

ADVANCES IN MECHANICAL CULTIVATION OF COTTON & PEANUTS

Jim T. Noonan
Design Engineer
John Deere Des Moines Works
Des Moines, IA

Abstract

The new John Deere 856 row crop cultivator provides the versatility, strength, and improved functionality to better serve today's cotton and peanut farmers.

Introduction

For cotton and peanut production it has long been recognized by many producers that combining chemical banding with mechanical cultivation on one pass provides effective economical weed control. Many studies back producers claims by showing that an integrated system can reduce weed populations, aerate the soil, reduce erosion, reduce costs, reduce risk, increase yield, and most importantly improve the bottom line.

The newly released John Deere 856 row crop cultivator replaces the previous 825, 845, & 875 models. The 856 was designed to operate in 3 major crop markets: cotton/peanuts, corn/soybeans, and sugarbeets/edible beans. This paper will focus on improvements made in row crop cultivation of cotton & peanuts.

Improved Sweep Penetration Capability

For a number of reasons, adequate sweep penetration has become more and more difficult over the years, especially behind the tractor tire track. A sweep that does not stay in the soil and maintain proper angle may not provide optimal weed kill.

The 856 improves sweep penetration in a number of ways. A customer can choose zero, one, or two down pressure springs per rig to transfer toolbar weight to the ground engaging tools (see figure #1). Each spring can be set in either a low or high setting to optimize individual rig conditions. With two springs in the high setting, up to 200 lb. of down pressure can be transferred.

Completely redesigned spring reset c-shank standard assemblies increase the trip force from 90 lb. to 145 lb (see figure # 4). An optional 200 lb. standard assembly can be used at the rear (row middle) of each rig where compaction is usually the greatest. Each c-shank assembly option has built-in sweep pitch adjustment by simply adjusting the spring bolt. Tightening the spring bolt not only increases

the sweep pitch, but also increases the trip force; both providing improved penetration.

Precise Rig Depth Control

Cultivating too shallow or too deep can have a major impact on the effectiveness of weed kill as well as moisture conservation.

To adjust rig depth on the 856, a customer simply walks to the back of a rig and rotates a rear mounted crank (see figure # 2). An indicator scale is provided to precisely adjust gauge wheel depth across the width of the machine. To meet varying customer needs, the 856 has 3 gauge wheel options: 4" x 12", 4" x 16", and dual 4" x 16". While the 4" x 12" gage wheel assembly gives adequate depth control in most conditions, the larger rolling radius of the 4" x 16" provides increased floatation in lighter soil conditions. For very light or sandy soils, the dual 4" x 16" gives even greater depth control. Each gauge wheel assembly uses shallow concave nylon rims which reduce rooster-tailing of soil around the tire, thereby reducing crop dusting and providing better chemical banding efficiency (see figure # 5). Since peanuts are very susceptible to above ground mold, reducing any source of soil contact is advantageous. The tire of the gauge wheel assembly uses a chevron tread design to keep the tire turning. A tire that always turns is less prone to snowplowing ahead of the tire and will maintain a more consistent depth. The interface between the tire and rim uses a clincher base design, creating a double lip to reduce soil infiltration between the tire and rim. Soil infiltration is a major cause of tire failure or loss. A double roller bearing with triple lip seal provides proven reliability.

Combining Chemical Banding With Mechanical Cultivation

Many cotton producers have been combining banding with mechanical cultivation for years. In the past, the speed of cultivation was sometimes limited by the steadiness of the nozzles relative to the row.

The new 856 spray shields are longer and taller (58" x 15") compared to the 825/845 predecessors (see figure # 6). With fore-aft pivot and increased length, the shields easily follow contours and accurately position the nozzles relative to the rows. The shields provide an inoculated (undisturbed) bandwidth for maximum chemical banding effectiveness. The increased height allows higher cultivation speeds without soil passing over the top. A new spring suspension system helps the shield to float and increases the wear life of the shield lower skids. The longer length shields are compatible with the longer rank spacing of the rig standards. The shield width can be adjusted from 8-1/2" to 11" for varying customer needs and conditions. Levelers attached to the shield sides provide a level plane for cotton picker height sensors.

