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Soil Moisture Controlled Surface Drip Irrigation on Sandy Soils

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Abstract: ***The belowground drip irrigation (SDI) is being adopted in areas to conserve water whereas maintaining for economical production of crops. These systems haven't been evaluated on sandy soils common to American state. AN SDI system was put in on a well−drained sandy soil for sweet corn production in American state. The SDI conduit was buried underneath every (76−cm spacing)at either 2 depths of twenty three or thirty three cm below the bottom surface to lead to 2 experimental treatments. in addition ,the two ways of irrigation planning were obligatory on the SDI treatments. One planning treatment was the initiation and termination of irrigation supported soil wet measured by time domain reflectometry (TDR) probes put in five cm on top of the drip line. And also the different planning treatment was a daily irrigation event at rates per typical apply within the region. Mechanical device irrigation scheduled kind of of like farmer practices within the region and non−irrigated management treatments were conjointly established. The soil wet mostly irrigation planning regime resulted in high frequency short period (30−min) irrigation events to satisfy crop water desires. The 23−cm deep soil moisture−based treatment resulted in similar yields and similar water use in 2002 and reduced water use Martina's with similar yields compared to mechanical device irrigation in 2003. this means that 23−cm deep Sides possible for sweet corn production underneath these conditions. The employment of water was achieved with soil wet based mostly set points of 100 percent to twelve-tone music by volume (on−off). The 33−cm depth. Like farmer practices within the region resulted in high frequency short period (30−min) irrigevents to satisfy crop water desires.***

Keywords: SDI, belowground drip, Automatic irrigation, Zee Mays, Irrigation water use potency, High frequency irrigation, Sweet corn, Time domain reflectometry (TDR).

1. Introduction

The analysis Initiative and approved for publication as Journal Series No. R−09973. Article was submitted for review in Jan 2004; approved for publication by the Soil & Water Division of ASAE in Gregorian calendar month2004.This analysis was supported by the American state Agricultural Experiment Station and a grant from the Southern Peanut The authors area unit Michael D. Dukes, ASAE Member Engineer, proof, Agricultural and Biological Engineering Department, Professor, scientific discipline Department, University of American state, town, Florida. Corresponding author: Michael D. Dukes, P.O. Box 110570, town, FL 32611;

2. Materials and Methods

The study was conducted at the University of American state Plant Science analysis and Education Unit (PSREU) close to Citra, American state with sweet corn (Zee Mays) in 2002 and 2003. Within the spring of 2002, the SDI system was put in. It consisted of AN irrigation management shed including the totalizing flow meters with pulse output for information acquisition, two hundred mesh disk filters, and pressure regulation to 103−kPa, electrical solenoid valves, air/vacuum relief valves, and low drains before association to distribution manifolds. The Water was provided to the shed by a frequently pressurized provide main. Plots were four.5 m wide and fifteen m long (fig. 1). Drip tube (Typhoon 630, NetFind USA, Fresno, Calif.) had a flow teof zero.98 L/h at sixty nine parrots for every electrode, 30−cm electrode spacing, and a 0.33−mm wall thickness. The drip system operated at a median pressure at the plots of sixty nine kPa.Pressure regulation at the management shed of 103 kea accounted for head losses to the furthest plot Drip tube was positioned at the desired soil depth with a soil shank employing a row spacing of seventy six cm. The irrigation system was controlled by adatalogger (CR−10X, mythologist Scientific, Inc., Logan, Utah) including time domain reflectometry (TDR) probes (CS−615, mythologist Scientific, Inc., Logan, Utah). These TDR probes are used on many previous comes and also the plant standardization has been found to be correct to within1% to two soil wet content determined gravimetrically IWUE = MY/IRRIG (1) IWUE = irrigation water use potency (kg/m3) MY = marketable yield (kg) IRRIG = seasonal irrigation water use (including mechanical device applications to all or any plots) (m3). The soil was mapped as consisting of a Candler sand and Tavares sand (Buster, 1979). These soils area unit well drained, consist in way over ninety seven sand, and have a displacement unit of5.0% to 7.5% by volume (all soil water content during this paper expressed as % by volume) within the higher a hundred cm of the profile (Carlisle et al., 1978).enty (by volume) compared to the below ground of water.

3. Time−Based Subsurface Drip Irrigation

This incidence was most likely as a result irrigation water moves downward speedily as seen within the quickly decreasing soil wet content once single time supported irrigation events (figs. 6 and 7). The applying time ought to be magnified to ninety min/day within the last third of the season kind of like 2002 to assist make amends for this problem. The Yields in 2002 for each time−based treatments were statistically kind of like one another and yield from treatment five, but on top of those from treatment four. Though there have been 3 yield groupings, irrigation water use potency showed less variability across treatments. The Treatments area unit one, 2, 3, and five had statistically similar water use efficiencies for starting from three.50to 4.13 kg/m3. These similar water use potency values indicate that though some treatments did have higher yields than others, this increase in yield was related to magnified water use. In 2003, Treatments one and three resulted in marketable yields below treatments a pair of and five. Yields for treatment one and three might need been magnified by increasing the irrigation. The water was applied on those treatments compared to 374 millimeter applied on treatment a pair of and 488 millimeter applied on treatment five.

