A Modified Implement For Constructing Wide Beds For Crop Production

Lawrence H. Ginn
Agricultural Science Research Technician
USDA-ARS Soybean Research Unit
Stoneville, Mississippi

Larry G. Heatherly
Research Agronomist
USDA-ARS Soybean Research Unit
Stoneville, Mississippi

E. Ray Adams
Mechanical Engineering Technician
USDA-ARS Application and Production Technology Research Unit
Stoneville, Mississippi

Richard A. Wesley
Agricultural Engineer
USDA-ARS Application and Production Technology Research Unit
Stoneville, Mississippi

The authors appreciate the expert technical assistance provided by Sandra Mosley in the preparation of this publication. This bulletin was published by the Office of Agricultural Communications, Division of Agriculture, Forestry, Veterinary Medicine, Mississippi State University, Publications Editor Robert A. Hearn. The cover was designed by George Taylor, Chief Illustrator and Graphic Artist.

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ABSTRACT

Crops are often planted and grown in areas or during seasons that are subject to inundating rainfall. Rainfall of this magnitude may submerge soil in areas that have flat topography and subsequent slow surface drainage. Inundating rainfall will also result in prolonged saturation of cracking clay soils that have slow internal drainage. Our objective was to develop an implement that could be used to construct wide beds of varying height and profile, and that could accommodate several rows of 7- to 40-inch width so that these rows would be elevated above the furrows on both sides. We modified a bedding implement that can create an 80-inch-wide bed. The implement can be adjusted to create a flat or sloping bed of varying height between furrows. The furrows serve as water collecting and drainage areas following heavy rainfall. The plant production zones are relieved of water stress in the shortest possible time since this area is higher than the drainage furrows.

INTRODUCTION

Crops grown in high-rainfall areas on soils with slow surface and internal drainage may be subjected to standing water and saturated soils. Prolonged periods under these conditions will result in water stress to plants. Thus, any practice that can alleviate this water stress should be advantageous to crop emergence, growth, and development. This is especially true for just-planted seed or just-emerged seedlings. Our objective was to construct a modified bedding implement that could be mounted on a standard row-crop tractor. The requirements for this implement were that: (1) the formed beds accommodate row spacings between 7 and 40 inches; (2) it be capable of creating a bed of sufficient width to accommodate several rows of varied spacing; and (3) it be capable of creating beds of varying height and shape.

DESIGN AND DESCRIPTION

An overall view of the bedder is shown in Figure 1. This perspective shows the overall configuration of the implement and the relative locations of the furrow plows (Figure 1-C) and bed-forming wings (Figure 1-B). The setup shown is for creating 80-inch-wide beds using a tractor with 80-inch wheel spacing. This bedder uses the Orthman[1] Model 504-30B tri-level bed implement (no longer manufactured) as the basic framework. It is equipped with an Orthman SP-430 splitter package [secondary tool bar, mounting brackets, and bed-splitting shovel (not used)], gauge wheels and tires, and Orthman Model 890S row markers. All specified parts and components can be fabricated or made from similar available devices by a skilled welder and machinist if those shown in this description are unavailable.

Modifications of the Orthman bedder were made to provide versatility in bed configuration that was necessary for creating beds for crops planted mainly on clayey soil. The wing pairs of the implement were spread to the maximum width by a bed width stabilizer (Figure 2-E). The stabilizer was constructed from two 50-inch lengths of 2 x 1 x 3/8-inch channel iron that were placed back to back and angled on each end to allow attachment to the upper and lower sides of plates (Figure 2-F) located on

[1]Mention of a trademark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by the USDA or Mississippi State University, and it does not imply its approval to the exclusion of other products that may be suitable.