Precise Cultivation Band

To minimize chemical costs, producers strive to minimize the chemical band. In most cases the bandwidth is adjusted to overlap with the mechanically cultivated portion and to account for side to side motion of the rig.

The 856 cultivator provides a new wide stance short coupled parallel rig linkage to firmly hold the rig for a consistent cultivated band (see figure # 3). The rig links have been changed from 2" x 2" x .134" wall on the 825/845 to 3" x 6" x .188" wall tubing to drastically reduce twisting and bending. The use of oil impregnated maintenance-free bushings spaced 6" apart provide a rigid & long lasting rig link pivot. A new rig attaching bracket provides a positive lock onto the toolbar for perpendicular mounting.

Three Rig Families To Chose From

The 856 was designed to provide the versatility to offer many different ground engaging element configurations. For the cotton/peanut producer three rig families are available: 3 conventional c-shank, 3 s-tine shanks, and the Deere exclusive 3 "Precision Plus Fin™" shank. Each rig family can be set up to run in either flat or bedded conditions by simply adjusting the depth of the rear standard relative to the row side standard. On c-shank rigs, the rear standard can be adjusted from level to 2-1/2" below the row side standards. The rear s-tine shank can be adjusted from level to 8" below the row side s-tine shanks. Each rig family has different ground engaging combinations to choose from to optimize a particular customer's needs.

Three Conventional C-shank Rig

The three c-shank configuration is the most popular rig today for cotton cultivation (see figure #1). The previous 825 & 845 models consisted of three 90 lb. trip force standards with 16" of underframe clearance & 18.8" front to rear rank spacing. For the 856, the three conventional standard configuration is made up of 145 lb. trip standards with 20" underframe clearance & 30.5" front to rear rank spacing. Residue flow capability is significantly improved over the 825/845 due to improved clearance and rank spacing. For difficult row middle penetration conditions, a 200 lb. trip standard is optional for the rear of the rig, providing unmatched penetration capability for a medium duty cultivator.

Three S-tine Shank Rig

S-tine shanks using a special low crown s-tine sweep are popular for peanuts, where less soil throw is desired. Some customers want the side to side vibration effect inherent with s-tine shanks. The prior 825/845 s-tine shank rig provided five 15.8" underframe clearance shanks.

With the trend towards fewer and stiffer s-tine shanks per rig, the 856 now offers a three s-tine shank arrangement

with 20" underframe clearance (see figure 2). Similar to three c-shanks, for hard to penetrate row middle conditions, a heavy duty s-tine option is available at the rear of each rig. To compliment the new s-tine rig, Deere is offering a complete family of "Precision Plus S-tine™" sweeps (see figure # 7) which feature a narrow wing design and a low crown to minimize soil throw using s-tine shanks.

Three "Precision Plus Fin™" C-shank Rig

Similar to s-tine sweeps for minimizing soil throw towards the plant, many peanut and some cotton customers use what the market refers to as a "Smith Fin" sweep assembly. This assembly is made up of a low crown base sweep with a narrow welded tang to mount to the shank. The sweep/tang arrangement resembles dragging a knife edge through the ground; causing very little soil and residue disturbance above ground. Competitive systems use a rigid straight vertical shank to mount the sweeps to the rig.

The 856 offers a three "Precision Plus Fin™" shank arrangement similar to the conventional standard rig (see figure # 3). The shank has a c-shape for improved residue flow and is mounted in a 145 lb. trip arrangement for rock or other obstruction protection. The standard assembly has built-in pitch adjustment capability for critical angle adjustment of the sweep for minimal soil throw. The underframe clearance and rank spacing of this rig is the same as the three conventional standard rig, making it compatible with spray shields.

