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CENTER PIVOT TRACK MANAGEMENT OPTIONS

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INTRODUCTION

Center pivot track management has been fairly straightforward for most pivots over the years. Farmers have purchased the standard 11.2 X 24 tires and used a tractor drawn track closer after harvest with good success. However, from the beginning some fields have had major issues with pivots creating deep tracks and getting stuck. Longer spans, larger pipe sizes, and corner systems have added to the problems until today many new pivots are sold with larger tires. On fields with tracking problems, the in-season challenges with getting the pivot around the field justifies taking action to solve the problem.

The three key variables that influence track depth include the water content of the soil when the pivot passes, the number of times the pivot will go around each year, and how much pressure (pounds per square inch) the wheels exert on the soil. If deep tracks are observed around the entire field, it is a good indication the field may be over watered.

Over the last several years, numerous wheel and sprinkler options have entered the market and are being purchased by farmers to help solve track problems in difficult fields. The market trends indicate a significant problem exists on a number of fields. Track management can involve a combination of several different complementary strategies. The approaches discussed in this paper are divided into four general categories including: design and installation, sprinkler options, tire/wheel/track options, and management and maintenance.

DESIGN AND INSTILLATION

During the design phase of a center pivot is the best and most cost-effective time to minimize tracking issues. At this stage, all options are open and modifications made on paper are much cheaper than in the field.

The first step is to upload a good accurate map of the field into the pivot design software and note areas that could have tracking issues. This step is best completed with the farmer and dealer working side-by-side. The areas to look for include: 1. Heavy soil types with high water holding capacities and poor drainage, 2. The areas in the field where the combination of slope, soil type, and relative position under the pivot will make it likely to have runoff, 3.Wet areas that are sub irrigated by springs, 4. Low areas where water tends to pond during surface runoff events from rain, 5. Surface drainage channels, and 6. Areas where wheel tracks will be going down steeper slopes on easily erodible soils.

Then armed with the knowledge of the problem areas, start with the design software and look for opportunities to adjust the span length so the pivot tracks can avoid as much of the difficult areas as possible. With the large selection of span lengths available today, it is usually possible to minimize or altogether avoid the wheels going through the problem areas.

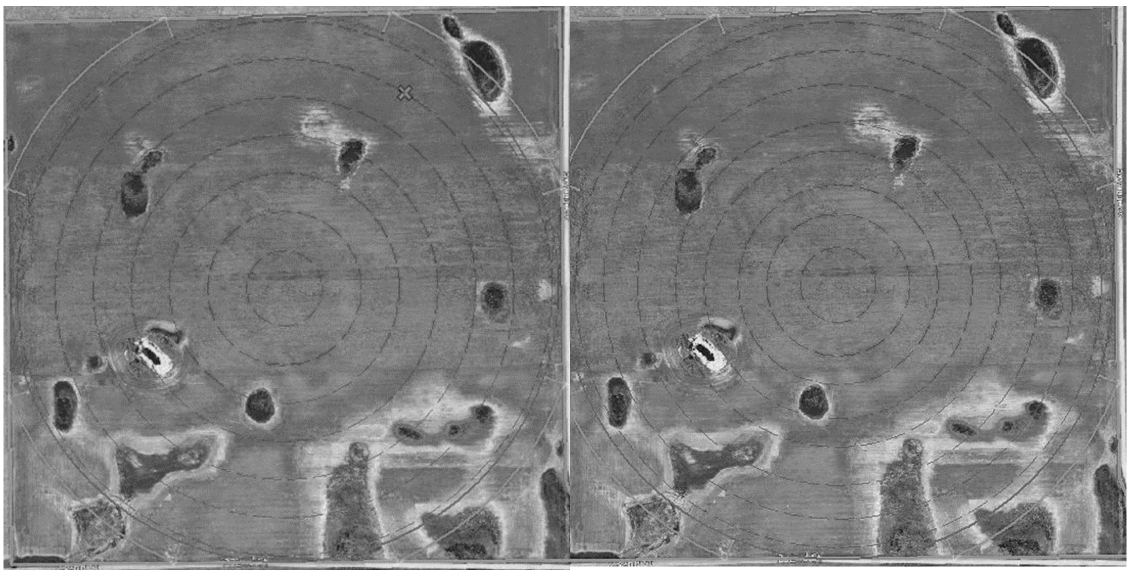

Figure 1. The pivot design on the left shows the standard seven span layout. The design on the right uses different span length and one extra tower to significantly reduce the problem areas the wheels need to cross.

