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V Hariharasudhan
Ph.D. Agronomy, Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India

C Chinnusamy
Professor (Agronomy), Principle investigator (AICRP-DWSR, TNAU, Coimbatore, Tamil Nadu, India

P Murali Arthanari
Assistant Professor (Agronomy), TNAU, Coimbatore, Tamil Nadu, India

Correspondence
V Hariharasudhan
Ph.D. Agronomy, Department of Agronomy, TNAU, Coimbatore, Tamil Nadu, India

Recent weed management techniques in micro irrigation system: Review

V Hariharasudhan, C Chinnusamy and P Murali Arthanari

Abstract
Weeds are considered as one of the important biotic constraints in agro ecosystems. In many parts of the world, chemical control of weeds with herbicides is the predominant method of weed management in crops. Recently, Drip Herbigation is essential to developing a holistic system in micro irrigation for weed management. The application of herbicides through a drip irrigation system has been used successfully for the control of weeds. Because many vegetable growers already use a drip irrigation system for water management, the injection of herbicide can easily and inexpensively be achieved with the addition of an injection pump and the required safety equipment for the injection herbicides. The extent movement of herbicides applied through irrigation systems is a function of solubility, adsorption and volatility. With Herbigation, there will be efficient use of both water and herbicides. Herbigation could be included as one of the components in integrated weed management.

Keywords: Herbigation, Micro Irrigation and Weed management

1. Introduction
Water is the most limiting factor in Indian agricultural scenario. Though India has the largest irrigation network, the irrigation efficiency has not been achieved more than 40 per cent. Water should be very effectively utilized through water saving techniques. Irrigation has transformed agriculture and shaped civilization since its use in the Fertile Crescent more than 6000 years ago. Micro irrigation system increased the productivity of agricultural systems around the world and supporting substantial population growth. Improper application of water and fertilizer can also allow weeds to flourish in crop field. While irrigation systems are usually designed and managed with a crop of interest in mind; the impact of irrigation on weed growth is an important component of any modern production system. Micro irrigation technology that has proven as an efficient way of water use in modern agriculture. Herbigation techniques to improve the application of agricultural chemicals through irrigation systems. Precise application of water and chemicals is necessary to insure considerable increase the crop productivity as well as minimizing the environment pollution.
Cultivation and hand hoeing have been employed for centuries to control weeds in various crops. In Egypt, hand hoeing is the method which has been usually employed to destroy weeds from all fields until recently and it resulted in good control of weeds in Egypt, but hand hoeing was the most expensive weed control method employed (Abdallah, 1978) [1]. In addition, the control of weeds has always been one of the greatest time and labor consuming operations in the production of crops. Hand weeding gave the highest yield and net profit, but requires more labor (Shaiboon, 1993) [7].
Chemical methods are considered more effective as a simple and quick method of weed control. Herbicides are particularly useful for intra-row weeding when it is difficult to hoe in the planted row without any damage for the plants. Shortage and high cost of labor especially at critical periods increased the use of herbicides and will continue to do so, even in the tropics where relatively few herbicides have been used out certain desirable herbicides occasionally, more cause crop injury, even when used correctly**.** Herbigation technique has been introduced to improve the application of agricultural chemicals through irrigation systems. Uniform application of such chemicals is necessary to insure considerable increase in vegetable production and real decrease in production costs.

2. What is Herbigation?
Herbigation is the process of applying an herbicides to the soil with irrigation water. It is started in the late 1960's and has rapidly gained acceptance. In recent years, with the rapid expansion of drip and sprinkler Irrigation, this technique has spread to other areas.

Herbicides through irrigation water is generally effective in controlling weeds in only portion of the area wetted by the irrigation water. This limitations on the area within which weeds are controlled may be significant disadvantage in humid climates, it may be of limited significance in semiarid and arid climates. Thus, herbigation through/trickle irrigation system may have higher degree of acceptability in arid climates.

The use of herbicides mixed with irrigation water for both tomato and cucumber reduced the weed growth by 55.5%, 68% and 65.9% for furrows, sprinkler and drip irrigation systems respectively, compared to sprayer traditional method. On the other hand, drip irrigation reduced the weed growth by 56.3% and 36.5% compared to furrows and sprinkler irrigation systems (El-Gindy, 1988) [3]. The use of irrigation systems to apply herbicides is a relatively recent development in weed control technology. Research findings have established a fact that some of the herbicides exhibit good activity by providing control of target weeds when applied through irrigation water. Herbigation insures no additional costs of application. Sprinklers are the most widely used irrigation system for applying herbicides. The extent of the movement of herbicides applied through irrigation systems is a function of solubility, adsorption and volatility. With herbigation, there will be efficient use of both water as well as herbicide chemical (Sujith *et al*., 2003) [8].