For customers who want to use the same cultivator for both peanut and cotton cultivation, the row middle "Precision Plus Fin™" can be replaced with either a 145 lb or 200 lb trip conventional standard to provide a deeper furrow for cotton defoliation purposes. The customer still receives minimal soil throw next to the crop, but more disturbance or furrowing capability in the row middle.

As with the s-tine rigs, Deere is offering a complete line of "Precision Plus Fin™" sweep assemblies (see figure 8). The sweeps feature a plated cutting edge on the mounting tang for reduced wrapping of residue around the tang and to further reduce soil turbulence ahead of the tang. An extra weld on the underside of the sweep between the sweep & tang provides extra protection from inadvertent loss of the base sweep.

Stale Seedbed Cotton Cultivation

Stale seedbed cotton production is the process of planting cotton on previously harvested & reformed beds without performing any primary tillage. In most cases the residue levels and hardness of the soil in the row middle is significantly higher than comparable mulch till environments.

With the increase in sweep penetration capability and increased rank spacing between standards, the 856 can be an

excellent tool for the stale seedbed environment. For very high residue levels and penetration requirements the Deere 886 row crop cultivator with a 550 lb single standard per rig can provide improved performance.

Accessories

Optional frame stabilizer coulters can be added to the mainframe and/or wing frames to help hold the machine relative to the row on hilly conditions and reduce side to side movement.

Frame gauge wheels can be added to keep the cultivator level across the width of the machine. Depending on bedded versus level conditions, the underframe clearance can be pin adjusted from 28” to 33” in 1” increments for optimum rig down pressure and rig motion.

A Size To Meet All Needs

The 856 has new sizes to meet both the narrow (30” row spacing) and wide (36”, 38”, & 40” row spacing) customer needs. A combination of rigid & folding frame machines allow sizes from 6 to 16 row for the narrow class and 4 to 12 row for the wide class. The new folding toolbars use a clean fold design which places the fold cylinders inside the mainframe section, allowing true row spacing of rigs attached at the hinge area.

Specifications

Sizes:	
Wide Class	4 to 12 Row (36”, 38”, & 40” Spacing)
Narrow Class	6 to 16 Row (30” Spacing)
Toolbar	Rigid or Clean-fold
Rig Construction	3 x 6 x 3/16” parallel linkage tubing, bolted rig assembly
Rig Pivot Points	Oil impregnated, heat treated, powdered metal bushings
Rig Down Pressure	No springs standard, one or two springs optional for up to 200 lb. additional down pressure.
Rig Gauge Wheel:	Chevron-tread clincher-base rubber tire, nylon rim, 1.60” roller bearing and rear-mounted crank adjustment
Standard Tire	Single 4 x 12” tire assembly
Optional	Single 4 x 16” tire assembly
Optional	Dual 4 x 16” tire assembly
Toolbar Underframe Clearance	28 to 33” adjustable in 1” increments
Rig Standards:	
Spring Reset	Three shanks with 145 lb trip force or optional 200 lb on rear, 8” trip height and built-in pitch adjustment
S-tine	Three medium duty s-tine or optional heavy duty high clearance s-tine on rear

Frame Gauge Wheels:

Standard	7.60x15 4PR tires, with 28 to 33” height adjustment
Optional	6.00x16 single rib, with 28” to 33” height adjustment

Crop Shields:	
Rolling shields	20” diameter with 3” teeth
Spray	58” long x 15” long, width adjustable from 8.5 to 11”, spring suspension, pivot float, with optional levelers
Spray Equipment	Hoses, fittings, mounting brackets, Tee-Jet nozzles

Sweeps:	
S-tine	
Regular	2-3/4”, 4” V-pattern, 4”, 7”, & 9”
Precision Plus	8”, 10”, 12”, 14”
Tru-Width	3/16” Thick x 7”, 9”, 10”
	1/4” Thick x 7”, 9”, 10”, 12”, 16”
Precision Plus Fin™	8”, 10”, 12”, 14”

