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Sprinkler irrigation system field checklist

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Sprinkler Irrigation System Field Checklist

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ABSTRACT. ***This recommendation came out of a noted need by the ASABE NRES-241 sprinkler irrigation committee in 2019 committee meeting for a simple checklist to quickly educate new center pivot operators on what to look for to determine if a center pivot is operating at designed performance. This checklist is meant to be simple and user friendly. Simple and clear language was incorporated purposefully. It is intended as a quick guide to new irrigators, or as a reminder to more experienced irrigators as to what to check to ensure efficient and effective center pivot and linear move irrigation system operation for optimal performance. Different checklists were developed for various frequencies of system evaluation. This was done as a cooperative project of the sprinkler irrigation committee members as an outcome of this stated need. It is hoped that this checklist can be adapted and used by growers, consultants, and other irrigators.***

Keywords. Center pivot, Field check, Pivot maintenance, Checklists

Introduction

Since invention of center pivot sprinkler irrigation system by Frank Zybach (1952), and later commercialization by Robert Daugherty and Valmont Industries, the sprinkler irrigation system has been widely adopted all over the world for crop production. In the U.S., the center pivot irrigation system has revolutionized the landscape of many different areas globally and profoundly changed output of the food production system by turning the Great Plains of the United States from rainfed land that was in some areas, marginally suitable for some dryland crops to irrigated land that can reliably produce higher yielding and/or economically viable crops. In order to deliver water to these crop production lands efficiently when using center pivot irrigation system, routine system checks are necessary. While there are procedures and standards to address certain components or aspects of center pivot performance, such as uniformity (Heermann 1990, ANSI/ASAE S436.2), nozzle maintenance (Kranz et al., 2012), and irrigation audits (Thompson and Ross, 2011), there is a steep learning curve for new center pivot operators to understand and adopt such literature. Therefore, as a noted need by the ASABE NRES-241 sprinkler irrigation committee in 2019, a clear checklist for center pivot operators was developed to quickly access whether pivot is operating at designed performance in the field.

Recommended checklist based on visiting type/frequency

The following checklists are meant to serve as a simple guide for new and experienced irrigators/operators on items to check for to ensure proper center pivot and linear move sprinkler irrigation system operations for maximum application efficiency. However, this doesn't guarantee maximum economic productivity as it is affected by many other factors such as weather, water availability, crop management, crop price, etc. Readers can refer to the respective section to see the checklists developed for drive-by, weekly, by telemetry, preseason, after season, and every five years assessments.

INFORMATION TO BE READILY AVAILABLE

1. Design sprinkler pressure at the pivot.
2. Design flowrate.
3. Table of gross application depths and hours to apply for various percent timer settings.
4. VRI information.
5. Allocation and/or water permit limit.

DAILY – CENTER PIVOT WITH TELEMETRY OR REMOTE OPERATION

1. Is system communicating properly and regularly?
2. Does system start/stop on command?
3. Is the system pressure at the design pressure or higher/lower?
4. Is pivot location at where it's expected?
5. Is the end-gun state as expected?
6. Is aux ports state as expected?
7. Is the pivot as expected for the applied water depth?
8. Are field sensors reporting and data makes sense?
9. Status of the water application for the season compared to allocation / water permit
    a. Do adjustments need to be made?

DRIVE-BY ITEMS:

1. Are all sprinklers operating? Are there any plugged nozzles?
2. Observe the water spray pattern of each sprinkler on a calm, non-windy day to visually assess the pressure and flow rate of each sprinkler.
3. If irrigation system is equipped with moving parts, such as rotators or spinners, are those parts moving properly?
4. Is the end gun operating correctly over the angles as per the sprinkler chart?
5. Is the end gun spraying onto roads or other areas outside of crop area?
6. Is there surface runoff (most likely under the last span)? Is water ponding in low spots?
    a. Can be due to leaks. If runoff is everywhere, consider speeding the pivot up (applying less water per pass).
7. Is there any visual observation of any non-uniform water application areas?
8. Are there any water stressed areas in the field? When checking system in the midafternoon on sunny days, are the crops showing any water stress such as corn leaves 'rolling' or other wilting symptoms?

