ANSI/ASAE S436.1 JUN1996 (R2016)
Test Procedure for Determining the Uniformity of Water Distribution of Center Pivot and Lateral Move Irrigation Machines Equipped with Spray or Sprinkler Nozzles

American Society of Agricultural and Biological Engineers

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Approved January 2011 as an American National Standard

Test Procedure for Determining the Uniformity of Water Distribution of Center Pivot and Lateral Move Irrigation Machines Equipped with Spray or Sprinkler Nozzles

Developed jointly by The Irrigation Association and the ASAE Sprinkler Irrigation Committee; approved by the ASAE Soil and Water Division Standards Committee; adopted by ASAE June 1983; reconfirmed December 1988; approved as an American National Standard May 1989; revised editorially June 1989; reconfirmed December 1989, December 1990, December 1991; reaffirmed by ANSI September 1992; reaffirmed by ASAE December 1992, December 1993, December 1994, December 1995; revised June 1996; revision approved by ANSI October 1997; revised editorially September 1998; reaffirmed by ASAE January 2001; reaffirmed by ANSI March 2001; reaffirmed by ASAE December 2001, February 2006, January 2007; reaffirmed by ANSI January 2007; reaffirmed by ASABE January 2012; reaffirmed by ANSI February 2012; reaffirmed by ASABE and ANSI December 2016.

Keywords: Irrigation, Sprinkler, Test

1 Purpose and scope

1.1 The purpose of this Standard is to define a method for characterizing the uniformity of water distribution of sprinkler packages installed on center pivots and lateral move irrigation machines. This test produces data to be used in computing the coefficient of uniformity, which can assist in system design and/or selection, and can be used to quantify certain aspects of system performance in the field. The coefficient of uniformity is only one factor in evaluating total system performance. Application rates, runoff, wind, amount of water applied, pump performance, and overall system management can greatly affect the total performance of irrigation systems.

1.2 This Standard specifies a method for measuring water application depths in the field and calculating a coefficient of uniformity from the data. The Standard covers evaluation of water distribution from center pivots and lateral move irrigation machines equipped with sprinklers or spray devices. The Standard does not apply to systems in which the water application device is less than 1.5 m above the soil surface, or in which the water distribution from adjacent devices does not overlap.

2 Normative references

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the edition indicated was valid. All Standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent edition of the Standard indicated below. Standards organizations maintain registers of currently valid Standards.

ASAE S526.1 DEC96, Soil and Water Engineering Terminology

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3 Definitions

3.1 effective length of the lateral move system: The nominal distance parallel to the pipeline that is to be irrigated. Calculated as the distance between the terminal devices (see clause 3.5) on ends of the pipeline, plus 75% of the wetted radius of each terminal device.

If a portion of the area under the pipeline is used for the water supply system and not for crop production, that distance should not be included in the definition of the effective length. For this case, the effective length is the distance between the terminal sprinkler or spray devices on each end of the lateral, plus 75% of the wetted radius of each terminal water applications device, minus the distance used for the water supply system.

An alternative definition for effective length may be used, and shall be clearly stated in the test results.

3.2 effective radius of the center pivot: The nominal radius of the circular field area that is to be irrigated. Calculated as the distance from the pivot point to the terminal sprinkler or spray device on the pipeline, plus 75% of the wetted radius of the terminal water application device. If an alternative definition for effective radius is used, it shall be clearly stated in the test results.

3.3 endgun: A set of one or more sprinklers installed on the distal end of a center pivot or lateral move machine to increase the irrigated area. The endgun operates a fraction of the time required to irrigate the entire field. Sprinklers at the distal end of the machine that operate continuously while the field is being irrigated are not considered endguns.

3.4 sprinkler package: A collection of water distribution devices fitted to the outlets of either a center pivot or a lateral move system. The devices may consist of sprinklers, spray devices, piping, pressure or flow control devices, and supporting plumbing designed for a specific machine and set of operating parameters.

3.5 terminal device: The sprinkler or spray device at the moving end of a center pivot system or at one or both ends of a lateral move system. The terminal device operates continuously and is not an endgun.

3.6 test pressure: The pressure at the inlet where water enters the lateral pipeline. The test pressure shall be measured at the first available outlet downstream of the inlet to the pipeline.

3.7 wetted radius: Distance measured from the sprinkler or spray device centerline to the farthest point at which deposition of water declines to approximately 1 mm/h. The wetted radius is based on tests conducted when there was no wind. For the purposes of this test, the wetted radius can be estimated from manufacturer's catalog data as half of the diameter of coverage, or by observation of the machine operating in the field.

4 Test conditions and equipment

4.1 Collectors

4.1.1 All collectors used in the test to measure the depth of water applied shall be identical and shaped such that water does not splash in or out. The lip of the collector shall be symmetrical and without depressions. The height of the collectors shall be at least 120 mm. The entrance diameter of the collector shall be one-half to one times its height, but not less than 60 mm. The collector should be of a light color to reflect solar radiation and minimize evaporation.