The amount of weight on each set of wheels is also important. The longer the span and the larger the pipe, the more weight each wheel will need to support. In the areas where deep tracking is a concern, consider using shorter spans and/or smaller pipe. Shorter spans will mean the cost of the pivot will go up because you're buying more towers, but if it eliminates some tracking issues it is money well spent. Likewise, smaller diameter pipe can mean higher friction losses requiring higher energy costs, but if it eliminates major tracking issues it may also be money well spent. During the design phase it is easy to look at the options and determine if the costs are worth the benefits. Corner systems are also heavier and special consideration should be given to using larger wheels and/or a three wheel tower on the last span. Keep in mind the wheel and sprinkler options discussed below may only be needed on the towers going through the problem areas.

Another option some farmers like to use is to put a 3 ft extension in the pivot pipe at the pivot point. By adding the extra length the wheels are moved out of the old track. The strategy is to move the pivot out this year and back in next year. Some only move the pivot when the tracks become a problem and not on a regular basis. The move allows the soil placed in the tracks an extra year to firm up. Often the extension pipe and the longer span cable are ordered when the pivot is purchase new. However, the modification can be made on any existing pivot.

An important point to consider during the design phase is moving soil in the field so water can be directed safely off the field. It is important to keep runoff from collecting in the pivot tracks and running down steeper slopes causing erosion problems. Often by moving just a little soil the problem can be prevented.

In some wet parts of the field it may be beneficial to raise the area around the wheel tracks so the water drains off keeping the area dryer. In addition many options exist to use pivot bridges to go over ditches or smaller wet areas. During the design phase it is much easier to minimize the amount of soil moved to accomplish the objectives.
Drainage through tile drains is another option worth considering for wet areas. It will not only help prevent wheel track problems, but should also help improve the yields.

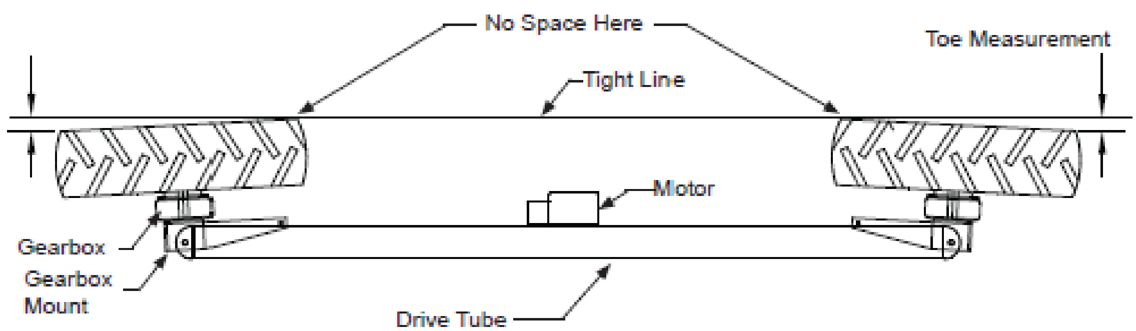

Figure 2. Diagram of location to measure wheel toe alignment on a center pivot tower.

During the installation process, it is very important to make sure the wheel toe alignment is adjusted correctly on each tower. The inside three or four spans are the most critical because they are required to turn the shortest circles. Without adjusting the wheel toe alignment the pivot point literally drags the tires around the circle which will cause a great deal of stress on the pivot and scrub the tracks out deeper. For example, if the first span is 157 ft with 11.2 X 38 tires the toe is 2 inches on each wheel.

After the pivot is installed, it is always a good idea to run it around once and evaluate the tracks to make sure everything is working the way it was designed.

SPRINKLER OPTIONS

The sprinkler configuration around each tower can be easily modified to help direct the water away from the pivot tracks or to apply the water after the pivot has passed. On every pivot it is important not to install a sprinkler on a drop directly over the wheels and sprinklers close to the tower on drops should always have the height adjusted to minimize the sprinkler pattern interception by the pivot structure. Water that hits the tower structure usually ends up in the pivot track.

