Low Pressure Drip Irrigation

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Abstract:
Maximizing application efficiency (Ae) of irrigation systems depends mostly on the irrigation manager's ability to:

1. Reduce and/or eliminate runoff.
2. Reduce deep percolation below the root zone.
3. Overcome the infiltration variability of the soil surface.
4. Optimize irrigation scheduling.

Presently, the subsurface drip irrigation (SDI) method is the only method capable of giving a manager this ability but to do so it requires excellent design and intensive management. A new advance in drip irrigation has been recently developed in Israel. This approach may provide the capabilities of SDI in fulfilling the above requirements for improving Ae but with less stringent demands on precise design and intensive management and at a lower cost than SDI. The low pressure system (LPS) is installed just below the soil surface, it operates at very low flow and pressure and it can stay on for longer periods of time without generating runoff or deep percolation. This project will test the validity of these claims with cotton by comparing the performance of LPS with four bed spacing/line placement treatments. Performance will be measured by carefully monitoring plant, soil and water variables, calculating evapotranspiration, measuring water applied, crop yield and quality and system distribution uniformity Seminars and press releases will be used to disseminate the information to water agencies, extension services and growers.

Justification:
In California (DWR Bulletin 160-98), conservative predicted population increase (+15.4%) may cause agricultural applied water to decrease by 4% between 1995 and 2020. In addition, in the central portion of the San Joaquin Valley of California, due to lack of drainage outflow and the rising of saline water tables, several thousand acres of agricultural land are scheduled to go out of production and this will threaten the economy and welfare of small surrounding cities as well as that of the State of California. Throughout the cotton belt where warm weather attracts population and industry, similar conditions and decline of aquifer levels (such as the Ogallala aquifer) are also decreasing availability and quality of water used for irrigated agriculture. Properly designed and managed drip irrigation systems have been shown to increase application efficiency of irrigation systems and could help alleviate the decreasing water availability for irrigated agriculture in the cotton belt. The LPS technology has many potential technical, energy and economic advantages over standard drip and subsurface drip irrigation. These advantages need to be documented by research and demonstrations.

Previous Work and Present Outlook:
Years of research by the USDA and others have documented the soil and water conservation advantages of drip irrigation and subsurface drip irrigation. Recently, the LPS technology was developed in Israel by Netafim Irrigation. The LPS irrigation has been under commercial demonstration in Israel, Australia and the USA. The LPS technology has shown a high potential for economically improving application efficiency of irrigation systems under sandy soil conditions in areas where water is scarce and/or expensive or where deep percolation to groundwater could be damaging. Because the LPS operates at pressures ranging between 2-4 psi, the energy required for operation is minimal. Rigorous research is needed to compare the LPS method to furrow irrigation and to ensure the viability of this technology.

Objectives:

1. Demonstrate the validity of the LPS technology for economically growing crops while improving irrigation application efficiency (Ae) where:

$$Ae = \frac{Water\_used}{Water\_applied} * 100$$

2. Compare crop yield and quality, economics and Ae of LPS to similar results achieved with furrow (or other) irrigation systems.

3. Provide "recipe"-style recommendations to grower so that he can easily implement LPS technology.