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MULTI-DIKE

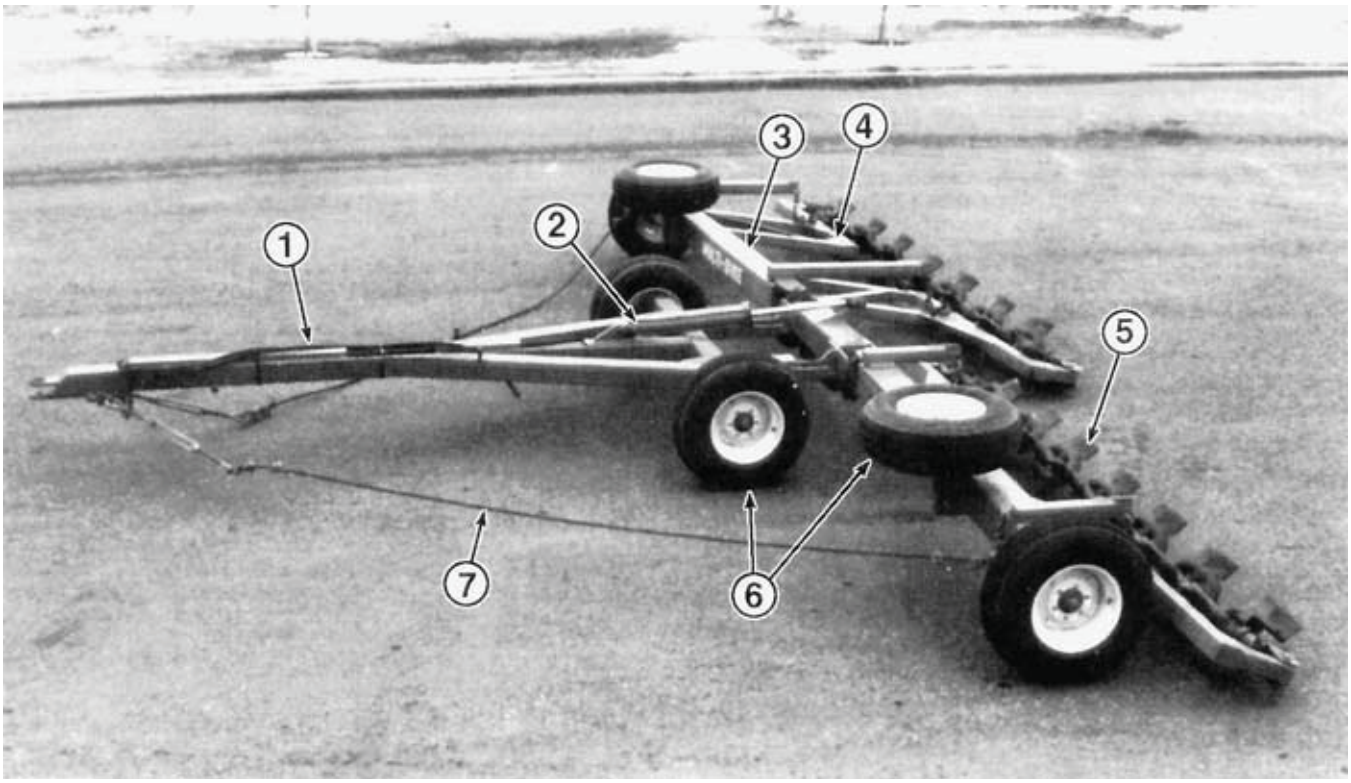

FIGURE 1. MULTI-DIKE: (1) Hitch, (2) Hydraulic Lift Cylinder, (3) Boom, (4) Pivoting Arm, (5) Studded Cable Chain, (6) Transport Wheels and (7) Wire Rope.

SUMMARY

One of the methods used to control or retain rainfall is called basin tillage. One of the machines available in Canada to make basins in the soil is a Multi-Dike. The major component of the unit is a large studded cable chain with bent plates welded longitudinally on opposing sides of the chain links. When pulled over land, the chain rotates and the bent plates leave a broadcast pattern of diamond-shaped basins.

