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An Experimental Investigation on Irrigation Water Management Using Mulch

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Abstract — *An experiment was conducted during the January, 2016 to February, 2016 on clayey soil (c-type) to investigate the effect of low cost drip irrigation and plastic mulch on tomato (Solanum Lycopersicum) crop. To accomplish the objectives of investigation 12 treatments were organized. All the combination of four levels of irrigation viz. 0.40, 0.60, 0.80 and 1.00 of pan evaporation (PE) and three different mulch treatments Viz. silver plastic mulch, black plastic mulch and no mulch (control) were studied. The study revealed that drip plus silver plastic mulching scheduled at 0.80 PE level was the best amalgamation which gave the maximum height and foliage to tomato plant and weed control was found more than 90 % over no mulch treatment.*

Keywords- *Low cost drip irrigation system, Pan Evaporation (PE), Plastic mulch, Tomato crop, Weed.*

I. INTRODUCTION

In the scarcity of irrigation water efficient utilization of available water recourses are very crucial for developing countries like India.

India occupies a prominent position in agriculture business. The micro irrigation is an advanced technology which reduces the water evaporation and distribution system losses [1]. Ultimately it leads to increase the quality and quantity of produce.

Huge saving in irrigation water and better yield was observed under drip irrigation. However, poor section of the farming population has no more benefits from the innovation in micro irrigation adoption due to its higher cost in states of Maharashtra and Gujarat of India [2][3].

Nilkanth et al [4] showed that for small holding of land & in water scared area pitch irrigation is also an alternative of drip irrigation

Sweeney[5] and Asiegbu[6] have studied that micro irrigation including mulch can increases the crop yield and growth by way of enhancing soil productivity, control of weed etc. depending upon the types of mulch.

Chakraborty[7] and Singh[8] have reported that the use of black plastic mulch in vegetable products could control weed growth, reduces nutrient losses and improves the hydrothermal regimes of soil.

As the tomato is the most important vegetable crop, the present investigation was undertaken to investigate the effect of different levels of irrigation with and without plastic mulch on tomato plant growth and weed.

II. MATERIALS AND METHODS

In order to assess the relative effectiveness of each treatment, the data of water applied, plant height, plant foliage and weed were recorded using standard methods.

The field experiment was conducted to evaluate the low cost drip irrigation along with mulches for tomato (Solanum Lycopersicum) crop. The experiment was set up in plot C_8 of the instructional farm, department of Agronomy, college of Agriculture Junagadh Agriculture university Junagadh, Gujarat (India) during Rabi season December 2015.The soil of the field was clayey (40.37 %). The soil was classified as C-type having pH of 7.74 and neutral in nature. That contains high inorganic carbon and available phosphorus with medium availability of nitrogen.

Tomato seedlings (Junagadh tomato, variety JT3) of 30 days old were transplanted manually with plant to plant spacing 45 cm and row to row spacing 90 cm. On 15th of December 2015, the experiment was laid out in split plot design having twelve treatments replicated thrice with each plot size of 2.70 mt. x 4.50 mt .Two meter gap was provided between each replication to lay down the drip irrigation system.

For mulching silver and black plastic film of 25 micron thickness were spread manually over the prepared bed and lateral. Twelve treatments were tried.

T_1: 0.4 PE + Silver Plastic Mulch
T_2: 0.4 PE + Black Plastic Mulch
T_3: 0.4 PE + Control (non mulch)
T_4: 0.6 PE + Silver Plastic Mulch
T_5: 0.6 PE + Black Plastic Mulch
T_6: 0.6 PE + Control (non mulch)
T_7: 0.8 PE + Silver Plastic Mulch
T_8: 0.8 PE + Black Plastic Mulch
T_9: 0.8 PE + Control (non mulch)
T_{10}: 1.0 PE + Silver Plastic Mulch
T_{11}: 1.0 PE + Black Plastic Mulch
T_{12}: 1.0 PE + Control (Non mulch)

30 days tomato seedlings were transplanted on 15th December 2016. A hole of 5 cm diameter was made on plastic film. The laterals with inner emitters (40 cm centre to centre distance) were placed in each row of plants. 'Catch can' volumetric method was used to determine uniformity co-efficient LCDI system [2].

