

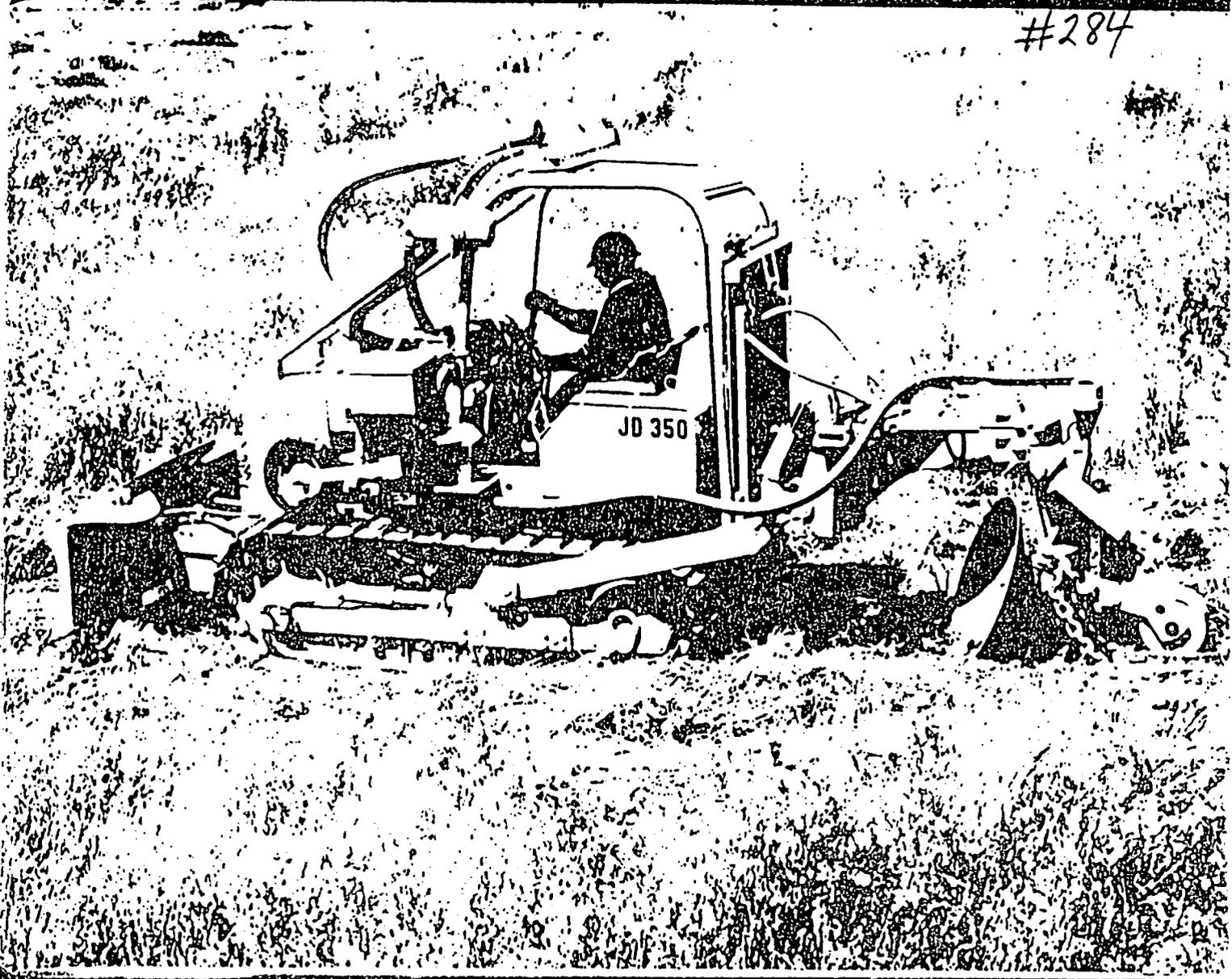
32nd Annual Report

Vegetative Rehabilitation & Equipment Workshop

San Antonio, Texas

February 5-6 1978

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Participants

U.S. Department of Agriculture

U.S. Department of the Interior

State and County Organizations

State Wildlife Agencies

Industry Representatives (Chemical, Equipment, Mining, Seed)

