Rubber Tires Lead!

Eugene G. McKibben
Iowa State College

J. Brownlee Davidson
Iowa State College

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Reduce Shock, Pull Easier and Pack Soil Less Than Does Steel

WHEN FARM machines are operated in the field or on the road at speeds higher than $2\frac{1}{2}$ to 3 miles per hour they should be equipped with rubber tires. And when these machines are pulled behind rubber-tired tractors the speed should be as high as the operating conditions and the design of the machines permit. In most cases the speed will be higher than $2\frac{1}{2}$ to 3 miles per hour for most efficient use.

That's the general conclusion we've reached here after conducting numerous laboratory and field tests with all kinds of steel wheels and rubber tires.

Our tests show that rubber tires are better than steel wheels on almost every count. Briefly, here are the advantages:

1. Regardless of speed, rubber tires greatly reduce the number and intensity of shocks a machine gets on the road and in the field. This means reduced breakage and a much longer life for the machine plus added comfort for the farmer. A dollars and cents saving in the long run.

2. Under most road and field conditions, rubber-tired machines pull easier than those with steel wheels. As a result considerable saving in time and fuel can be chalked up in favor of the rubber tire. The amount of the saving will depend on the number of days the machine is used per year and the conditions under which it is operated.

3. Rubber implement tires pack soil less than steel wheels. Nor do they roll up as badly on wet, sticky soil or lift as much dust when the soil is dry. The exact savings from these advantages are hard to measure but they do exist.

This problem of rubber tires for farm machines is becoming more important because nearly all of the tractors being sold today are on rubber tires, and much of the advantage of rubber tires for tractors is in their use at higher speeds. A farm machine pulled behind the tractor has to stand up to this increased speed. But the problem is more troublesome because it is different on every farm, depending on the types of machines the farmer has and the number of days they are used during the year. Each farmer will have to study the advantages of rubber tires in the light of his own particular situation.

A survey we conducted shows that, on the average, only six machines are used more than 10 days a year. These are the tractor plow, cultivator, combine, corn picker, manure spreader and wagon. The wagon and manure spreader are used the most days per year, and much of our experimental field work was done in comparing a rubber-tired spreader with a steel-wheeled spreader.
We pulled these two spreaders, identical except for the tires, over a course of 5 miles of gravel road at different speeds and measured the number and intensity of the shocks each received. The results were amazing! At 2 1/2 miles an hour, the average speed for horse-drawn equipment, the steel-wheeled spreader received five times as many shocks as the one on rubber tires. When we increased the speed to 5 miles an hour there were 42 times as many hard jolts on the steel-wheeled spreader, and at 10 miles per hour this figure had jumped to over 50. Not only did the number of shocks increase, but the intensity of the jolt on the steel-wheeled spreader was much greater.

It's easy to see what these tests show. Any farm machine with steel wheels that's pulled at speeds higher than 2 1/2 miles an hour is going to be subjected to a terrific pounding which will show up in lost, worn and broken parts. Even at the slower speeds, rubber tires will give better wear and longer life to the machine, and that means less expense for repairs.

When we went into the laboratory we found the same thing was true. The rubber tire acted as an air cushion, softening the jolt and allowing for much higher speed than was possible with the steel wheel.

**Rolls Easier**

The second advantage of rubber tires on farm machines is that they reduce the rolling resistance. The machines are easier to pull. This was a little more difficult to measure. We found that the rolling resistance of a wheel varies with soil conditions and the size and shape of the wheel. On the average, though, rubber tires pulled 23 percent easier than steel wheels.

Pneumatic tires, when used as transport wheels on agricultural machines, are most effective in reducing rolling resistance on rough or soft surfaces or soils, the conditions under which most farm machines are operated. In our tests a material reduction in rolling resistance was obtained in all trials made under these conditions—in one instance as much as 46 percent. The 23-percent average reduction in rolling resistance is based on a number of tests with different wheels. Of almost as much interest to us is the fact that rubber tires differ quite a bit in their ability to reduce draft. We found that it depends mostly on three factors: (1) The outside diameter of the wheel, (2) the inflation pressure and (3) the wheel arrangement.