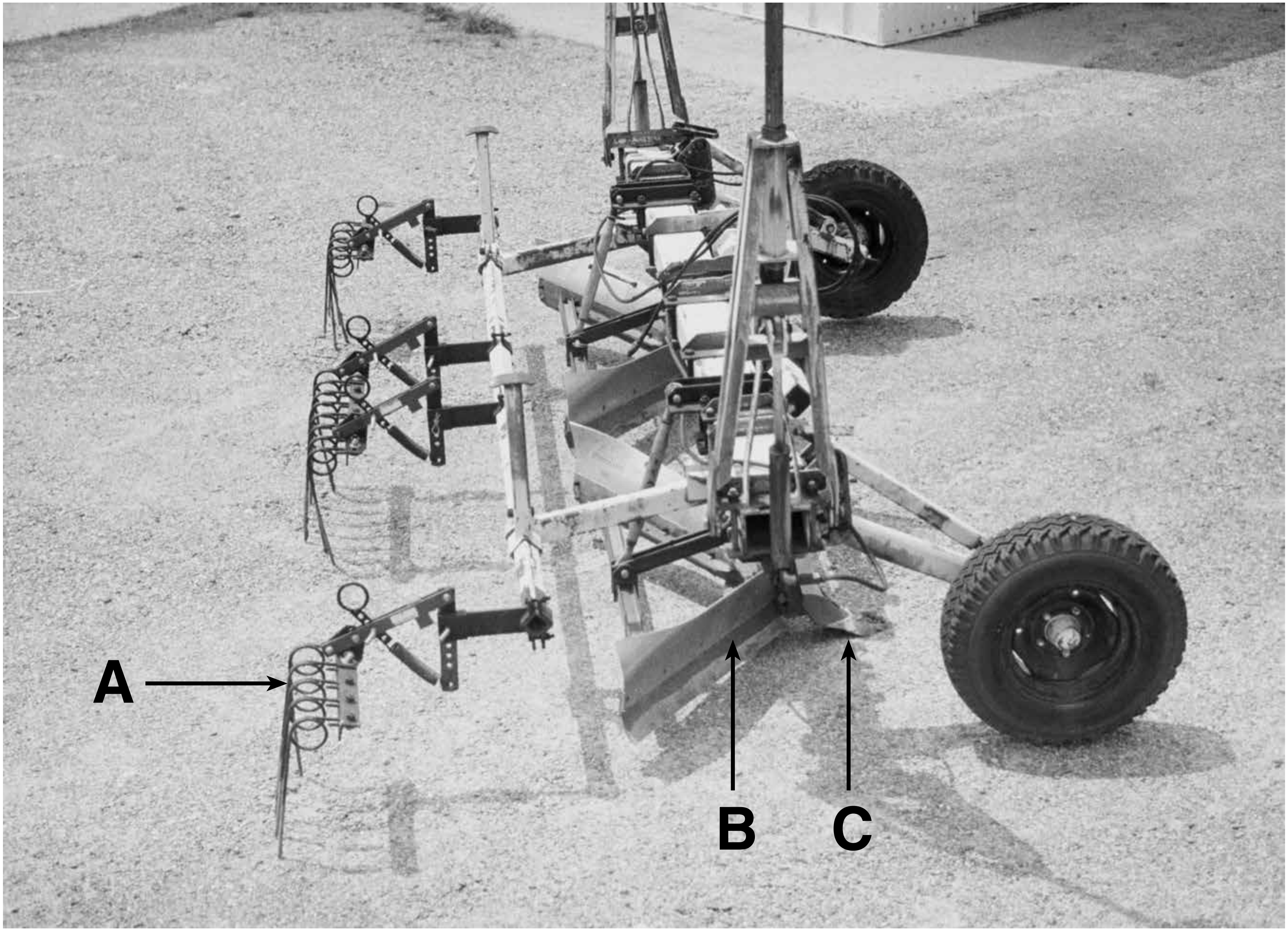

Figure 1. Overall view of modified bedding implement: A = leveling drag; B = bed shaping wing; and C = furrow plow located at center of wing pair.

the back of each wing. The attachment was made with a 1/2-inch-diameter, 1 1/2-inch-long bolt. Two 20-inch lengths of 2-inch-wide, 1/2-inch-thick flat iron were used for pivoting braces (Figure 2-D). A bed height adjustment mechanism was made by installing a Category I three-point hitch top link (Figure 2-C) between the main tool bar and the bed width stabilizer. This addition allows each wing pair of the implement to be angled up or down to obtain the desired bed height and shape. Raising or lowering the angle of the wing pairs dictates the amount of soil that is deposited along the path of each wing. We replaced the existing pieces of angle iron that held the shank to the tool bar with 13-inch-long pieces of 2 x 2 x 3/8-inch angle iron (Figure 2-B). These pieces of angle iron serve as the top mounting point (Figure 2-G) for the Category I top link used for bed height adjustment.