Educational Institutions

Ranchers

Canada

Mexico

Equipment Parts Facilities

Frank Winer, *Chairman*

Final Report

The Forest Service Stockton Equipment and Service Depot, Stockton, Calif., closed in September 1977. The remaining repair parts for the rangeland drill, brushland plow, and contour furrower were transferred to the BLM Vale District, Vale, Oreg. Other possible

parts sources could be commercial firms or past drill, plow, and furrower fabrication contractors. Laird Welding & Manufacturing Works, Merced, Calif., is an active fabrication contractor of drills, plows, and furrowers. And this firm is able to supply most repair parts for this equipment.

Papers

Land Imprinting

Gary Frasier, *Science and Education Administration*

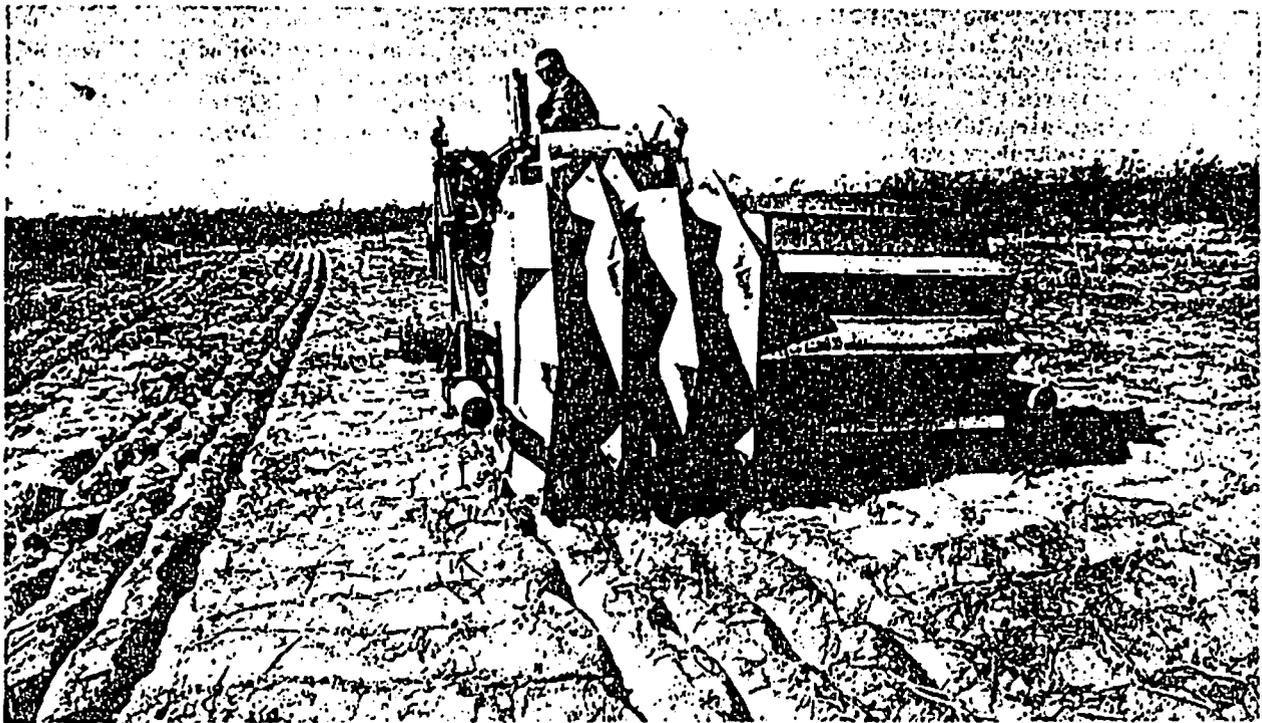
Theoretical Basis

Design of the land imprinter is based on a new concept for controlling rainwater infiltration referred to as the air-earth interface (AEI) concept. The AEI concept indicates that water infiltration is controlled by the microroughness and macroporosity of the soil surface through a complex interaction of many physical, biological, pneumatic, and hydraulic processes.

