Disk-Chain for Seedbed Preparation

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Problem

Revegetation of rangeland with improved grasses and forage plants can increase forage production two- to three-fold; however, increasing costs have limited this practice. Approximately 836 million acres of rangeland are located in the western and plains states; much of this acreage can be improved for forage production. Therefore, a critical need exists for cost-effective revegetation techniques to improve these lands. The invasion of brush on much of this rangeland further complicates the problem since costly removal methods are required before conventional seeding equipment can be used.

Rootplowing (for brush control), raking, diking, and drill seeding is an effective method of establishing good grass stands; however, this method is slow and costly. A low-cost rapid system for revegetation with a good probability of producing adequate grass stands could presently be utilized on 50 million acres (about the area of Utah).

A New Concept and Its Validation

Research to develop improved brush control and range seeding equipment has been conducted by the Texas Agricultural Experiment Station, Texas A&M University at Vernon, for the past 12 years. This research has shown that diking with large offset disks consistently resulted in better grass stands than other methods tried; however, large stumps and cost often prevent or limit their use. Chaining was lower in cost, but results were poorer. Therefore, an attempt was made to combine the two methods. Disk blades were welded to alternate links of a large anchor chain. When attached to swivels and pulled on a diagonal between two crawler tractors, the “disk-chain” performs like a giant one-way plow and can traverse heavy brush and logs without difficulty. The disk-chain is well suited to covering extensive acreages and, combined with aerial seeding, is a low-cost, practical method of converting brushland to grassland.

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The disk-chaining concept originated with the King Ranch, Kingsville, Texas, in the 1960's and has been used both in their Texas and international operations. Operators of the King Ranch have stated that with additional research and development, disk-chaining has potential for converting extensive acreages of depleted rangeland to grassland in the United States and developing nations.

Grass establishment evaluation studies have been conducted in Northwest Texas in a 22- to 25-inch annual rainfall zone on rangeland rootplowed for control of mesquite (Prosopis glandulosa Torr. var. glandulosa). In a year with near normal rainfall, disk-chaining plots increased grass stands 35 to 71% compared to chaining in sandy loam and clay loam, respectively, while in a year with below-average rainfall (-36%), disk-chaining increased grass establishment by 55 and 225% over chaining in sandy loam and clay loam, respectively. Average grass densities in all disk-chained plots have been between 0.50 and 1.66 plants per square foot and all plots were aerially seeded with 1- or 2-lb pure live seed (PLS) per acre of Selection 75 kleingrass (Panicum coloratum L.).

Two-tractor pulling technique for disk-chain implement.

A disk-chain with $24 \times 1/4$-in. blades welded to a 34-lb/ft chain, and pulled on a 45-degree angle between 2 tractors, gave the optimum results in rootplowed land. This disk-chain demonstration model has been extensively tested for effectiveness on 500 acres of rangeland and on a total of 1,400 acres of large-scale plots over the last 5 years. Predictions from regression equations based on field measurements of drawbar pull indicate a per-blade pull of 215-lb at 3 mph. Using regression equations to predict pull requirements, a D-8H Caterpillar tractor pulling a 94-blade chain at 3 mph assisted by a D-6C Caterpillar tractor would result in a pulling cost of $6.50/acre\(^1\). This compares with rangeland disking costs of $18 to $25 per acre.

**Disk-Chain Development to Completion**

The Texas Agricultural Experiment Station experimental disk-chain validated the improved grass stand establishment effectiveness over smooth chaining with a predicted cost reduction in seedbed preparation of over 50% when compared to seedbed preparation by use of standard disking equipment. While the experimental disk-chain has been used on over 1,400 acres, it was designed for replicated plot studies and not large-scale commercial projects.

To complete the development of the disk-chain, a full-scale engineering development effort must be completed in which the optimum blade size, chain size, and pulling method are determined for different soils, soil depths, and vegetation; followed by the design, fabrication, and field-pulling performance testing of a full-size disk-chain implement. This full-scale engineering development effort would begin with development tests on rootplowed soil to determine optimum pulling angle, optimum disk size, and evaluation of pulling techniques (one- two-, and three-tractor systems) in varying soil, soil depth and vegetation.

The one- and three-tractor systems offer some major advances over the current two-tractor system used with

The three-tractor system, with a disk-chain pulled diagonally on both sides of the center or lead tractor, offers a very potentially maneuverable unit without the high side-draft associated with the two-tractor pulling technique. The single-tractor system would also use two disk-chains, but a rolling brace would separate the chains at the proper angle. In addition to the advantage of a single tractor and operator, the rolling brace may provide some beneficial soil packing to enhance reseeding.

A triangular disk-chain, requiring only one tractor for pulling, has been fabricated for testing. This disk-chain has reduced pulling requirements by 36% and increased operating width by 23% compared to the two-tractor diagonal pulling technique. Also, the reduction of side draft in the single-tractor pulling technique reduces wear in thecrawler tractor's undercarriage.

A second set of developmental tests would determine the optimum weight needed to operate on undisturbed soil. These tests are needed because rootplowing is not necessary in many areas. Tests would be conducted in various soils and vegetation to provide data which could be used to select the optimum pulling method, blade size, and chain size based on power requirements and effectiveness. With these data, a full-length disk-chain could be designed, fabricated and field tested for performance.


Results of Control of Prairie Dogs

Glen P. Snell

When the article, "Control of Prairie Dogs—The Easy Way," appeared in the December 1980 issue of Rangelands, Bob Larson, a Barber County, Kansas rancher, had drastically reduced his prairie dog town after 4 years of deferred grazing during June, July, and August. Largely because the rapidly growing warm-season plants hid predators and obstructed visibility for the prairie dogs, the town area dropped from 110 acres in 1976 to 12 acres by the fall of 1980.

In 1981 and 1982 Larson left a "few" cattle in that pasture during the growing season. His "few" cattle amounted to about 5% of the stocking capacity. But they concentrated on the prairie dog town. At the end of 1981 the burrowed area had grown to 15 acres. By the fall of 1982 it was up to 20 acres.

In 1983 Bob again totally deferred that pasture from grazing during June, July, and August. That fall the prairie dog area measured just 5.7 acres. This is dramatic evidence of how deferred grazing can check prairie dog development.

Editor's Note: This paper shows another reason for practicing good range management.