC personnel began working with the BLM to develop equipment and techniques to revegetate lands under arid and semiarid conditions where establishing vegetation is difficult and expensive. Six pieces of equipment were eventually built to accomplish six specific revegetation tasks. Each piece of equipment is described in the following text. The six equipment systems currently are being evaluated in various locations in the West to perfect the techniques and to establish cost data. For additional information, write USDA Forest Service, Missoula Equipment Development Center, Fort Missoula, Missoula, MT 59801.

DRYLAND PLUG PLANTER

Function

The dryland plug planter (fig. 1) is designed to automatically plant containerized trees and shrub stock on surface-mined reclaimed sites. To insure survival on semiarid sites, the root systems must stay in contact with soil moisture. To help accomplish this, the planter is able to plant containerized stock seedlings that are up to 61 cm long.

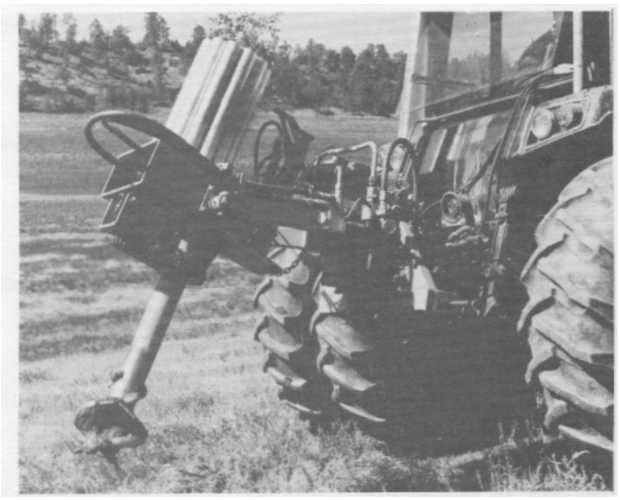

Figure 1.--Dryland plug planter plants large container stock; large stock improves survival chances.

Description

The dryland planter is designed to be mounted on the rear of a tractor. It features hydraulic leveling devices, hydraulic auger with a scarifier, rotating carousel mounted on a movable carriage and two packing spades. The machine plants containerized shrubs or trees quickly and effectively. The leveling devices and high clearance enable operations on rough ground or moderate slopes, while insuring adequate placement. The containerized root system and auger holes allow sufficient moisture uptake and unrestricted root growth for better survival.

The planting is automatic and controlled from the tractor. When the planter is positioned, the platform is leveled with hydraulic cylinders. The auger digs a hole; the scarifier auger then removes any competing vegetation from around the hole. The carousel containing the seedlings rotates and the carriage moves forward on the platform, dropping a seedling into the hole. The packing spades firm the soil around the seedling. Planting rate is estimated at more than one per minute.

Specifications

Carousel capacity: 24 seedlings
Auger diameter: 7.6 to 12.7 cm
46 cm scarifier
Depth: 61 to 76 cm
Power requirements (drawbar): 52 to 75 kW

TREE TRANSPLANTER

Function

The tree transplanter system (fig. 2) was designed to transplant small trees and large shrubs that grow naturally around the mining site to the revegetation area. The trailer is an important part of the system because it greatly reduces overall transplanting costs by reducing the transport time required for each tree. Up to 24 trees per day can be transplanted with the tree transport trailer system. The front-end loader-mounted tree spade is very maneuverable and can negotiate slopes up to 20 percent.

Description

The system consists of a Vermeer Model TS-44A Tree Spade mounted on an Owatonna 880 articulated front-end loader and a specially built trailer consisting of two rows of four cone-shaped pods. The pods are 112 cm in diameter and 108 cm deep.

Eight soil plugs are removed from the transplant site, loaded into the trailer, and transported to the transplant supply area. They are then replaced in the trailer with selected trees and shrubs that are transported back to the transplant site and planted. The front-end loader-mounted tree spade digs the trees or plugs, places them in the trailer pods, and tows the trailer between the transplant site and transplant supply area.

Specifications--Trailer

Overall width: 2.4 m with walkway removed
Height: 2.1 m
Weight: 2,722 kq
Capacity: 8 trees or plugs or 3,922 kg Cone size: 112 cm diameter, 109 cm deep Power requirements: 60 kW recommended

Specifications--Tree Transplanter

Ball (cone) depth: 46 to 152 cm
Tree size: to 25 cm diameter (maximum tree size may vary with the type of root structure)
Mounting: tractors, trailers, truck or front-end loaders

Figure 2.--Tree transplanter revegetates reclaimed mine site with trees and shrubs.

DRYLAND SODDER

Function

The dryland sodder (fig. 3) transfers native topsoil from the mine area to the reclamation area with its structure, profile, and vegetation intact. Reclamation is greatly enhanced because the soil horizons are not mixed, so soil development does not have to be repeated.