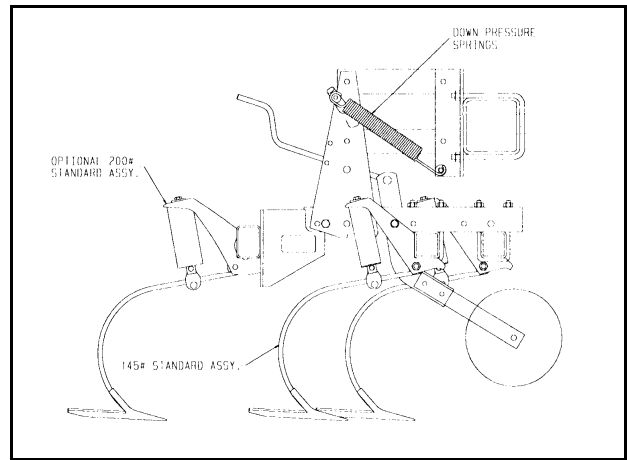


Figure 1. Three Conventional Shank Rig.

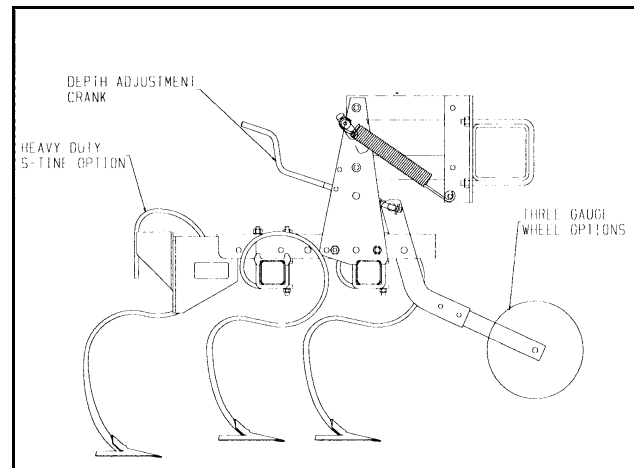


Figure 2. Three S-Tine Shank Rig.

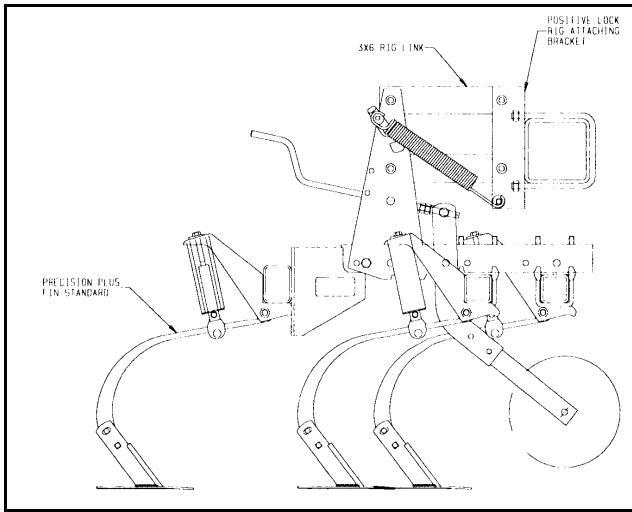


Figure 3. Three "Precision Plus Fin" Rig.

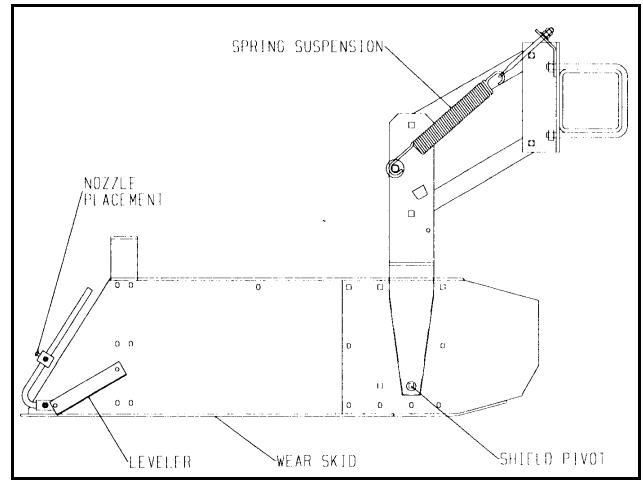


Figure 6. Chemical Banding with Spray Shield.