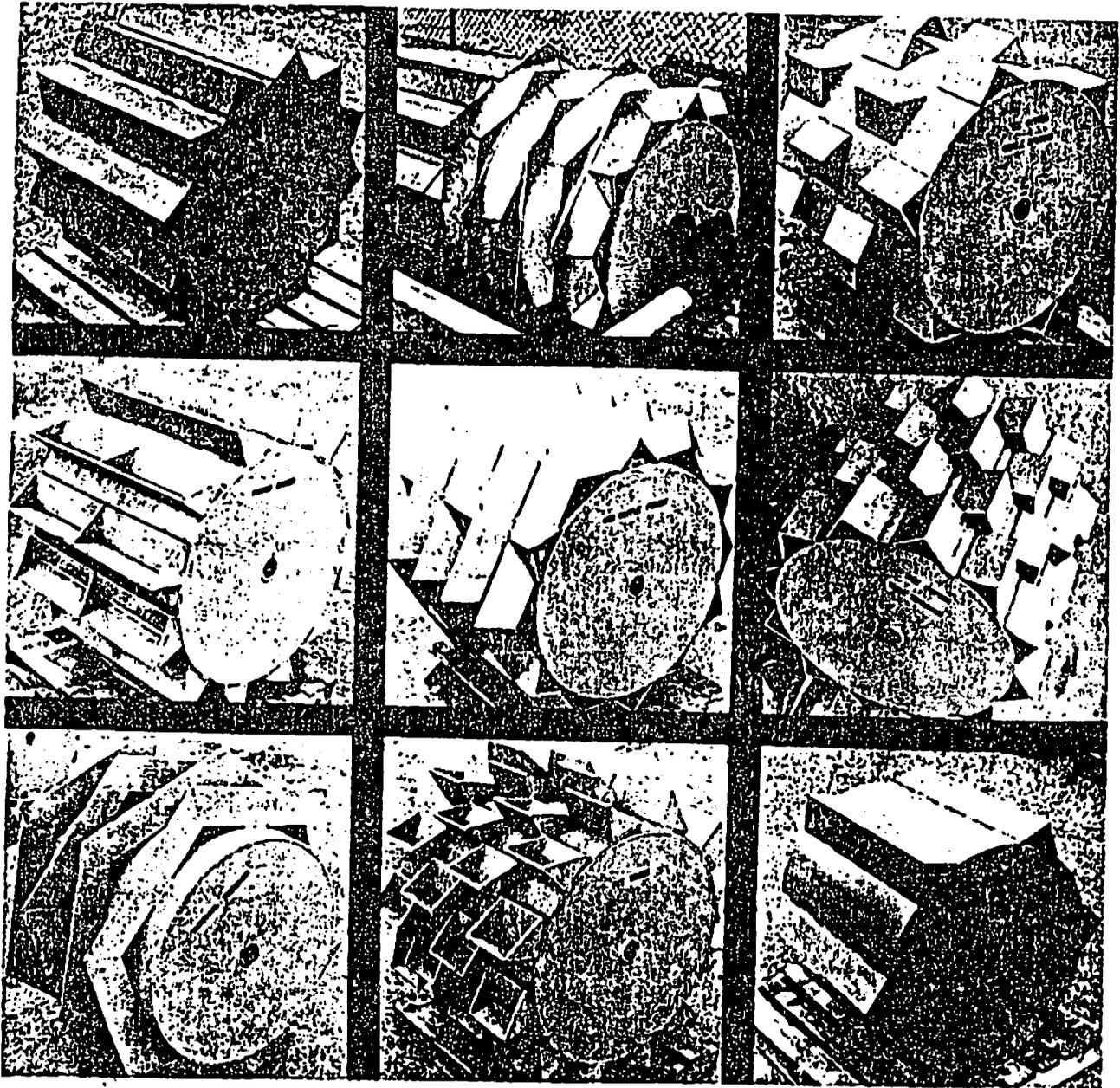
This concept was rigorously tested during the past decade under a wide diversity of edaphic, vegetal, and climatic conditions in Wisconsin, Montana, Nevada, and Arizona. Infiltration runs made on hand-imposed microroughness and macroporosity treatments dem-

onstrated that infiltration can be controlled by an order of magnitude immediately and by up to two orders if treatments are maintained for several years. This widening of the control range with time is caused by a number of physical and biological processes which may be active either during the infiltration event or between events, or at both times.