In general, the larger the diameter of the wheel the easier it is to pull. This is particularly true on soft, loose surfaces. On hard, packed surfaces loads pull easier if the tire pressure is increased, but on loose soil the pressure should be reduced for easy pulling. So for spring work, on loose fallow soil, it would be a good idea to let some of the air out of the tires on farm machines even though such operation may shorten the tire life slightly. In regard to wheel arrangement, we found that the tandem arrangement, where one wheel is behind the other, is best, but in many cases that means redesigning the machine and for that reason it
Most tractors now are sold with rubber tires. Many of these field machines can and should travel more than 2 ½ to 3 miles per hour in order to get the highest efficiency possible. Often old automobile tires can be used on such machines.

is not as practical as the dual or single wheel setup.

Whereas the reduction of shock by rubber tires gives long-run savings in the form of longer life for the farm machine and less expense for repairs, the reduced draft gives daily savings in the form of less tractor fuel consumption. But it's hard to measure just how much these savings will amount to. It varies with the size and kind of machine, the type of work it is doing, the kind of a tractor that is being used, and the number of hours the machine is used per year. These are different on each farm.

Packs Soil Less

Little more needs to be said about the third advantage—the effects of rubber tires on soil conditions. This advantage also varies with different wheels and different soil conditions. In general, though, the rubber tires on implements don't pack the soil as much as steel implement wheels, and this means less damage to temporary field roads. This is especially true when low inflation pressures are used.

We have found that less soil sticks to the rubber tire than steel when the ground is wet, and neither does the tire sift so much dust into the air when the soil is dry.

Although our tests do show conclusively that rubber tires are better than steel wheels under most road and field conditions, they don't show just how much rubber tires are going to cost the user. As we mentioned before, the cost problem is different on every farm, depending upon the kinds of machines, the conditions under which they are used and the number of days they are used each year. The cost of any tire will depend upon such factors as first cost, depreciation, interest, taxes, insurance and maintenance.

We do know that the daily cost of the tire will depend largely on the life of the tire and the number of days it is used per year. Most observers seem to think that a rubber tire on a farm machine will have as long a life as rubber tires on tractors—about 7 years. And most observers believe that the life of the tire is more or less independent of the number of days it is used. This simply means that the more days you use the tire the less it will cost per day, and the tire goes to pieces very little faster even with more daily use. This fact brings up an interesting possibility. How about changing tires on farm machines?

The accompanying table shows a list of the common farm machines and the average number of days they are used each year.

Six of these machines are used more than 10 days per year, and of these six, four are used during different seasons. If tires could be changed from one machine to the other as it was used, the savings would be considerable. Manufacturers of farm machines and rubber tires have been aware of this problem, and considerable work has been done to reduce the number of different tire sizes. It is expected that more of this work will be done in the future. Each farmer should study the possibilities for interchanging rubber tires on the farm machines that he uses.

Old Auto Tires

There is still one other point that should not be overlooked by the average farmer who is convinced of the advantages of rubber tires. Often new wheels and tires may be too expensive for farm machines, and the wheel can be purchased without the new tire and mounted with used automobile or truck tires. Most farms have or can purchase at low cost old tires that are unsafe for fast road use but which would be entirely suitable for field work on farm machines.

Another procedure to follow if the steel wheel on the machine is in good condition is to cut off the rim and weld on a drop-center rim on which a tire can be mounted. This is often much less expensive than buying the new steel wheel, but it requires some special tools and equipment. Complete details for mounting drop-center rims on steel wheel hubs can be found in our illustrated popular bulletin P9, "Rubber-Tiring Farm Machines." This bulletin will be sent to anyone upon request to the Bulletin Office, Iowa State College.