GENISIS OF SHALLOW SUBSURFACE DRIP IRRIGATION (S^3DI)

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Abstract

Yield, economics, and management decisions for corn, cotton, and peanut row crops using deep subsurface drip (SSDI) and surface drip irrigation (SDI) systems led to the use of shallow subsurface drip irrigation (S^3DI). With SSDI there was little or no yield difference with all three row crops between 100 and 75% irrigation rates implying a possible 25% water savings. Various crop rotations irrigated using SSDI showed little yield difference except with continuous peanut and alternate year peanut rotations with corn or cotton which had lower yields compared with longer peanut rotations. Further SSDI research showed that yield of corn, cotton, and peanut, independent of lateral location under each crop row or with alternate row middles, was equivalent. The greatest management problem was the repair of SSDI tubing due to biological or mechanical damage. Tubing damage required the manual digging of each individual incident. The extent of labor prompted the possibility of laying drip laterals on the soil surface (SDI) where drip tubing could be easily serviced. Further research showed that laying drip tubing on the soil surface, during years of less than adequate precipitation, had yield potentials over 2, 3, and 7 times greater than nonirrigated crops for peanut, cotton, and corn, respectively. The SDI system was very economical during drought years especially for corn and cotton even when drip tubing was replaced annually. Yearly SDI installation on peanut was not as economical as corn or cotton and was highly dependent on precipitation patterns. Research showed that it would take approximately 1480 kg/ha increase in peanut yield to cover the cost of a SDI system while corn and cotton yield would need to increase 4645 and 663 kg/ha, respectively. The major management problem associate with SDI was rodent damage especially after inter-row canopy closure. There was little tubing damage to SDI in corn and cotton due to the open canopy orientation allowing less protection for rodents to predators compared with peanut. Chemical treatment of SDI tubing with registered pesticides for peanut did not result in less tubing damage but burying the tubing 3 to 5 cm below the soil surface reduced rodent damage to less than 5 holes/ha per year. Therefore, shallow burying of drip tubing (S^3DI) could be used for row crops especially corn, cotton, and peanut. The S^3DI was easy to install and remove and reduced rodent damage so that drip tubing could be used one year and possibly longer. Further research showed that S^3DI can be used economically in cotton and corn for one year during drought years. With the use of strip tillage and tractor guidance systems, it was possible that S^3DI could be installed and left in the field for at least three years in a cotton, corn, peanut rotation without yearly tubing removal. During a 6-yr trial, removing old and reinstalling new tubing between the 3rd and 4th year, irrigated cotton, corn, and peanut rotations had a $2658/ha net revenue increase compared with nonirrigated regime using the same crop rotation. The S^3DI is easily installed and removed (with proper equipment), yields are higher than nonirrigated regimes especially in reduced precipitation years, and can remain in the field for up to 3 or more years with proper management and crop rotations. Therefore, S^3DI could be recommended for small fields of corn, cotton, and peanut (or other row crops) where overhead sprinkler systems may be cost prohibitive.