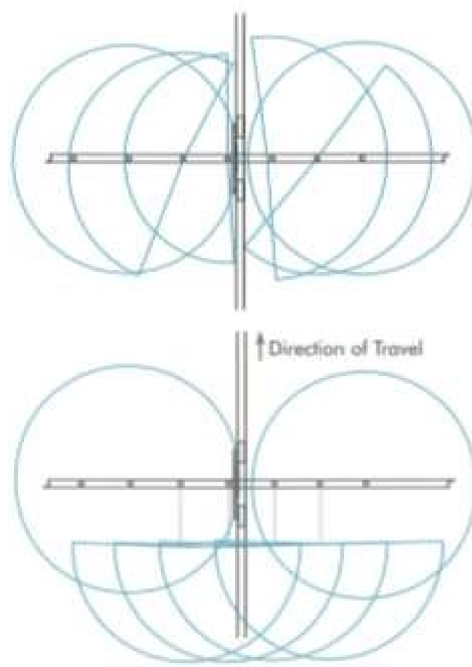

Image courtesy of Nelson Irrigation Corp.

Figure 3. Diagram of part circle sprinkler arrangements to keep wheel tracts dry.

Part circle sprinklers are often used to manage the water around the pivot tracks. The sprinklers can be oriented to just leave the track area dryer or can be oriented to apply water after the pivot has passed by. Another part circle configuration is to attach the sprinklers on the end of a 15 foot offset behind the pivot so all the water is applied after the pivot has passed by. Offsets can be attached on both sides of the tower with an electric controlled valve system so no matter which way the pivot is moving, water is applied after the wheels have gone by.

The sprinkler wetted diameter on the entire sprinkler package should be large enough to prevent runoff in the area that was determined to be the most likely to have runoff. Even if the area is small, the runoff will usually end up in the pivot track where it will run to the lowest point of the track. Often the area is already a problem and the pivot runoff just makes it worse. If the decision is made to allow some runoff in a small area, take the resulting problem into account and use other options to minimize the problem.

Variable rate irrigation technology or VRI is another very effective method of managing tracking issues in wet areas of the field. Areas that are sub irrigated or pond water after a heavy rain are just simply going to be too wet during parts of the year and will not need irrigation until they dry out. The VRI technology can be programmed to not apply water in these areas until they actually need it. Letting the crop use the water and reducing the soil water content below field capacity before irrigating will reduce the depth of the tracks throughout the season.

TIRE/WHEEL/TRACK OPTIONS

The pivot industry and numerous aftermarket manufacturers have created an amazing amount of different tire/wheel/track options for pivots and laterals. Most of the options focus on improving the traditional pneumatic tire option in two ways. First, by eliminating flat tires and second, by reducing the depth of pivot tracks. Many of the options do well with one or the other of the objectives and a few do well at both.

One of the biggest keys to minimizing wheel track depth in a given condition is to minimize the pounds per square inch the wheel exerts on the soil. The two main methods to reduce the pounds per square inch are fairly straightforward; 1. Reduce the weight on each tower by making shorter spans or using smaller pipe, and 2. Increase the footprint area of the wheels supporting each span. Increasing the foot print area can be done by increasing the size of the tires, by adding tracks/large footprint wheel options, or by adding more wheels per tower.

The 11.2 X 24 tire has become the standard because it has worked well in the past in most situations and is an economical option. However, today most new pivots are much heavier because of longer spans and/or larger pipe and should be equipped with larger tires. Currently, as an example, Lindsay sells about as many of the larger 11.2 X 38 tires as the 11.2 X 24s. For example on a Zimmatic 9500P with two wheels per tower, 6 5/8” pipe running wet with a 135’ span with 11.2 X 24 tires (5419 lb) puts 11.2 psi on the soil as were a 201’ span with 11.2 X 38 tires (7760 lb) puts 12.1 psi on the soil.

Pneumatic tires provide a nice balance between traction, wheel track depth, and minimal wear and tear on the drive train. So always, consider using a larger size pneumatic tire option to help reduce tracking issues. Most farmers prefer using taller over wider tires because the wider ones make tracks that are rougher to cross with farm equipment.

Radial tires are finding their way onto pivots over the last several years and are making claims of 20 to 30 percent less track depth as compared to comparable sized bias tires. One of the advantages of the radial tire is they are designed to run at lower pressures (~15 psi) and thus have a larger footprint. In fact, the 12.2 x 38 has a 24% larger footprint than the 11.2 x 38 bias tire. Wider, flatter tread profile for improved flotation, durable side walls, the lowest driveline forces of any wheel option, and heavy load ratings at lower pressures are some of the other benefits.