The dryland sodder strips the top layer of soil and vegetation (sod, forbs, shrubs, and small trees) from areas to be surface mined and places it intact over reshaped areas. The soil layer is scooped into the sodder and transported to the reclamation area. It is removed by tilting and shaking the bucket while slowly moving the loader backward. The conveyer system will
feature hydraulic control of the conveyor rollers, allowing the sod to be removed without tilting the bucket.

Description

The dryland sodder is a modified front-end loader bucket. The side walls and back wall are vertical to minimize damage to shrubs and tree seedlings that are stripped along with the soil and sod. The wide, flat bottom of this bucket is sprayed with plastic to reduce friction. A conveyor system is being developed for the bottom of the dryland sodder to aid loading and unloading of the sod strips and to prevent excess soil separation during the transfer.

Specifications

width: 4.3 m
Length: 2.4 m
Depth: to 30 cm
Power requirements (flywheel) 80 to 391 kW

Figure 3.--Dryland sodder preserves topsoil and its vegetation for later replacement on reshaped spoil materials.

SPRIGGED

Function

The sprigger (fig. 4) undercuts and gathers sprigs, or portions of rhizomatous stems, that can produce roots and shoots. The harvested sprigs are then spread out on the area to be revegetated and covered with soil.

Description

The sprigger is a modified potato harvester. It consists of an undercutting blade and a pair of wide, inclined conveyors. The conveyors are long rods attached between two chains and spaced 3.8 cm apart. A third conveyor across the top of the machine moves the harvested material to the side where it is dumped into a truck or piled in windrows. The sprigger is towed and powered by a tractor.

After the shrubs are mowed, the sprigger is pulled through the stand, cutting the roots well below the ground surface. The cutting action lifts the soil and shrubs onto the conveyors. The soil is shaken loose and falls through the spaces in the conveyors to the ground. The bareroot rhizomatous shrubs, or sprigs, are gathered and carefully planted on the reclamation area.

Specifications

Width: 1.5 m
Depth: 30 cm
Power requirements (drawbar): 60 to 75 kW

Figure 4.--Sprigger digs up rhizomatous material for planting on reclaimed areas.

BASIN BLADE

Function

The basin blade (fig. 5) scoops out large basins or depressions along slopes. Moisture accumulates in these basins to provide a favorable microsite for plant growth. The large basins reduce wind erosion. They also provide the advantages of terracing with fewer hazards and less expense. They collect runoff and trap snow and blowing topsoil. The furrows formed by the scarifying teeth help retain broadcast seed and fertilizer and promote increased infiltration.

Description

The basin blade is a large, crescent-shaped, heavy steel blade mounted on the rear of a crawler tractor. The blade is mounted on a parallelogram multiple-ripper shank. It is raised, lowered, and tilted hydraulically. Several replaceable scarifying teeth are located along the bottom edge of the blade.

The tractor is driven along the contour of a slope and the blade is periodically raised and lowered to form large depressions. Seed is then broadcast along the slope.

Specifications

Width: 3 m
Depth: to 91 cm
Power requirements (flywheel) 216 to 276 kW

Figure 5.--Basin blade makes depressions in soil that trap moisture, creating favorable conditions for plant growth.

HODDER GOUGER

Function

The gouger (fig. 6) creates numerous depressions in the soil surface. These depressions provide a suitable microclimate for plant establishment by increasing moisture availability, reducing wind and water erosion, and providing shade.

Description

The gouger consists of three to five semicircular heavy steel blades attached to solid arms. Each blade has three scarifying teeth along the bottom edge. The arms are attached to a heavy-duty frame with spring-loading mechanisms. They may be mounted in either one- or two-row configurations. The frame is supported with side wheels that are periodically raised and lowered to allow the blades to scoop out depressions. The unit is operated hydraulically and features positive depth control and automatic up and down cycling. A seedbox spreader is mounted on the rear of the machine to broadcast seed into the depressions.

The gouger is towed behind a tractor. The hydraulically powered automatic cycling system moves the frame up and down in relation to the wheels to create depressions. The depth of the depressions, cycle rate, and blade configuration can be varied to suit the site conditions. Average production rates have varied from 1 to 1.1 ha per hour.

The gouger creates more and larger depressions than similar equipment. The automatic cycling and hydraulic depth control make it easier to operate and the adjustable cycle rate and variable blade configurations contribute to its versatility. The spring-loaded blade arms enable it to operate in fairly rocky ground.

Specifications

Implement width: 3.4 m
Depression width: 38 to 56 cm
Depression length: 0.9 to 1.2 m
Depth: 15 to 25 cm recommended
Power requirements (drawbar): 37 kW minimum

Figure 6.--Hodder gouger makes depressions in soil and simultaneously seeds area to establish plant cover.

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