Spring-type bed leveling drags (Figures 1-A, 3-A, and 4-C) from a Kongskilde Triple K spring-tooth harrow were adapted to fit the rear of the bedder. These drags are positioned to spread the soil that flows from opposing wings of adjacent wing pairs (Figure 4-B). The drag assemblies consist of an angle iron frame (part no. 02-247-051), spring teeth (part no. 02-200-004), and a bracket assembly (part no. 02-247-089) (Figure 3). The drags are attached to a 2 x 2 x 1/4-inch tube steel secondary tool bar by a special mounting bracket (Figure 3-C). This secondary tool bar is part of the bed splitter package that was mentioned previously.

The spring-type drags were added to assist in final forming and smoothing of the bed and to determine the amount of crowning that will occur in the center of each formed bed (Figures 5-A and 6-A) or the areas between wing pairs. The amount of soil that flows from the ends of each wing pair (Figure 4-B) will be determined by depth of the furrow and by upward slope or angle of the wings. Adjusting the height of the bed-leveling drags and using higher- or lower-tension springs (Figure 3-B) will allow variation in the amount of this emitted soil that is spread between the wing pairs (Figure 4-B) to form the center of the beds (Figures 5-A and 6-A).

PERFORMANCE

We have used this implement since 1990 to form beds on clay soil for wheat planted in 7-inch rows and for soybeans planted in 20- and 40-inch rows. Loose soil created by at least one disk harrowing has been sufficient for bed preparation where little plant residue was on the soil surface. Where plant residue from killed weeds or from crop harvest is heavy, more than one disk harrowing will be required if beds are to be formed before residue decay since heavy surface residue can interfere with soil distribution along the path of the wing. This implement can be used to form beds in a stale seedbed with no loose soil if surface residue has decayed and the soil is at the proper moisture content for surface tillage.

Using this implement will result in a raised area that will provide relief from water stress following heavy rainfall. We have created beds that range in height from 2-6 inches before rain on clay soil. The view in Figure 7 is of a field with 0.04 percent slope that was bedded with this implement on July 22 as preparation for wheat planting in October. This picture shows the water collected in the furrows on July 23 after an overnight 1.5-inch rainfall. The furrows created in the bed-forming process also are sufficiently deep to provide down-slope movement of irrigation water. We have not tested the longevity of the beds; in our work, we have made new beds before the planting of each year's crop.

This implement can be adapted to setups other than those for which it was constructed. Changing the length and size of the primary tool bar (Figure 2-A) will accommodate the number of units necessary to make the required number of beds per pass. The number and width of beds needed per tractor pass will depend on tractor size, planter size, and row spacing pattern. Changing the span of the bed width stabilizer attached to each wing pair will change the width of each bed. This adjustment, along with changing the location of the mountings on the primary tool bar, will be necessary to accommodate variable spacing of tractor wheels and planter units. The length of each wing can also be increased or decreased to allow each wing pair to have a wider or narrower span.

The depth of the furrow (Figures 5-B and 6-B) created by the 9-inch-wide furrow plows (Figure 4-A) can range from 2-6 inches, and depth can be varied by relocating the front mounting point of the wings on the back of each plow. This is the most time-consuming and labor-intensive adjustment, and adjustment of the added top link will substitute for much of this. The vertical angle of the wings and the resulting slope from front to back also contribute to determining the bed's height and levelness. This angle can be changed by adjusting the top link (Figure 2-C). This adjustment will determine the amount of soil deposited along the path of each wing pair. A low vertical angle (wing pairs nearly level) will result in more soil being carried to the ends of each wing to form a crowned bed (Figure 6-A). A high angle (rear of wing pairs significantly higher than front) will result in more soil being deposited along the path of each wing to form a nearly flat bed (Figure 5-A) that will be 4-6 inches high. Adjusting the height of the bed-leveling drags and using higher- or lower-tension springs (Figure 3-B) will vary the amount of soil that is spread between the wing pairs. The implement can be leveled through adjustment of the tractor's three-point hitch.