A good comprehensive university research study has not been conducted on the numerous options in the market today. The non-pneumatic tire options will all succeed at overcoming flat tires. However, the question about how they affect wheel track depth and if they cause premature drive line failure is more difficult to answer. In general, hard rigid wheels when compared to similar sized pneumatic tires tend to make deeper tracks. Many of the other wheel/track configurations greatly increase the footprint and may help reduce track depth. All non-pneumatic tire options add more stress on the driveline. The wheel/track configurations using a rubber belting material have shown to be a good combination of eliminating flat tire problems and increasing the footprint to reduce track depths.

If the decision is made to use one of the wheels discussed above, keep in mind, all of the wheels on a tower need to match. However, if tracking problems only exist on two towers, there is no need to modify all of the wheels on the pivot. The only caution to this mix and match approach is if the outside tower is the only location where the taller wheels are used, the ratio needs to be calculated to make sure the next tower in can keep up when the pivot is set to move at 100% speed. If the second tower cannot keep up, the pivot may end up with an alignment fault.

MANAGEMENT AND MAINTENANCE

Pivots, like everything else on the farm, respond very well to good management and maintenance. The majority of the pivots across the United States have standard sized tires and do not have deep track problems because the farmers follow good management practices. Several of the practices are discussed below.

Good pivot track management involves adjusting air pressure in the tires before you start the irrigation season. When the pressure is too high the tires will make deeper tracks and if the pressure is to low the tires may come off of the rim. Check the Owner's Manual for the correct pressure and adjust to the lower end of the range if tracking is expected to be a problem.

Then during the first pass of the year, run the pivot around dry on a day when the soil is fairly moist but does not stick to the tires or squeeze out. The conditions are optimum for packing the soil in the wheel track. During the second pass and if the soil is very dry during the first pass, apply 0.25-0.50 inches of water. The procedures will help compact the soil and reduce the depth of the pivot track during the season.

In season, strive to run the pivot around as few times as possible because each pass will make the track a little deeper. So, apply the largest practical irrigation without runoff and allow the field surface to dry off some before the next irrigation. In addition, it is important to use good irrigation scheduling to make sure the pivot is not sent around when the soil is wet from irrigation or rain. Stopping the pivot right after a significant rain is important. Over watering and keeping the field too wet is probably the leading cause of deep tracking problems with center pivots. However, in many fields some parts will need water before others are dry enough to prevent deep wheel tracks. In these fields, VRI technology may be a good economical solution.

Another option to consider in areas were pivot tracks become deep is to put a layer of crushed rock or other base material in the bottom of the track to provide a firm foundation for the pivot to move over. It is best to do this when the pivot track is of sufficient depth to apply the products below the normal tillage zone.

Pivot tracks coming down steep slopes are especially vulnerable to soil erosion during heavy rains. Before the crop is planted, it is important to move soil to stop the water from running into the pivot track where it can deeply erode the track. Many strategies have been used over the years from a full tile drained terrace system too small ridges of soil or ditches to safely take the water off the field to prevent eroding the pivot track.

Part circle pivots create a different issue because of the back-and-forth nature of operation. The best method to prevent deep tracks is to stop the pivot for 12 to 24 hr. after it reaches the stop to let the soil firm up before restarting the machine. If that is not possible because the crop is needing water, another method to consider is to program the speed control option in the pivot panel to automatically speed the pivot up as it comes into the stop, then reduce the speed after it reverses and moves back out into the field. The method provides a full water application, but the tracks receive less water during the first pass.

Having a wireless irrigation management system on the pivot makes all of these management practices much easier to accomplish. From starting and running the pivot around exactly 360 degrees the first time to stopping the pivot right after a rain, remote monitoring and controlling makes good pivot management take a lot less time and minimizes trips to the field.

The last management technique of the year and probably the widest used is to fill the pivot tracks after harvest if needed. A wide range of tractor drawn equipment is available to fill pivot tracks. Filling the pivot tracks just as soon after harvest as possible is important to give the soil more time to firm up in the wheel track before the next irrigation season.

CONCLUSION

Today more options are available than ever to help manage pivot track problems. Many tracking issues can be prevented by doing a good job of designing the pivot. In addition, many other issues can be resolved by following good pivot management practices. In the more challenging areas though, modifying the sprinkler package around the towers and increasing the footprint of the wheels/tracks may be required.