3. Weed Control Methods under Trickle and Sprinkler Irrigation Systems

The growing weeds in the experimental field were classified into two groups. First group is annual broad-leaved weeds such as wild beet, dock weed, pigweed, mallow weed, purslane, and bur clover, while the second group is annual grasses such as panic grass and green bristle grass. The results show (Fig.1) that the highest values of eradication percentage (90.6 and 82.7%) was obtained when the hoe weeding method is used as compared with the conventional spraying method (78.8 and 67%) and herbigation (43.3 and 56.6 %), at herbicide application rate of 2.5 l/fed. under trickle and sprinkler irrigation systems, respectively. The increased eradication for hoe weeding method was due to the increased collection, removed of most of annual weeds such as pigweed, wild beet and purslane during hoeing process, and ejected out the field. On the other hand, the increased eradication of herbicide for conventional spraying method as compared that of the herbigation under sprinkler irrigation system was due to increased absorption of concentrated herbicide through the surfaces treated of weed leaves. Meanwhile, for sprinkler irrigation system, the reduced eradication of weeds may be due to dilution of herbicide through irrigation system comparing to back sprayer application. In addition, wind distorts the water application pattern, causing the herbicide to the distributed unevenly; high evaporation increases the loss of herbicide (Ogg, 1986) [5].

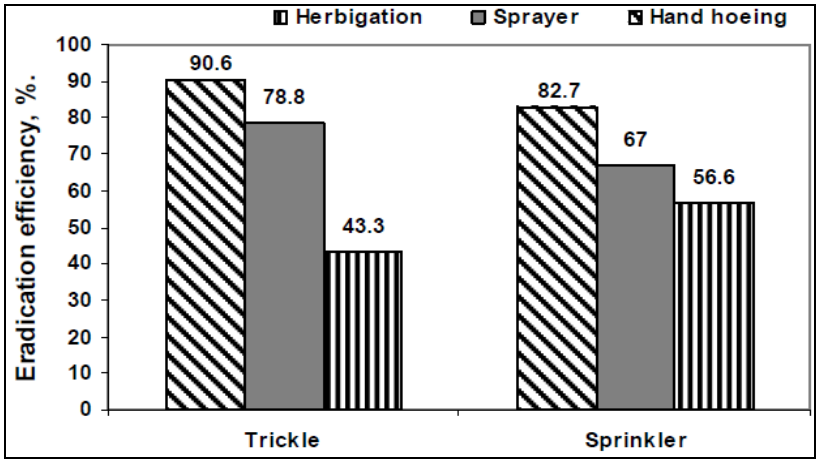

Fig 1: Effect of weed control methods on total eradication efficiency under trickle and sprinkler irrigation systems

Moreover, the efficiency of herbigation reduction controlling target weeds under trickle irrigation system as compared that of sprinkler irrigation system could be attributed to herbicide uniformity in wetted area under emitters which is not enough to cause a satisfactory contact for herbicide molecules to germinated weed seedlings, and trickle irrigation system distribute the herbicide only in the wetted area, so distance between these wetted area were highly infested with many weeds. In addition, accelerated degradation of the herbicide in the wet zone, and weeds will invade these areas soon after the initial treatments (Ogg *et al*., 1983 and El-Gindy *et al*., 1995) [6, 4].

4. Effect of Herbicide Application Rate on Eradication Efficiency

Results showed that eradication percentage of weeds increased by increasing the herbicide application rate as shown in Fig. 2. Meanwhile, the application of herbicide at a rate of 2.5 l/fed gave the highest values of eradication percentage (56.6 and 43.3%) as compared that of the other application rates (7.1 and 5.4% at application rate of 1.25 l/fed.) and (31.5 and 22.6% at application rate of 1.875 l/fed) for sprinkler and trickle irrigation systems, respectively. This phenomenon is logically attributed to the effect of the herbicide concentration on weeds, which resulted in the increase of herbicide absorbed through the leaves and root system of weeds. On the other hand, the relationship between increasing application rates of herbicide used in herbigation and eradication efficiency was studied, the data were best fitted to an exponential function showing that the superiority of sprinkler irrigation over trickle irrigation is more noticeable in the higher application rate of herbicide. With trickle irrigation, herbicide molecules do not directly contact the weed leaf surface; they pass through the soil before being translocated upward in the xylem. This process is accompanied with detoxification processes.