This bedding implement can be used to construct a raised bed of sufficient width to accommodate several rows of 7- to 40-inch width so that these rows are higher than the adjacent furrows. The implement can also be adjusted to create a flat or sloping bed of varying height between the furrows on either side. The furrows serve as water collecting and drainage areas following heavy rainfall as shown in Figure 7. The plant growing area is relieved of water stress in the shortest possible time since the bedded area is higher than the furrows. Thus, our objectives were met with the development of this modified implement.

VENDORS

Orthman Manufacturing, Inc.
P.O. Box B
Lexington, NE 68850
Phone: (308) 324-4654

Kongskilde
19551 N. Dixie Hwy.
Bowling Green, OH 43402
Phone: (419) 354-1495

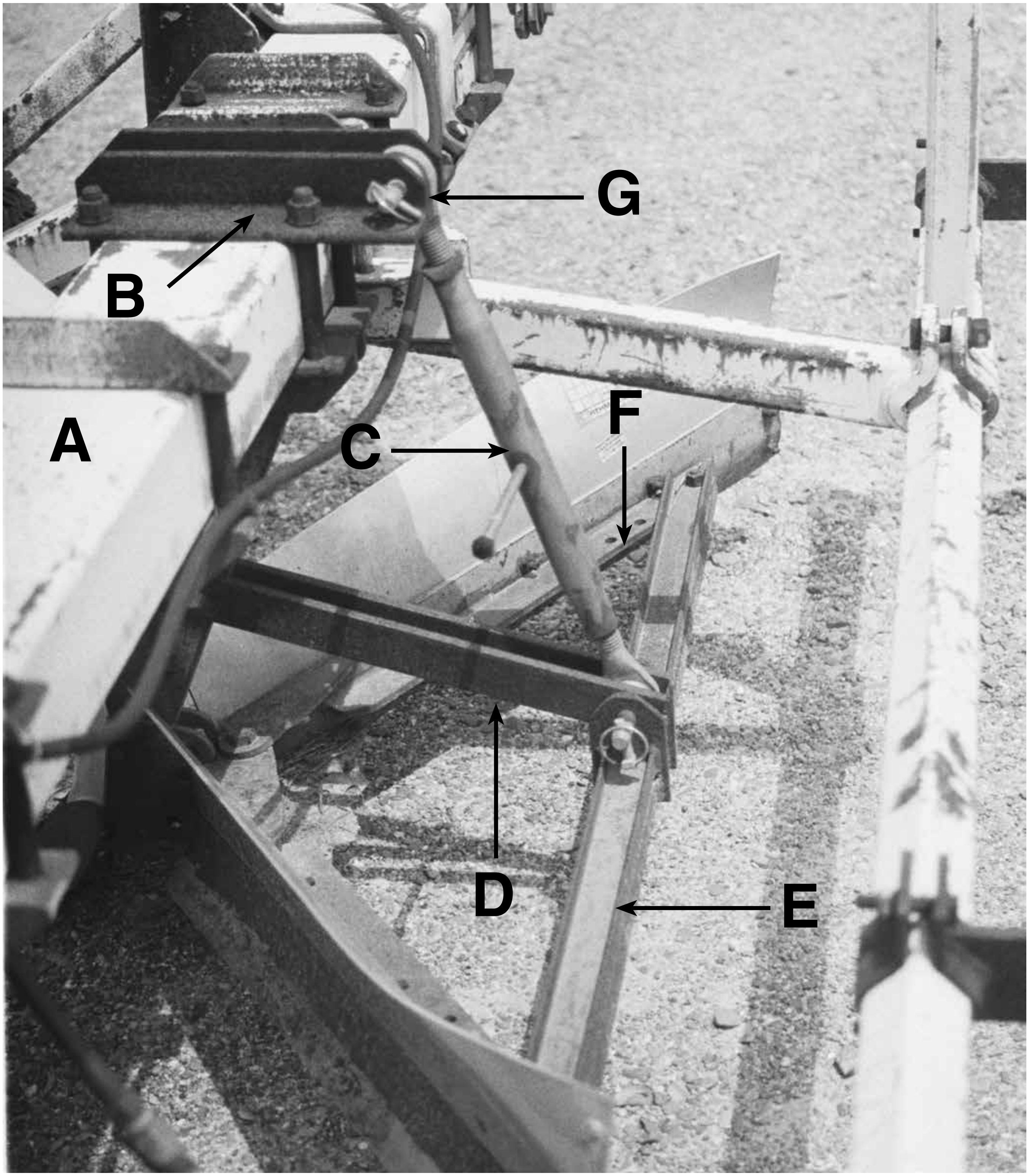

Figure 2. Overhead view of components of modified bedding implement: A = main frame tool bar; B = tool bar bracket for mounting Category I top link; C = bed height adjustment (Category I top link); D = pivot brace; E = bed width stabilizer; F = plates on rear of wings; and G = mounting point for Category I top link.