In drip alternative irrigation was followed and total quantity of irrigation water need to be applied was calculated over two day CPE values. IS Standard Pan was used for measuring the daily evaporation.

In Low Cost Drip Irrigation System high density PVC of 63 mm was used for main line, 16 mm diameter low density polyethylene pipe was used for laterals. Each crop row was assigned a separate lateral line. Online emitters of capacity 4liter/hr were provided in lateral. The main supply line was connected to over head tank mounted at 4.25 meter from field level. Simple valves were installed in LCDI system.15 mm diameter cocks were put to control the irrigation water.

To find out the relative effectiveness of every treatment the water applied data, plant height, plant foliage and weed were recorded.

III. RESULTS AND DISCUSSION

A field test was carried out to find uniformity co-efficient of discharge. The uniformity coefficient (U_c) of discharge of LCDI system was found higher during the experimentation such as 94 %. The high value of uniformity coefficient indicates outstanding performance of drip irrigation system in delivering water uniformly throughout the lateral lines during experiment.

3.1 Effect on Height

The Maximum Height of plant recorded for treatment T_7 (53.06 cm) was 22.73% more in comparison of treatment T_9 at the same irrigation level (0.8PE). It might be due to healthy environment surrounding root zone.

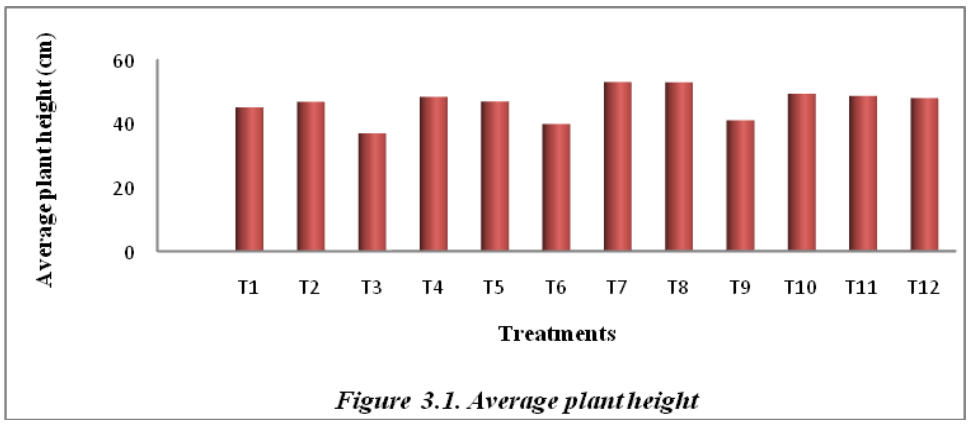

Figure 3.1. Average plant height

3.2 Effect on Foliage

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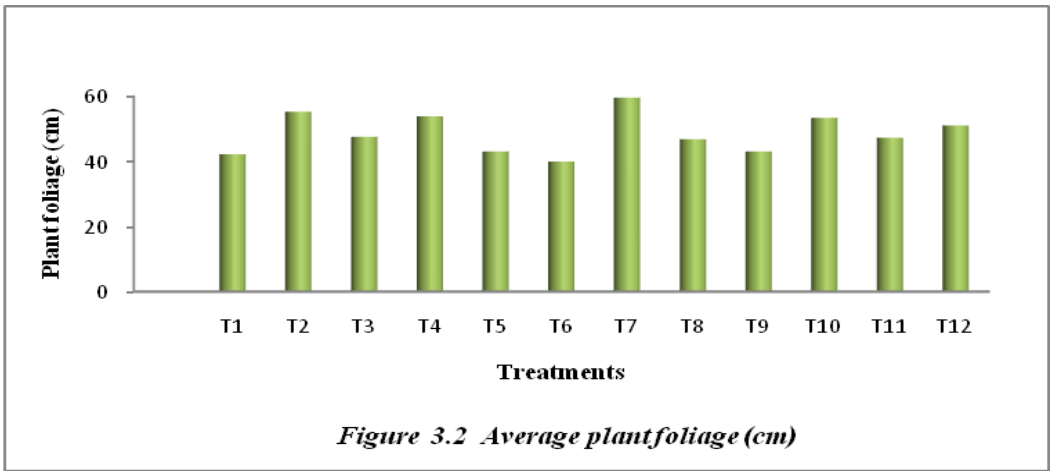