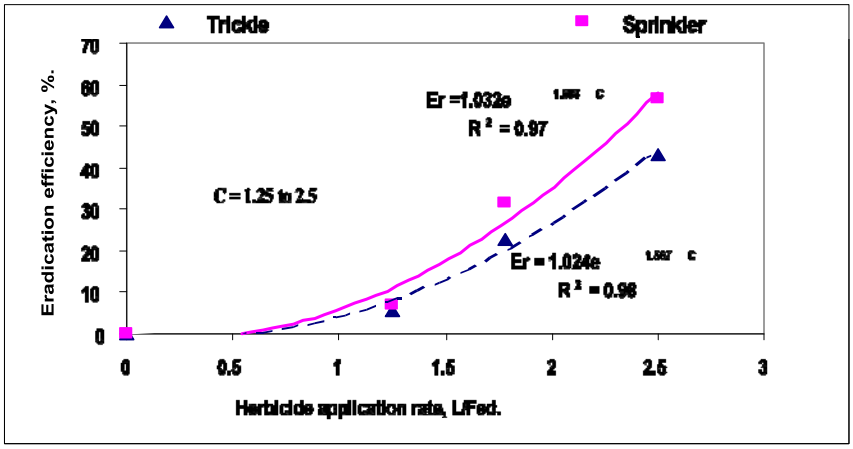

Fig 2: Effect of herbicide application rate (C, l/fed.) on eradication efficiency (Er, %) under trickle and sprinkler Herbigation Systems.

The controlling method of weeds affected the pea yield as shown in Fig. 3. The results indicated that the highest pea yield was (2.46 and 1.98 Mg/fed.) under hoe weeding method as compared with that of the conventional spraying method (2.11 and 1.79 Mg/fed.) and herbigation through irrigation water (1.78 and 1.50 Mg/fed.) at herbicide application rate of 2.5 l/fed under both trickle and sprinkler irrigation systems respectively. The pea yield increase for hoe weeding was attributed to the increase eradication percentages of weeds as discussed before.

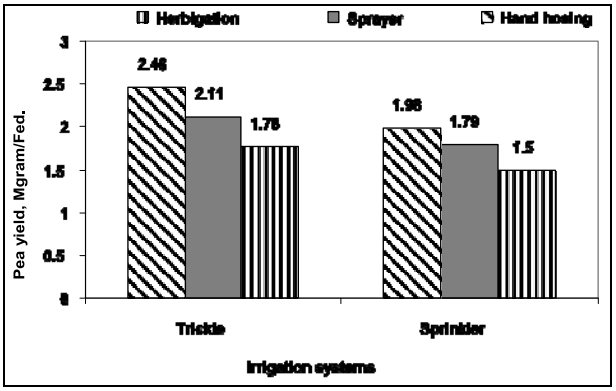

Fig 3: Effect of weed control methods on total yield of Pea

On the other hand, total yield of pea under sprinkler irrigation (1.98 Mg/fed) was lower than that under trickle irrigation system (2.46Mg/fed). This could be due to the relatively high amount of water in the root zone, more water penetration, less evaporation losses, less salinity, better aeration and better fertilizers distribution with trickle irrigation as compared to sprinkler irrigation system (Badr and Shakshook, 1977) [2].

5. Limitations

As with any new technique, there are limitations. Most of these can be overcome and, are outscored by the advantages. Most pre- plant or pre emergence herbicides should be applied before weed seeds germinate. Herbigation must be planned to coincide with other farming operations, including planting. If the planter gets more than two or three days ahead or Herbigation, weed seedlings may become established. It is generally recommended that Herbigation be done as soon after planting as possible, or, in some cases, even before planting. Another disadvantage is herbicide loss in run-off water or by' deep leaching. With proper irrigation management, these losses can be avoided. Herbicides with potential usefulness for water run applications in drip systems, are necessarily limited. Such a herbicide should be sufficiently soluble in water and mobile in the soil so that it will move uniformly from the emitter and encounter the roots of the weeds.

6. Conclusion

Drip Herbigation is a holistic approach of micro irrigation system for weed management and effectively utilize the both water and herbicides. The application of herbicides through a drip irrigation system effectively control the weeds and enhance crop productivity. In addition to there is no detected residues of herbicide in both the soil and crop in herbigation. It could be included as one of the components in integrated weed management in Micro irrigation system.

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