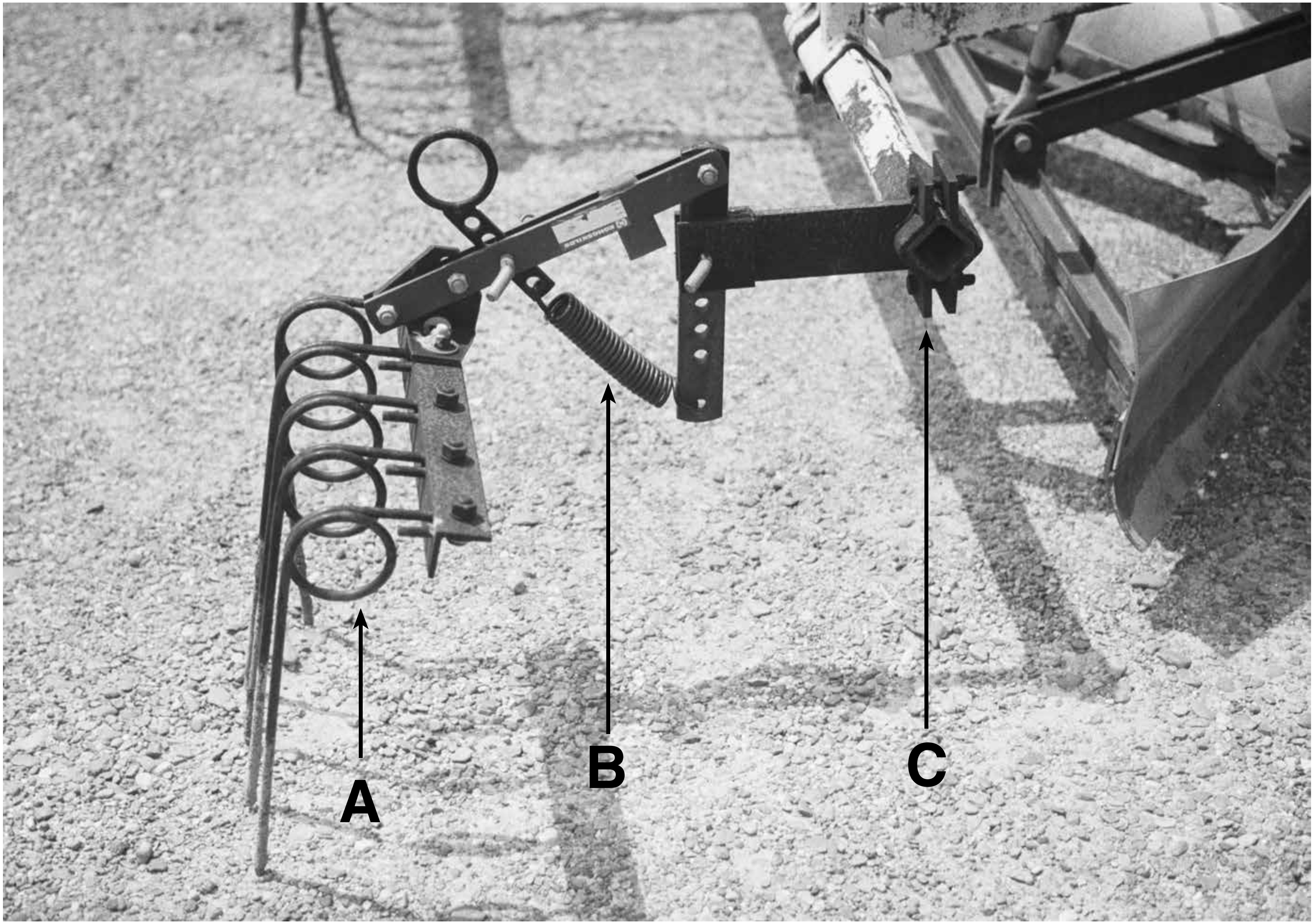

Figure 3. View of leveling drag added between ends of opposing wings on modified bedding implement: A = spring tooth unit; B = tension spring; and C = mounting bracket.