4.1.2 The collectors shall be spaced uniformly along two or more straight lines perpendicular to the direction of travel of the machine (see figures 1 and 2). The collector spacing along each line shall not be more than 3 m for spray devices and 5 m for impact sprinklers. Collectors can be moved to avoid wheel tracks. If possible, the collector spacing should not be an even multiple or fraction of the sprinkler or spray device spacing. The location of the collectors shall be recorded.

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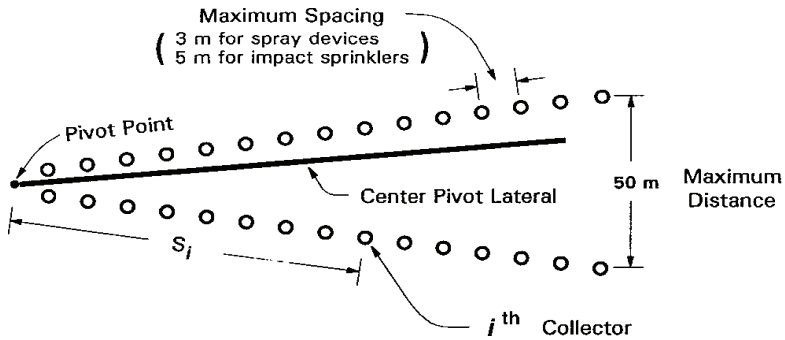

Figure 1 – Collector layout for determining the water distribution of center pivot irrigation machines

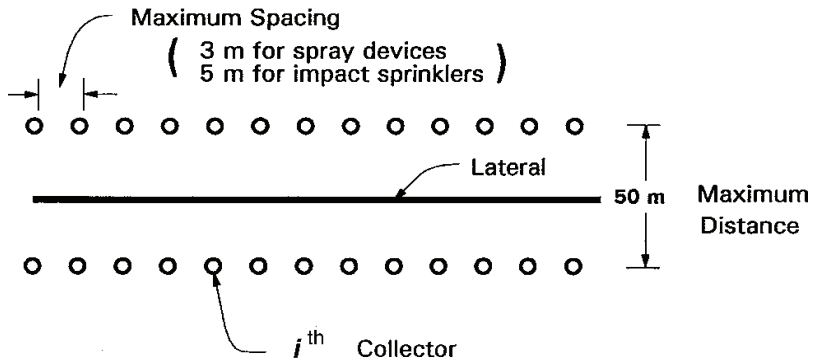

Figure 2 – Collector layout for determining the water distribution of lateral move irrigation machines

4.1.3 The collectors shall be located so that obstructions, such as the crop canopy, do not interfere with the measurement of water application. When the obstruction is higher than the elevation of the collector, but below the nozzle height, an unobstructed space of at least twice the distance between the height of the obstruction and the top of the collector shall be maintained on both sides of the collector rows as shown in figure 3. For systems with nozzles that operate below the crop canopy height, an unobstructed distance of at least 1.25 times the wetted radius of the sprinkler shall be maintained on each side of the collector rows as shown in figure 3.

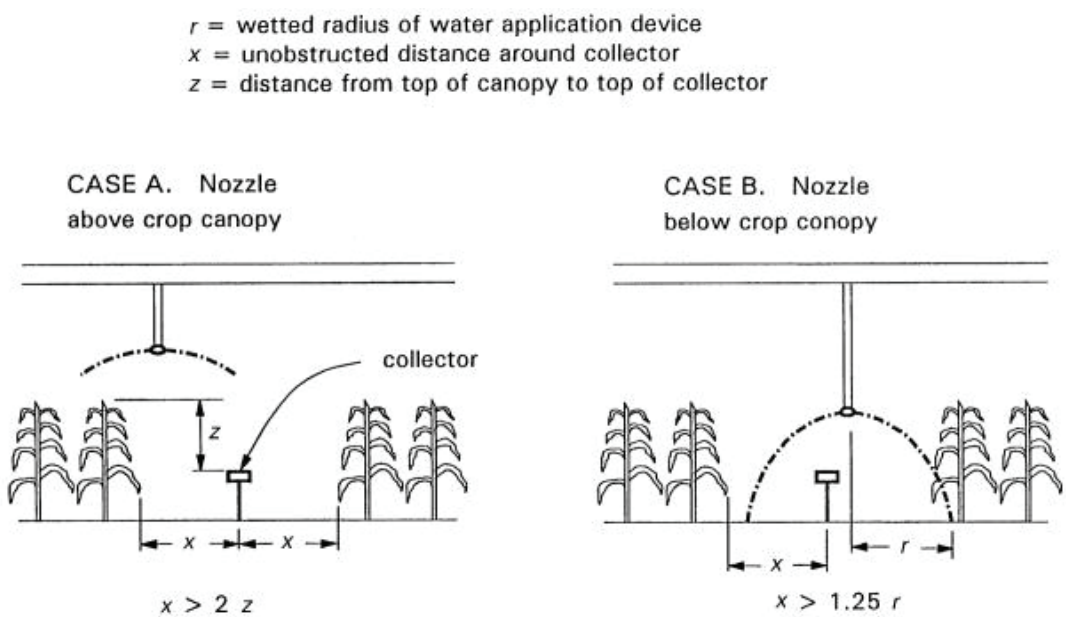

Figure 3 – Diagram of the required unobstructed area around the collectors

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