The Alberta Farm Machinery Research Centre used the Multi-Dike for one season. The unit was tested for suitability in the Southern Alberta farming and ranching area. Size and depth of the basins depended on the amount of secondary tillage, soil moisture content and residue cover. The Multi-Dike left basins in the soil with average measurements of 14 in (356 mm) wide, 9.5 in (241 mm) long and 3.5 in (89 mm) deep.

The Multi-Dike was used for two different reasons during the test. The purpose of the basin tillage in the first set of fields was to capture water in the basins and prevent run-off to low areas.

The basin tillage was performed after seeding and before seed germination. An average of 1.5 seeds per basin or 3 percent of the total seeds were left on the surface after the basin tillage. A second pass of the chain diker in one field increased the depth of the basins. An average of 4 seeds per basin or 8 percent of the total seeds were left on the surface after two passes with the Multi-Dike. The basins captured small amounts of rainfall and irrigation water but could not handle the high amounts of irrigation water applied in one setting.

The purpose of the basin tillage in the next three field conditions was to pack the soil and prevent wind erosion. The basin tillage was performed after harvest and fall tillage. The soil packing was adequate for all the fields. None of the soil in the fields eroded during the winter. The Multi-Dike was effective in breaking up soil lumps and leaving a level soil surface.

Power take-off horsepower requirements to pull the Multi-Dike ranged from 1.0 to 1.5 PTO hp/ft (2.5 to 3.8 PTO kW/m).

MULTI-DIKE

MANUFACTURER AND DISTRIBUTOR:

Jones Manufacturing
P.O. Box 1577
Vernon, Texas
76384
Phone: (817) 552-6311

RETAIL PRICE:

$8,900.00 US funds (August, 1995 Freight extra) for a 28 ft (8.5 m) Multi-Dike.

INTRODUCTION

Controlling or retaining rainfall and irrigation water is important to the production of crops. One of the methods used to control or retain rainfall is called basin tillage. Lyle and Dixon (1977) describe basin tillage as a method of tillage whereby mounds of soil are mechanically placed at intervals across the furrow forming small basins. When rainfall occurs it is impounded in the basins where adequate time for infiltration is provided, rather than being lost as run-off. One of the machines available in Canada to make basins in the soil is a Multi-Dike.

The Multi-Dike is a ground driven, soil finishing tool. The major component of the unit is a large studded cable chain with bent plates welded longitudinally on opposing sides of the chain links. Bearings are located on each end of the chain. When pulled over land, the chain rotates and the bent plates leave a broadcast pattern of diamond-shaped basins.

The unit consists of a three section boom with two sections of studded cable chain. The left section of chain is ahead of the right section in field position. A v-shaped hitch is connected to the front of the boom and supported on the back by two wheels. Pivoting arms connect the boom to the chain bearings. The chain is raised into transport by a hydraulic cylinder which turns the boom. The hydraulic cylinder is connected to the hitch. Arms and small chains connected to the two outside booms lift the two sections of studded cable chain. The three boom sections are connected by two way swivels which allow the outside sections to fold back for transport. Two wheels are located on the end of each outside section to support the boom in transport and field positions. Wire ropes connect the end of each outside boom to the front of the hitch during field operation. FIGURE 1 shows the location of the major components while detailed specifications are given in APPENDIX I.

The test unit was 27.9 ft (8.5 m) wide. Other widths are available from 14 to 80 ft (4.2 to 24.4 m) wide. A tractor with one set of remote hydraulics was required to operate the Multi-Dike.

The Alberta Farm Machinery Research Centre used the Multi-Dike for one season. The unit was operated in the Southern Alberta farming and ranching area. Soil conditions and machine performance were monitored during the test. The unit was operated on 488 ac (195 ha) of land with soil texture ranging from sand to clay loam. The unit was evaluated for quality of work, ease of operation and adjustment, power requirements and operator safety.

