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Radial Tractor Tires

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Getting more power to the ground has been a goal of tire and tractor designers for many years. With today's inflationary fuel and machinery costs, this becomes even more important.

Radial tractor tires should not be overlooked when looking for ways to increase traction efficiency.

Radial tires on cars provide a smoother ride, are longer lasting, provide better traction and increase gas mileage. But are there advantages for running radials on tractors? Before discussing this an explanation of tire construction and design is in order.

CONVENTIONAL (BIAS) TIRE

The carcass of a bias ply tire consists of layers, or plies, set diagonally to the tread and criss cross at an angle called a bias angle. The cords are arranged in two or more plies, depending on the strength needed. The bias ply has a relatively stiff sidewall to provide stability.

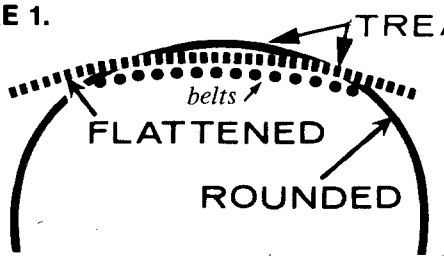
RADIAL TIRES

Radial ply tires have plies that run at right angles to the tread and may have one or more layers or plies. A belt around the radial ply tire gives it stability and strength. This design, with plies running at 90° to the tread, lets radial sidewalls flex more than bias tires and produce a larger, more stable, ground contact area.

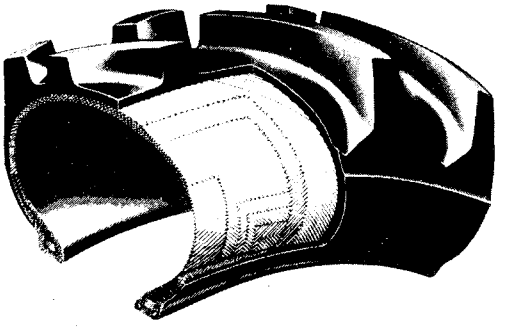
TEST RESULTS

Field tests were conducted at North Dakota State University to compare radial ply tractor tires to bias ply tires. The tires were both manufactured by the same company. Tires tested were 18.4-38, 6 ply, inflated to 14 pounds per square inch air pressure. No liquid ballast was used.

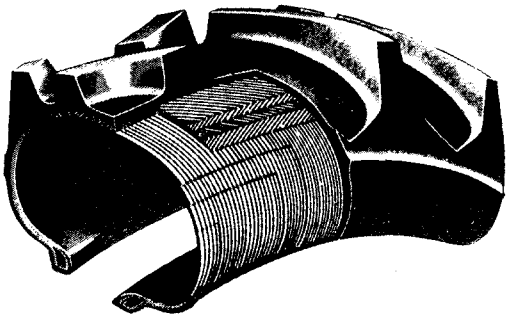
FIGURE 1.



Flattened tread base of the radial-ply tire with encircling belts distributes weight more evenly than conventional rounded base.



Fabric cords in the conventional tire are in diagonal layers.



Cords in a radial-ply tire are in parallel layers with belts under the tread area.

A 112 PTO HP tractor was used to pull an 18 foot cultivator with spike teeth. The cultivator was adjusted to run at the same depth during all tests.

Tests were conducted on Fargo clay soil in two separate summer fallow fields. Each test consisted of five rounds on one-half mile long fields. The tractor was run at wide open throttle in the same gear for all tests. Each test was repeated twice.