WEEKLY ITEMS:

1. If irrigation resource is surface water and filter is used, check the filters to make sure pressure loss is in acceptable range.
2. If there is a flow meter, is the weekly flow rate close to the expected value?
    a. For instance, if 1.5 inches of water is expected to apply in 1 week for a 150-acre field, the flow meter should register a difference of 1.5 inches x 150 acres x 27154 gallon/(acre-in) = 6109650 gallons in that 1-week time period.
3. If the flow rate or well drawdown changes during the season, update the percent timer on the panel based on the current well flow rate(s). Does the flow rate require a change in sprinkler nozzles?
4. If using aerial imagery to assess uniformity issues,
    a. If pattern of rings is observed in the field, that could possibly indicate potential nozzle/leak issues.
    b. If pattern of wheel spoke(s) is observed, it may occur at light application depths due to low pressure setting in the panel is incorrect or if the pump is surging, or if the irrigation schedule results in consistent day time watering of one part of the field.

ANNUAL ITEMS:

Start of season

1. Locate the current sprinkler chart.
2. If you have a flow meter: Does the flow rate match the sprinkler chart?
3. If it is a part-circle or wiper pivot: Are the bumper bars in place and functional?
4. Has the pivot point bearing been greased?
5. With the power off (be sure it's really off), have an electrician check for loose connections (terminal screws) or loose cord grips in the control panel and tower boxes. Do contactors show signs of arcing?
6. Are the electrical grounding conductors solidly connected? (both to the ground leads/terminals and the power supply ground wire) Clean or tighten as required.
7. Check all tire condition and pressure. Check wheel lug nut torque and wheel alignment if the pivot is newly installed.
8. Check for water leaks at tower joints, goosenecks, and at sprinkler and hose couplings.
9. Does the operating pressure match the design pressure (from the sprinkler chart)?
10. Check the oil level in the gear boxes (will need a wrench to open fill plug). Is there water in the oil? If so, drain the old oil into a collector and fill with new oil.
11. Are the drive shaft safety shields in place?
12. During center pivot operation, check for gearbox noise indicating wear or problems?
13. Is the filter for the hydraulic tubes for hydro-valves actuators clean?
14. Does the pivot alignment look straight when it is operating?
15. Check for rodent damage to wiring by checking if there are visual marks on the wires and if all electrical communications/commands are working as expected.
16. Walk the entire system while it is operating and check wheel track depth.
17. Is it time to replace the sprinkler nozzles, sprinklers, or regulators? Issues to look for are:
    a. Because of indications of non-uniformity in the field which may be related to sprinkler operation.
    b. Higher flowrates and lower pressures than expected
    c. Usually recommended every 5-10 years depending on water quality.

End of season

1. Prepare water use report.
2. Record hours of operation for the season. Do they seem reasonable based on the weather conditions?
3. Will you need to budget for winter maintenance?
4. Was the system flushed? Are the sand traps clean?
5. Is the pivot and connections to the well completely drained of water?
6. Is the power off?

EVERY FIVE YEARS (or if have concerns) ITEMS:

1. Do a pumping plant performance audit (Martin et al. 2017).
2. Consider replacing the sprinkler package. Does the package need redesigning or updating?
3. Compare installed nozzles to sprinkler chart.
4. Are pressure regulators working as expected or need to be replaced?
5. Do pressure gauges and flow meters need replacement?
6. Change the gearbox oil at the interval recommended by the manufacturer.

7. Check structural bolts, chains, and nuts. Are they still tight?
8. Inspect the tower drive motor contactors and replace if necessary.
9. Have an electrician and/or a dealer person do an inspection for electrical safety.
10. Collect some aerial images to help evaluate the sprinkler package
11. Conduct a catch can test to check application uniformity, refer to ASABE standard: ANSI/ASAE S436.2

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