RESULTS AND DISCUSSION

QUALITY OF WORK

Size and depth of the basins depended on the amount of secondary tillage, soil moisture content and residue cover. The Multi-Dike left basins in the soil with average measurements of 14 in (356 mm) wide, 9.5 in (241 mm) long and 3.5 in (89 mm) deep. The basin depth ranged from 2.4 to 4.7 in (61 to 119 mm). The basins were shallower in the tire tracks. The basins were arranged in a checker pattern with 22.5 in (572 mm) between consecutive basins on each row and 15.7 in (399 mm) between rows. The average number of basins was 17,800 per acre (44,500 per ha).

The Multi-Dike was used for two different reasons during the test. The purpose of the basin tillage in the first three field conditions was to capture water in the basins and prevent run-off to low areas. The basin tillage was performed after seeding and before seed germination. An average of 1.5 seeds per basin or 3 percent of the total seeds were left on the surface after the basin tillage. FIGURE 2 shows the seed depth variation of a seed row with and without basin tillage.

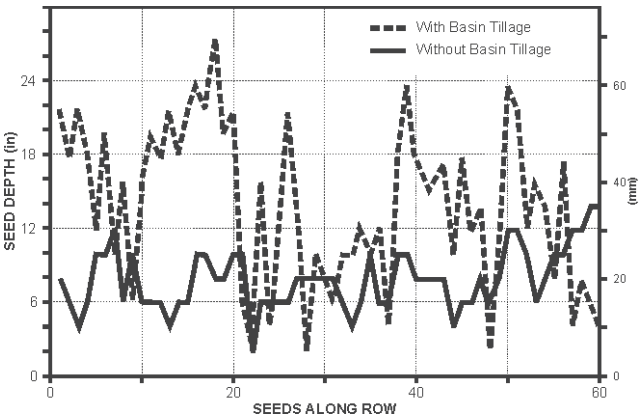

Figure 2. Seed depth variation of a seed row with and without basin tillage.

The first field condition was three high areas in irrigated fields seeded to barley with an air seeder (FIGURE 3). A coil packer was pulled behind the air seeder. The soil was silty clay loam. The basins were shallow because of the residue in the soil and the coil packing so the amount of water captured was minimal. The basins eroded to a level surface by the time the crop was harvested. Larger basins were required to capture the high amount of irrigation water applied in one setting.

FIGURE 3. Soil surface before and after basin tillage in a seeded barley field with high residue cover.

The second field condition was the side of a large hill in an irrigated field seeded to wheat with a hoe press drill. The soil was sandy loam with no residue cover. The basins were average in depth. The basins prevented run-off for a short period of time early in the growing season but were eroded to a flat surface later in the season.

The third field condition was a sandy soil which grew had a potato crop that year. The field was seeded to barley as a cover crop a few days earlier. The field was irrigated after the basin tillage to help the crop germinate. The basins were deep because of the sandy soil with no residue cover (FIGURE 4). A second pass of the chain diker increased the depth of the basins. An average of four seeds per basin or 8 percent of the total seeds were left on the surface after two passes with the Multi-Dike. The basins prevented run-off of the irrigation water onto the low areas.

FIGURE 4. Soil surface after basin tillage in a sandy soil with no residue cover.

The purpose of the basin tillage in the next three field conditions was to pack the soil and prevent wind erosion. The basin tillage was performed after harvest and fall tillage. The soil packing was adequate for all the fields. None of the soil in the fields eroded during the winter.

The first field was cultivated once. There was residue on this field so the basin depth was shallow. The second field was disced three times to incorporate manure. There was no residue on this field. Both fields were clay loam soil. The basin depth was average.

The third field condition was also on recently harvested fields which were tilled but the Multi-Dike was pulled behind a tandem disk harrow (FIGURE 5). The fields were cultivated with a chisel plow prior to the operation of the disk harrow. The soil was sandy loam. The Multi-Dike was effective in breaking up soil lumps and leaving a level soil surface. The basin depth was shallow due to the high amount of residue in the soil.

FIGURE 5. Soil surface before and after discing and basin tillage in a sandy loam soil with heavy residue cover.