TABLE 1

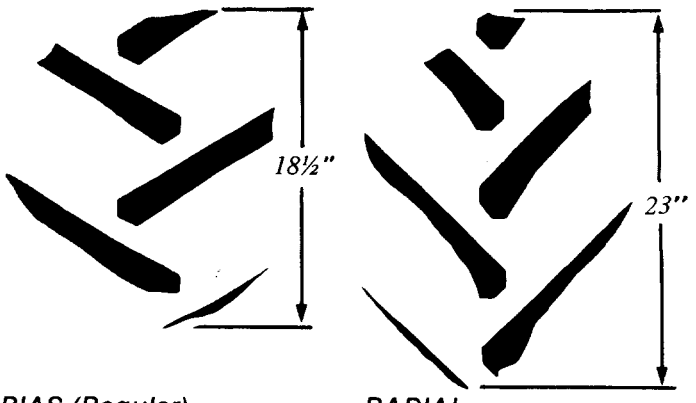
Field and Tire	Fuel Consumption, Gallons/Acre	Effective Field Capacity, Acres Per Hour	Slippage, Percent
Loose Fallow			
Conventional Tire	0.62	9.00	14.6
Radial Ply	0.58	9.57	10.3
Firm Fallow			
Conventional Tire	0.62	9.47	11.4
Radial Ply	0.57	9.67	9.2

The results (Table 1) show radial ply tires reduced fuel consumption an average of 7.25%. Slippage was reduced from an average of 13% for conventional tires to an average of 9.75% for radial ply tires. Radial ply tires increased the effective field capacity from 9.23 acres per hour to 9.62 acres per hour, an increase of 4.2%.

The USDA National Tillage Machinery Laboratory conducted a test to compare a smooth (no tread) experimental tractor tire of radial construction with a conventional bias tire. Engineers conducting the tests felt the radial tire was more stable and maintained more uniform contact with the soil.

Why radial ply tires increased traction efficiency is partially explained by the longer "foot print" made by the radial ply tire (Figure 2) which results in more tire-soil contact.

Figure 2. Tire "foot prints" on concrete floor.



BIAS (Regular) 18.4-38, 6 ply, 14 psi, load 3500 lbs., W16L rim

RADIAL 18.4-38, 6 ply, 14 psi, load 3500 lbs., W16L rim

Tractor Tire Selection and Cost

There can be many material and design differences in tires. The final product is a combination of all these factors. Differences are difficult to evaluate because there are no "overall" tests for tractor tires like there are for tractors.

Tire manufacturers normally produce more than one quality level of tires. These quality levels can generally be divided into three broad classes.

1. **Original Equipment** (OEM) tires are those sold to farm equipment manufacturers for installation on new tractors and implements.

2. **Premium** tires have improvements in design, materials or assembly. These tires are expected to give longer tire life and better traction. They cost more and generally weigh more.

3. **Economy** tires are usually lower "quality" compared to OEM or premium tires. They cost less and usually weigh less.

While there is no industry standard for comparing different grades of tires, two published qualities which can be used for comparison are retail price and tire weight. One manufacturer's line of tires is compared in Table 2. Note that the change in price of the premium and economy tires to OEM tire is related to their change in weight.

TABLE 2
TRACTOR TIRES*

Tire Type	18.4-36, 6 Ply			
	Cost		Weight	
Bias Construction	$	%	lbs.	%
Premium	638	115	314	122
Original Equipment	554	100	257	100
Economy	438	79	218	85
Radial Construction				
Original Equipment	666	120	338	132

*One manufacturers line of tires.

The radial tire is very comparable to the premium bias tire in both price and weight (Table 2). When compared to a bias ply tire of similar quality the radial tire may not be much higher priced. Both time and fuel savings are achieved due to less slippage when operating with radials. Less slippage means less tire wear which should give longer tire life. Putting a price on these factors will offset the higher initial price of radials, even when compared to OEM tires, in a relatively short time of use.

A reduction in slippage may be achieved more economically by the addition of weight to conventional bias tires. However, when the optimum tractor weight level is reached, additional weight will result in increased soil compaction and an increase in rolling resistance. More weight requires additional power to move the tractor across the field, causing a reduction in usable horsepower. (For more information on tractor ballasting consult the North Dakota Extension Circular AE-644, "Tractor Ballasting.")

During the NDSU tests the tractor operator noted a smoother ride when the tractor was equipped with radial ply tires, another benefit to consider in addition to direct economic returns.

The questions on whether to use radials may still be a matter of economics. However, with energy costs continually rising, radials may become the standard tire for tractors as they have in the automobile market.

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