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Drip Irrigation

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Introduction

Drip or trickle irrigation was used as early as the late 1800s, although it was not until the development of modern plastics during World War II that drip irrigation became economically possible. Developed initially to reduce or prevent moisture stress in the plant, drip irrigation systems also offer an excellent method to apply agrichemicals to the root zone of plants. The application of insecticides through a drip irrigation system was first attempted in the 1980s by using various carbamates and organophosphates, although success was limited. Currently, several newly-developed insecticides such as the neonicotinoids and anthralinic diamides are drip-injected for the control of many vegetable insect pests. The advantages of drip-injection of insecticides over ground application methods include a uniform distribution of insecticide throughout the plant; a reduction in pesticide application inputs, including manpower and vehicle or tractor fuel; and a reduction in soil compaction, plant disturbance, and applicator exposure to pesticides. Insecticides applied through a drip irrigation system can replace or reduce the number of foliar insecticide sprays, reducing the risks to non target species.

The application of insecticides through a drip irrigation system has been used successfully for the control of a variety of vegetable insect pests. Because many vegetable growers already use a drip irrigation system for water management, the injection of a pesticide can easily and inexpensively be achieved with the addition of an injection pump and the required safety equipment (switches, check valves, drain valves) for the injection of soluble pesticides. The current availability of novel, systemic insecticides that are labeled under the EPA Reduced Risk Pesticide Program such as neonicotinoids (including imidacloprid, clothianidin, thiamethoxam, and dinotefuran) or anthranilic diamides (including

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chorantraniliprole and cyantraniliprole), as well as additional future insecticides under development have advanced the opportunities for drip insectigation as an effective and environmentally sound pest management tactic.

Water availability is one of the most important parameters regulating biological activities in soil. Changes in water availability will influence soil organisms through complex interactions with nutrient conditions, soil temperature, pore size distribution and soil atmosphere. Drip, or trickle, irrigation can be defined as a method of uniformly delivering water to a plant's root zone through point or line sources (emitters) on or below the soil surface at a small operating pressure. Modern drip irrigation systems use low pressure (~34.48-68.95 kPa [5-10 psi]) to force water through plastic or metal tubing with emitters spaced at regular intervals down it's length to deliver water to the plant's root zone, and can be either a surface system (tubing on top of the soil) or a subsurface system(tubing buried beneath the soil). Water savings with drip irrigation can be as high as 80% compared with other irrigation methods . During the late 1970's researchers were successful with injecting liquid fertilizers through drip irrigation systems, followed soon thereafter with other agrichemicals including insecticides and fungicides. Today, many agricultural chemicals are labeled for application through various irrigation systems, including overhead, sprinkler, and drip/trickle, in vegetable and other crops.

The use of drip irrigation technology in crop production is widely regarded as the most promising irrigation system. The drip irrigation system designed to provide frequent low volume irrigation to crops, conserve energy and labour in addition to conserving water and

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minimizing environmental contamination (Bahme et a. Currently the drip irrigation system has been used to deliver fertilizers, pesticides including biopesticides. It is also reported that the crop yield in this system is higher compared to crops irrigated through conventional system under similar situation..

General advantages of drip irrigation A major advantage of the system is that it supplies only the volume of water required by the plant directly to the root zone. Hence it is an economically sound method for applying water because costs are minimized. This is quite important in areas where water costs are rising rapidly. Additional general advantages (Davis and Bucks, 1983 , Shoji,1977) include the following: 1. The grower controls water infiltration rates. 2. Water is supplied to plants on the basis of phenological requirements. 3. Drip irrigation systems can be easily adapted to automated control

Disease incidence is reduced through decreased wetting of plant leaves. 5.Weed growth is reduced by decreasing the area of soil supplied with water. 6. The system provides a vehicle for application of fertilizer and pesticides

Advantages in application of insecticides:

- The total pesticide input for the control of pests in most crops is reduced using drip chemigation when compared with that of traditional foliar applications.
- The entire plant is protected.
- In many trials with vegetable crops, 1–2 drip applications of an insecticide per season resulted in equivalent, or better, control of specific insect pests as compared with multiple foliar applications (Kuhar et al. 2010).
- With fewer applications needed, less total energy inputs are required (either by tractor or by large horsepower overhead irrigation system pumps), and no soil compaction occurs as a result of heavy spray equipment being operated within the crop.
- No need to spread the agricultural chemicals (so coverage is more even, and a lot of work is saved).
- Chemical placement at right place and better uniformity.
- Efficiency is high – saving of chemicals.
- Controlling the depth of application.

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- Prevent chemical leaching to the groundwater.
- Mechanical damage to the crop by sprayers is reduced by chemigation
- It may reduce environmental hazards associated with spray drift.
- Chemical application cost saved by 40 % or more.

The total insecticide input for control of targeted insect pests in most crops is significantly reduced when compared with that of traditional foliar applications, while at the same time essentially 100 % protection of the plant is obtained because these materials are root systemic and trans locate throughout the plant, resulting in a more even distribution of the pesticide within the plant.

Disadvantages

- Requires considerable management input and personnel training.
- Requires a change in management techniques.
- Some chemical may react with irrigation system components.
- Additional equipment may be required for chemigation.

Also, drip irrigation systems generally require a high level of maintenance and regular monitoring of the entire system for pressure fluctuations, leaks in the system, plugged emitters, and other potential problems, all of which are even more important when insecticides are injected.

After the final harvest, clean-up costs of drip/ trickle systems may be higher than with other irrigation systems. Costs may include removal of plastic row covers, all drip lines and tubing, and injection and safety equipment. The disposal cost of used plastics (plastic mulches, drip lines) continually increases.