EASE OF OPERATION AND ADJUSTMENT

The Multi-Dike was placed in field position by moving the unit in reverse until the wings folded out. The wings must fold out equal distance or damage will occur to the unit when the chain is lowered to the ground. The hydraulic cylinder was then used to rotate the chain to the ground and lift the transport wheels off the ground. The wing draw cables were then attached to the hitch. The reverse was done to place the unit in transport position (FIGURE 6).

Sharp turns were avoided with the Multi-Dike to prevent the wing draw cables coming in contact with the rear tractor tires or the disks of the disk harrow.

FIGURE 6. Transport Position.

POWER REQUIREMENTS

The draft of the Multi-Dike decreased slightly as the speed was increased. Average draft for the 28 ft (8.5 m) unit ranged from 1510 lb (6720 N) at a speed of 4 mph (6.4 km/h) to 1460 lb (6500 N) at a speed of 6 mph (9.7 km/h). Average hitch weight ranged from 75 to 105 lb (334 to 467 N). The hitch weight decreased as the speed was increased.

Power take-off horsepower requirements to pull the Multi-Dike ranged from 1 to 1.5 PTO hp/ft (2.5 to 3.8 PTO kW/m). Overall tractor size needed to operate the 28 ft (8.5 m) unit ranged from 29 to 42 PTO hp (22 to 32 PTO kW). The tractor size has been adjusted to include tractive efficiency and represent a tractor operating at 80 percent of maximum power take-off rating as determined by Nebraska Tractor Tests or as presented by the tractor manufacturer. The tractor sizes given will have ample power reserve to operate in the stated conditions.

OPERATOR SAFETY

The Multi-Dike was safe to operate providing normal safety precautions were observed. A chain was provided to hold the wings together during transportation. A safety tow chain and the accommodations for securing the chain were not provided. A slow moving vehicle sign was not provided.

The Multi-Dike had a negative hitch weight of 110 lb (490 N) in transport and field position. Caution was taken when unhitching to prevent the hitch from hitting a person.

OPERATORS MANUAL

An operator's manual was not provided for the Multi-Dike.

MECHANICAL HISTORY

Both chains were tightened during the test. The left chain was interfering with the support arm for the right chain. A lever hoist was used to tighten the chains. Two people required one hour to tighten both chains. The ends broke off the hitch stabilization bar near the end of the test. The bar prevented the hitch from raising when the unit was in transport position and disconnected from the tractor. The bar most likely broke when the unit was pulled through a steep and narrow gully. One wheel hub and bearings were replaced at the start of the test.

REFERENCES

W.M. Lyle, D.R. Dixon. 1977. Basin Tillage for Rainfall Retention. Transactions of the ASAE.

APPENDIX I

SPECIFICATIONS

MAKE:	Multi-Dike	
MANUFACTURER:	Jones Manufacturing P.O. Box 1577 Vernon, Texas USA 76384	
DIMENSIONS:	**Field Position**	**Transport Position**
-width	27.9 ft (8.5 m)	7.9 ft (2.4 m)
-length	21.8 ft (6.6 m)	26.7 ft (8.1 m)
-height	2.2 ft (0.67 m)	7.5 ft (2.3 m)
-ground clearance		1.1 ft (0.3 m)
-wheel tread	25.4 ft (7.7 m)	7.9 ft (2.4 m)
CHAIN:		
-type	studded cable chain	
-number	two	
-length		
-right	13.5 ft (4.1 m)	
-left	13.3 ft (4.1 m)	
-weight	84.2 lb/ft (125 kg/m)	
-link		
-size	2.75 in (71 mm)	
-width	18 in (457 mm)	
-length	16.5 in (419 mm)	
-plates	4 x 11 in (101 x279 mm)	
FRAME:		
-cross section		
-hitch	5 x 5 in (127 x 127 mm)	
-frame	8 x 8 in (203 x 203 mm)	
-chain arms	3.5 x 4 in (89 x 102 mm)	
TIRES:		
-number	six	
-size	11L x 15, 8 Ply	
NUMBER OF LUBRICATION POINTS:		
-grease fittings	four	
-wheel bearings	six	
WEIGHT:	5270 lb (2372 kg)	

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