The land imprinter produces soil surface geometries very similar to the hand-imposed surface treatments used in validating the AEI concept. Consequently, the land imprinter is expected to give an infiltration control range similar to that of the hand-imposed treatments.



Land imprinter forming rainwater-irrigated seedbeds in an area infested with creosotebush near Tombstone, Ariz.



Some of the imprint capsules available for the land imprinter.

Unique Functions

Land imprinting is a unique new concept in land tillage. According to the land imprinting concept, the two major tillage functions are mechanical formation of (1) seedbeds having surface geometries and physical properties appropriate for rainwater infiltration control, crop seed germination, and crop stand establishment and (2) surface conditions appropriate for, and leading to, subsequent development of subsurface conditions that are optimal for growth of crop roots.

The first function is performed by the land imprinter, which creates unique rainwater-irrigated seedbeds through the formation of runoff-enhancing and runoff-directing furrows that are interconnected to runoff-ponding and infiltration-enhancing furrows. By this means rainwater is concentrated and infiltrated precisely where grass seeds are placed to insure adequate moisture for seed germination and stand establishment.

The second function is accomplished mainly by biological processes (and resulting physical and hydraulic processes) that are favored by the imprinted surface geometry. The newly established crop stand and the imprinter-created surface mulch interact to heighten the activity of small soil animals. This activity increases surface microroughness and macroporosity and thus water infiltration in accordance with the AEI concept.

Thus, mechanical infiltration control with the land imprinter leads to enhanced infiltration through greatly increased biotic activity. Additionally, this biotic activity and associated physical and hydraulic processes produce the desirable effects of deep soil tillage (including soil loosening, mixing, and aeration) without the development of traffic and tillage pans beneath the loosened tillage layer. Such pans restrict downward movement of crop roots and soil moisture.

Inherent Advantages

The land imprinter has several intrinsic advantages relative to alternative tillage implements. Included in these are the land imprinter's ability to:

- Increase depression storage by forming closed, angular pockets (that can hold up to 2 inches of rainwater) without inverting the soil surface layer and without covering above-ground plant materials.
- Form complex and stable geometric surface configurations by compressing, shearing, mixing, and embossing (essentially in that sequence) the immediate soil surface layer and above-ground plant materials.
- Increase (rather than decrease) effective surface mulch by crushing, chopping, mixing, and partially imbedding above-ground plant materials (thereby concentrating them at the immediate soil surface) while at the same time forming rainwater-irrigated seedbeds.
- Impress and emboss the soil surface with geometric patterns that give better control over rate, route, duration, and microsite of infiltration, runoff, and erosion for the purpose of enhancing seed germination, seedling establishment, crop growth, crop yield, and protection and conservation of soil and water resources.
- Make a smooth-sided, V-shaped furrow for efficient line concentration of forage seeds, soil fines, plant residues, and rainwater through the processes of gravity, wind erosion, splash erosion, splash-off, and runoff.
- Reduce land treatment costs because of the large number of tillage functions performed simultaneously and the relatively low maintenance and labor costs.

- Operate satisfactorily without breakdown and rapid wear on rough, rocky, brush-covered terrain usually considered untiltable.

Preliminary Tests

After 18 months of land imprinter testing (including one location in western Texas and 11 in southern Arizona), the following generalizations are apparent if not obvious:

1. The land imprinter is a rugged, simple machine with no apparent design flaws emerging after 200 acres of testing under extreme conditions.
2. The imprinter operates satisfactorily in soils ranging from rocky to clayey and from dry to moist.
3. The imprinter functions, as designed, to concentrate rainwater where seeds are placed.
4. Imprint geometries hold soil and water resources within the imprinted areas, even under intense, long-duration storms.
5. The imprinter successfully established Lehmann lovegrass during a hotter-and-drier-than-normal growing season.
6. Imprint capsules effectively crush and chop above-ground vegetative material to increase the protective soil cover.
7. The land imprinter can roll over shrubs having basal diameters up to 3 inches, or even larger if shrubs are laid down in advance of the imprint roller.
8. Splash erosion provides adequate covering for seeds.
9. Small grains can be successfully planted with the land imprinter without special modifications of the imprint capsule geometry.
10. The land imprinter kills most of the above ground growth of shrubs, mulching and anchoring this material at the same time. This helps conserve water for grass establishment by reducing transpiration and evaporation.
11. The imprinter thins existing grass stands somewhat, but the remaining grass responds rapidly to improved soil moisture conditions after the first good rain.
12. The land imprinter operates satisfactorily on deeply dissected land surfaces strewn with boulders.