4. Soil Depth

Soil depth refers to the thickness of the soil materials, which give the structural support, nutrients, and water for plants. Sandy lands area unit deep and contain low gravels at a depth of over fifty centimeters. These lands area unit characterized by high quantities of carbonate and located in some space of the gravel plain adjacent to the sandy desert. The depth of the soil layer of sand and gravel will have an effect on irrigation management choices. If the depth to the current layer is a smaller amount than three feet, the ontogenesis depth and out there soil water for plants is shriveled. Soils with less out there water for plants need additional frequent irrigation.

5. Texture

It's wide accepted that the salinity of soil water is adequate close to 3 times the salinity of irrigation water, and presumptuous comparatively very little leach is going on. In their conditions of comparatively high leach fractions, the soil water answer and drain water can have a salinity level is for slightly larger than the irrigation water. once considering salinity effects of the irrigation water, the plants and soil are literally subject to the salinity of the resultant soil answer, that may be a perform of the salinity of the applied water. In a lot of the arid and semi-arid regions, most of the salts gift in irrigation water and groundwater square measure chlorides, sulfates, carbonates or bicarbonates of Ca, magnesium, Na and metallic element. Every of those salts incorporate a distinctive solubility, that at the side of the composition of the mineral material through that water passes, dictates the salts gift within the water. Once these salts square measure dissolved in answer, they usually ionize, breaking down (disassociating) into cat ions (positively-charged molecules) and anions (negatively-charged molecules). the foremost common cat ions in arid and semi-arid square measures are Ca, metal and Na. every of those cat ions is alkaline , that means that they contribute to Associate in Nursing inflated OH- concentration within the soil answer and a decrease in H+ concentration. They usually dominate the exchange advanced of soils, having replaced atomic number 13 and gas. Soils with exchange complexes saturated with Ca, metal and Na have a high base saturation and usually high hydrogen ion concentration values. In addition to decreasing plant on the market water and being doubtless autotoxin to plants, soil answer salinity can even have an effect on soil physical properties. Salinity will have a flocculating have an effect on soils, inflicting fine particles to bind along into aggregates. Assessment of the connection between soil answer salinity and so physical properties needs information of the constituents of the dissolved salts, and particularly the Na. Na has alternative impact on soils that salinity will. Whereas elevated solution concentration might enhance action, Na saturation might cause dispersion. due to its comparatively massive size, single electrical charge and association standing, absorbable Na tends to cause physical separation of soil particles. The connection between soil salinity and its flocculating effects, and soil psychic phenomenon (exchangeable Na percentage) and its dispersive effects, dictate whether or not or not a soil can keep collective or become distributed below numerous salinity and fraternity mixtures distributed clay particles inside the soil answer will clog soil pores once the particles settle out of answer. to boot, once phase settle, they will type a virtually structure less cement-like soil. This pore plugging and cement-like structure build it troublesome for plants to urge established and grows. It additionally impedes water flow and water infiltration into the soil. The disruption of soil hydraulic properties has 2 main consequences. Firstly, there's less water infiltrating into the soil, and thus less plant on the market water, significantly at deeper depths. Second runoff, and thus water loss and erosion, is also increased, and each have an effect on the irrigation.

6. Conclusion

Sandy soils have a low pore space and a high infiltration rate. The consequences of these two features on irrigation systems and methods are of paramount importance. The low pore space is responsible for a low water holding capacity. Consequently the frequency of irrigation and the labor requirements are high regardless of the irrigation method used. Labor requirements can be reduced but the initial cost of equipment is then considerably increased. The high infiltration rates make surface irrigation very difficult, as an important task is to avoid losses when applying water to the fields. The adaptation of surface irrigation, when possible, requires higher investment costs for increased length and size of canals, canal lining, large number of small plots and eventually special on-farm equipment. On the contrary high infiltration rates have little influence on sprinkler irrigation. This method can therefore be considered as the best for sandy soils. It will lead to acceptable efficiencies if properly designed and managed. Drip irrigation is a promising method but its cost is still quite high. It is recommended to set up field trials before embarking on large scale developments with drip irrigation. Wireless sensors and networks have just started in agriculture to assist in precise irrigation where it can provide a potential solution to efficient water management through remotely sensing soil water conditions in the field and controlling irrigation systems in the site. The implementation of wireless sensors in the irrigation of sandy soil has a great potential, in which more water use efficiency will be achieved. More development of such technology is needed specifically for the agricultural area.

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