Figure 3.2 Average plantfoliage (cm)

3.3 Effect on Height

The weed control was found 91.95% and 91.55% in Treatment T_7 and T_8 respectively. Less weed required less water and up taking of nutrients. Less labour charges required, might increase the economy.

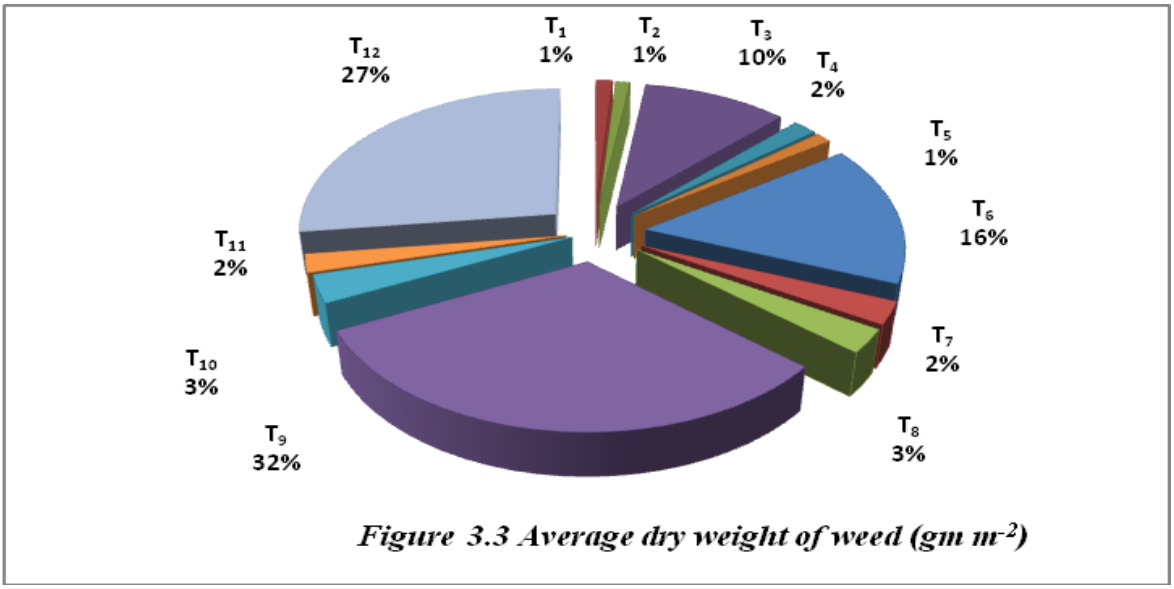

Figure 3.3 Average dry weight of weed (gm m^{-2})

IV. CONCLUSION

Treatment I_3m_1 (0.80 PE + silver plastic mulch) & I_3M_2 (0.80 PE + black plastic mulch) facilitates healthy environment surrounding root zone. Continuous moisture availability helps tomato plant in nutrient up taking and overall growth. I_3M_1 and I_3M_2 treatments control the weed growth by 91.95% and 91.55% over non mulch treatment (I_3M_3).Weed control reduces water requirement, nutrients need and labour charges leading to higher economy in areas of high weed density drip along with plastic mulch (PM) could be adopted.

V. ACKNOWLEDGEMENT

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