Evaluation Plans

The land imprinter is designed to be a versatile no-till implement. Because preliminary tests have been highly successful, plans are being developed for more extensive testing for uses including:

1. Conversion of desert shrublands to grasslands in the southwestern United States and northern Mexico.
2. Reclamation of surface mined lands in southern Wyoming.
3. Revegetation of abandoned farmland to control wind erosion and tumbleweed problems in southern Arizona.
4. Revegetation and interseeding of sagebrush lands of the Great Basin for enhancing the habitat of cattle and wildlife.
5. Revegetation of marginal wheatlands in the Great Plains for wind erosion control and forage production.
6. Interception of drainage from feedlots in Minnesota for point-source pollution control.
7. Pasture renovation in the Great Plains and Corn Belt regions.
8. Conservation seeding and planting of major food and feed crops in the Great Plains and Corn Belt regions.
9. Formation of rainwater-irrigated seedbeds and rootbeds for growing forage shrubs in Israel.
10. Conservation tillage for controlling runoff and erosion from croplands and the control of nonpoint source pollution of surface waters and groundwaters.

Research plans are also being developed to relate successful seed germination and seedling establishment to the physical properties of the microniches formed by the land imprinter. The outcome of such research will be useful in modifying old imprint geometries and designing new ones.

Dryland Farming and Range Equipment in Australia

Charlie Heinrich, *Horwood Bagshaw, Ltd.*

Horwood Bagshaw, Ltd., one of Australia's leading manufacturers of agricultural machinery, has been manufacturing equipment for dryland farming and range rehabilitation for over a century.

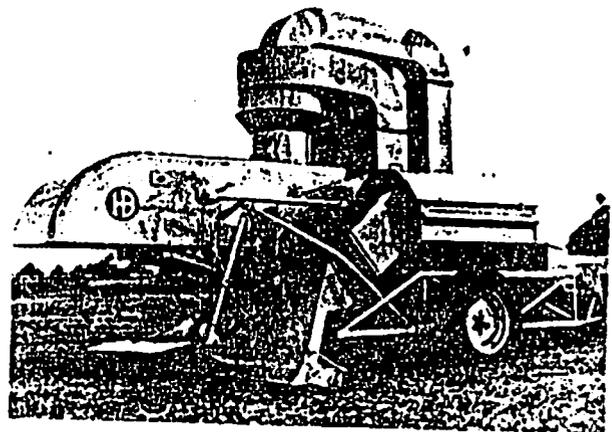
The company has two large manufacturing plants in South Australia and produces a range of products for agriculture and land development, including scrub rakes, wake rakes, and chain slashers; a range of heavy-duty cultivating equipment with stump-jump action up to 9 m wide with folding wings; seed and fertilizing drills up to 5.9 m; sowing width fertilizer spreaders; and a large range of line harrows hydraulically operated for trash clearance and folding working width up to 14 m.

Horwood Bagshaw, Ltd., also specializes in power takeoff grain combines for cereal crops, sorghum and other seed crops, and a machine of unique design, the Universal Seeds Harvester, using the suction pickup system to harvest pasture plants with prostrate seeding habits.

The company distributes a large range of haymaking and harvesting equipment throughout Australia, New Zealand, and neighboring countries.

The mining and industrial division manufactures a range of specialized mining equipment, including low profile ore loaders, well drilling equipment, and structural steel.

This company's products are exported to over 30 countries, where the equipment is preferred because of its specialized design, strong construction, and reliable performance.



Horwood Bagshaw, Ltd.'s Universal Seeds Harvester with large threshing cylinder.