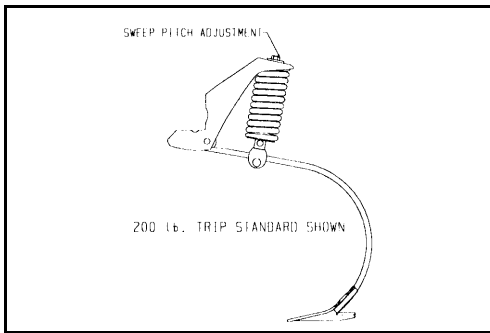


Figure 4. Spring Reset Standard.

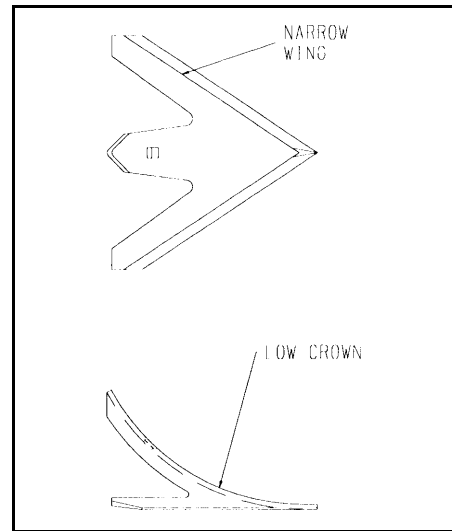


Figure 7. Precision Plus S-Tine Sweep.

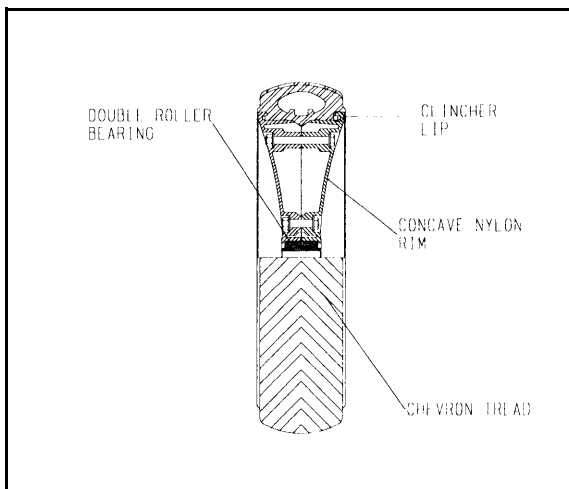


Figure 5. Rig Gauge Wheel.

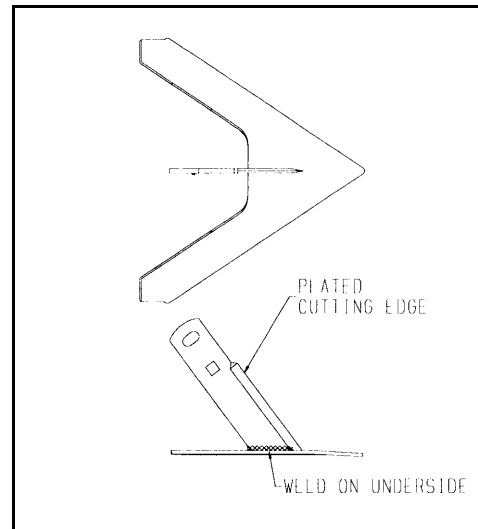


Figure 8. Precision Plus Fin Sweep.