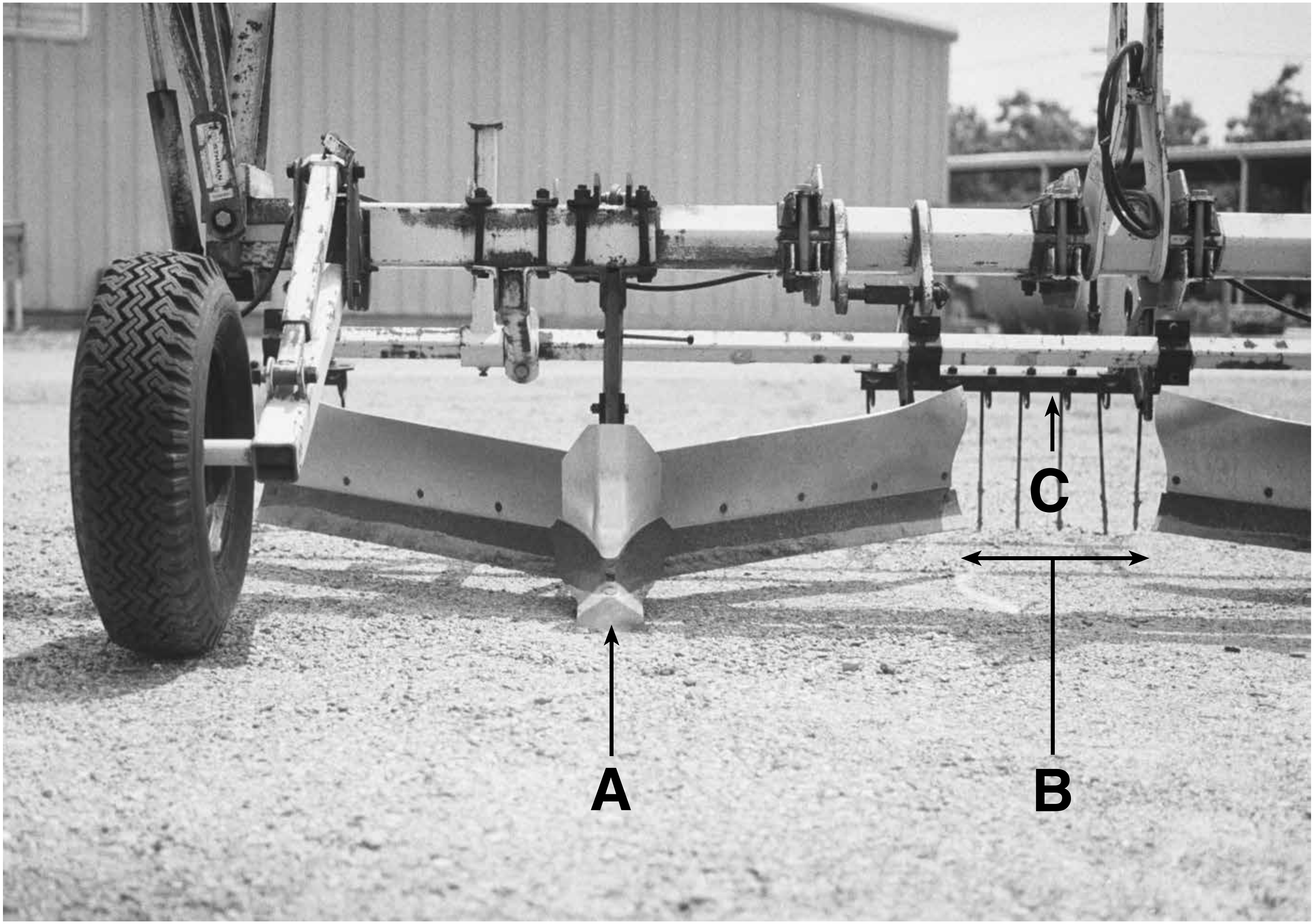

Figure 4. Front view of components of modified bedding implement: A = furrow plow; B = span between opposing wings; and C = leveling drag.

