

Sprinkle and Trickle Irrigation System Design Using Tapered Pipes for Pressure Loss Adjusting

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Abstract

Accurate computing of amount of pressure loss is very important in sprinkle and trickle irrigation system design. Not correctly adjusted of pressure loss are causes lack of appropriate performance or failure of sprinkle and trickle irrigation system. By tapered pipes, pressure loss adjusted using increasing or decreasing of pressure head. In this study using HydroCalc software, ability of single and tapered pipes in pressure loss adjusting has been compared. Single and tapered laterals were able to adjusting of pressure loss but single manifolds were not able to achieving to the desired pressure head. In single lateral-tapered manifold system due to the lower pressure loss in laterals, can be use from several types of pipe diameters for manifolds but in tapered lateral-tapered manifold system due to the more pressure loss in laterals, the choice is limited. The best diameters for tapered manifolds with single lateral were 69.2-36.8 mm, 69.2-58.2-36.8 mm, and 58.2-46.0-36.8 mm whereas the best diameters for tapered manifold with tapered lateral were 69.2-46.0-36.8 mm.

Keywords: HydroCalc software, pressure head, pressure loss, tapered pipe, sprinkle manifold design, trickle manifold design

1. Introduction

Many tries have been done to appropriate design of sprinkle and trickle irrigation system, which some of them will be described in the following.

Molina-Martínez and Ruiz-Canales (2009) evaluated drip irrigation lateral diameters with on-line emitters using a Pocket PC software. As results, it showed with a figure with light emitting diodes (LED), the commercial diameters that could be used. Other results implemented in this tool were the maximum and minimum pressures for each diameter and a table that showed, on a comparative basis, whether the pressure tolerance of every diameter was exceeded or not. Bresler (1977) presented principles and application of trickle-drip irrigation o soil-water management. Lesikar, Weyraud and Persyn (2004) evaluated the application uniformity of subsurface drip distribution systems in difference pressures. He showed that low operating pressures might be attributed to design and/or installation problems. Rareş (2009) designed a drip irrigation system using HydroCalc irrigation planning. He found that the use of HydroCalc allows the designer, dealer or end-user to evaluate the performance of micro irrigation in-field components, such as: Drip laterals and micro sprinklers, Sub mains and manifolds, Main lines (PVC, PE, etc.), Valves Energy calculation. Reynolds, Yitayew and Petersene (1995) designed low-head bubbler irrigation systems. They showed that these systems could operate at pressures as low as 1 m (3.3 ft). Zapata, Playánb and Martínez-Cobb (2007), presented a contribution to the design of collective pressurized irrigation networks in solid-set sprinkler-irrigated windy areas successfully. Jackson and Kay (1987) used of pulse irrigation for reducing clogging problems in trickle emitters. A laboratory study on a sandy loam soil has demonstrated that pulsed flows up to three times the equivalent continuous flow can be used with little change to the soil wetting pattern. Yazar, Sezen and Sesveren (2002) studied LEPA and trickle irrigation of cotton in the Southeast Anatolia Project (GAP) area in Turkey. The research results revealed that both the trickle and LEPA irrigation systems could be used successfully for irrigating cotton crop under the arid climatic conditions of the GAP area in Turkey. Colombo and Orion (2006) designed and managed a tool for trickle irrigation using plant water accessibility function (PWA). Simulated values and field observed values were in good agreement, demonstrating the potential usefulness of the proposed PWA function as a design and management tool for trickle

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Table of Contents Sprinkle And Trickle Irrigation

1. Understanding the eBook Sprinkle And Trickle Irrigation
 - The Rise of Digital Reading Sprinkle And Trickle Irrigation
 - Advantages of eBooks Over Traditional Books
2. Identifying Sprinkle And Trickle Irrigation
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Sprinkle And Trickle Irrigation
 - User-Friendly Interface
4. Exploring eBook Recommendations from Sprinkle And Trickle Irrigation
 - Personalized Recommendations
 - Sprinkle And Trickle Irrigation User Reviews and Ratings
 - Sprinkle And Trickle Irrigation and Bestseller Lists
5. Accessing Sprinkle And Trickle Irrigation Free and Paid eBooks
 - Sprinkle And Trickle Irrigation Public Domain eBooks
 - Sprinkle And Trickle Irrigation eBook Subscription Services
 - Sprinkle And Trickle Irrigation Budget-Friendly Options

6. Navigating Sprinkle And Trickle Irrigation eBook Formats
 - ePub, PDF, MOBI, and More
 - Sprinkle And Trickle Irrigation Compatibility with Devices
 - Sprinkle And Trickle Irrigation Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Sprinkle And Trickle Irrigation
 - Highlighting and Note-Taking Sprinkle And Trickle Irrigation
 - Interactive Elements Sprinkle And Trickle Irrigation
8. Staying Engaged with Sprinkle And Trickle Irrigation
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Sprinkle And Trickle Irrigation
9. Balancing eBooks and Physical Books Sprinkle And Trickle Irrigation
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Sprinkle And Trickle Irrigation
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Sprinkle And Trickle Irrigation
 - Setting Reading Goals Sprinkle And Trickle Irrigation
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Sprinkle And Trickle Irrigation
 - Fact-Checking eBook Content of Sprinkle And Trickle Irrigation
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

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- Interactive and Gamified eBooks

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