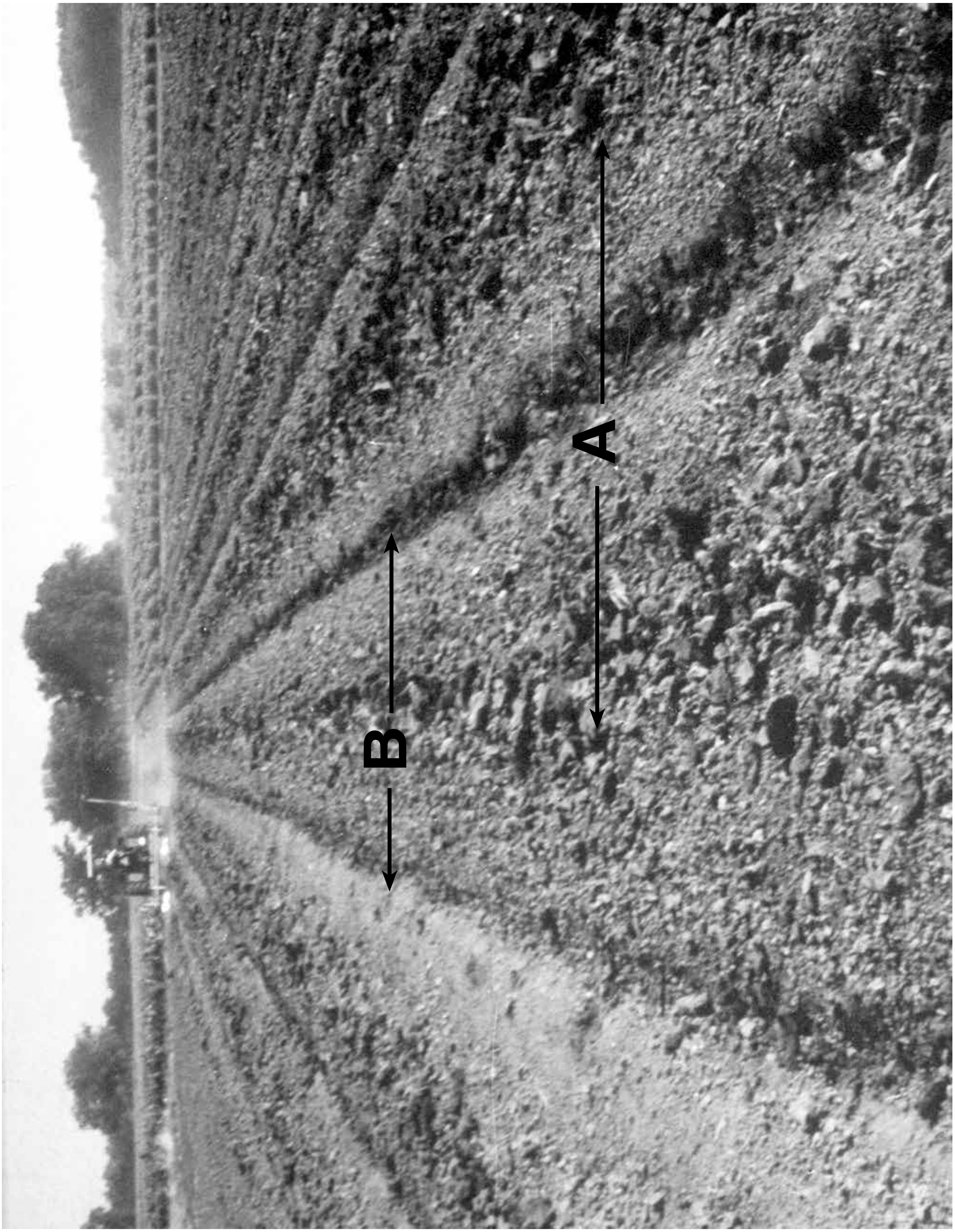

Figure 5. Field view of formed beds with nearly flat center (A) and furrows on each side of a formed bed (B).

Figure 6. Field view of formed beds with crowned center (A) and furrows on each side of a formed bed (B).

Figure 7. View of formed beds following a 1.5-inch rain.