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Effect of Irrigation Methods and Mulching on Growth and Seed Yield of Semialata

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ABSTRACT

A study was conducted to assess the effect of drip irrigation and plastic mulch on growth and seed yield of Semialata. Two types of plastic mulch (green and silver/black) were tested at three levels of irrigation (120%, 100% and 80%) by drip irrigation and one level (100%) by furrow irrigation. The daily water requirement of *Semialata* was estimated by the equation $ET_{crop} = ET_o$ x crop factor. ET_{crop} is crop water requirement mm/day. ET_o (reference evapotranspiration, mm/day) was calculated by FAO calculator which uses temperature and humidity data. In this experiments there were twelve treatments were considered. The treatments were replicated thrice. The experiment was laid in randomized block design. It was observed that drip irrigation with or without plastic mulch is yielding better results in terms of growth parameters and seed yield as compared to furrow irrigation without plastic mulch. It was also observed that maximum suppression (67.58%) of weeds resulted with drip irrigation and silver/black plastic mulch at 80% level of irrigation.

KEYWORDS

Semialata (Flemingia semialata), Drip irrigation, Furrow irrigation, Seed yield, Growth parameters

INTRODUCTION

Semialata (*Flemingia semialata)* is one of the most important leguminous species for intensive lac production. It is grown both in acidic and alkaline soil conditions. This plant is not suitably grown under waterlogged and marshy land conditions. Irrigating plants during water stress period is essential to obtain higher economic yield. Water is a scarce natural resource in the hills and plateau region. Hence, it should be used judiciously. Drip irrigation utilizes water judiciously for irrigation as it supplies water drop by drop directly or below the root zone of plants as per the water requirement of plants eliminating evaporation and deep percolation losses thus enhancing its water use efficiency as compared to other methods of irrigation.

The beneficial aspects of drip irrigation includes higher water use efficiency, less weed growth, no soil erosion, no leaching of fertilizer into the ground, less evaporation losses of water, improved seed germination, early maturity of crops, maximum crop yield, improved product quality, less labour requirements etc. Use of drip irrigation in conjunction with plastic mulch which increases soil temperature, reduces the loss of soil moisture and checks the weed growth (Tiwary *et al.*, 2014), further improves its water use efficiency and adds/increases its other advantages (Yaghi *et al.*, 2013). Crop yield and water use efficiency can be considerably increased by excess (Kachwaya *et al.*, 2016), optimal or deficit (Cann *et al.*, 2007, Singh *et al.*, 2009, Ramalan *et al.*, 2010, Biswas *et al.*, 2015) irrigation with drip irrigation in conjunction with plastic mulch (Halil and Naim 2006, Spehia *et al.*, 2007, Srivastava and Jeet 2018).

Seed of *Semialata* is very costly and not easily available, hence, a study was conceived to ascertain as to how much the seed yield can be increased with the use of drip irrigation and plastic mulch.

MATERIAL AND METHOD

A drip irrigation system was installed at the experimental field of research farm of ICAR-Indian Institute of Natural Resins and Gums, Ranchi. One line of drip lateral was provided to each row of the *Semialata* plantation. Every plant was provided with one dripper. The varying discharge drippers were used in the said drip irrigation system to facilitate the application of different levels (120%, 100% and 80%) of irrigation. The drippers were calibrated for applying desired quantity of water to each plant in stipulated time. Furrows were excavated on both sides along the length of nine furrow irrigated plots. The experiment was laid out in randomized block design (RBD) with twelve treatments replicated thrice making total number of plots to 36.The treatments are as follows:

1. 120% irrigation requirement met through drip irrigation.
2. 120% irrigation requirement met through drip irrigation and silver/black plastic mulch.
3. 120% irrigation requirement met through drip irrigation and green plastic mulch.
4. 100% irrigation requirement met through drip irrigation.
5. 100% irrigation requirement met through drip irrigation and silver/black plastic mulch.
6. 100% irrigation requirement met through drip irrigation and green plastic mulch.
7. 80% irrigation requirement met through drip irrigation.

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8. 80% irrigation requirement met through drip irrigation and silver/black plastic mulch.
9. 80% irrigation requirement met through drip irrigation and green plastic mulch.
10. 100% irrigation requirement met through furrow irrigation.
11. 100% irrigation requirement met through furrow irrigation and silver/black plastic mulch.
12. 100% irrigation requirement met through furrow irrigation and green plastic mulch.

For plastic mulch treatment two types of plastic mulch silver/black and green were spread over plots as per treatments. The holes were punched in the plastic where *Semialata* plants were grown. The plastic mulch was anchored in the soil on all sides of plot up to a depth of 6 inches. The drip laterals and drippers were placed under plastic mulch before it was laid. The irrigation was provided to plants with drip irrigation on every alternate day and with furrow irrigation on every fifth day.

RESULTS AND DISCUSSIONS

The study revealed that the drip irrigation with or without plastic mulch is performing better in terms of growth parameters (shoot height, girth of shoot, no. of shoots, no. of flowers, no. of pods excluding leaves number and leaf area) of *Semialata* as compared to furrow irrigation without plastic mulch at all levels (120%, 100% and 80%) of irrigation (Table 1). Shoot height, shoot girth and shoot number varied between 119-169, 13-16.5 and 10-16, respectively. Leaf number and leaf areas varied between 5-6 and 14.50-25.41 cm^2, respectively. Flower number and pod number varied between 41-91 and 21-50, respectively. Result revealed that plant physiology parameters of plants shown better results under drip irrigation with mulch than furrow irrigation and without mulch conditions. Mishra *et al.* (2008), Singh *et al.* (2009) also reported almost similar results of their study.

Table 1: Effect of different treatments on growth parameters and seed yield of *Semialata*

Treatments	Shoot height (cm)	Shoot girth (mm)	Shoot number	Leaf number	Leaf area (cm^2)	Flower number	Pod number
1	144.89	15.38	11	6	15.10	69	44
2	159.44	15.09	13	6	22.27	76	50
3	168.71	16.24	14	6	20.26	84	42
4	151.89	15.96	13	6	18.35	63	38
5	132.01	15.22	11	5	21.65	54	37
6	164.46	14.74	14	6	14.50	71	43
7	142.35	15.21	15	5	21.33	91	35
8	148.20	15.63	11	6	22.21	59	43
9	163.66	16.05	12	6	15.72	88	38
10	119.56	13.55	10	5	19.06	41	28
11	161.75	14.85	15	6	18.67	81	40
12	130.50	15.30	12	5	25.41	53	41
Avg.	148.95	15.26	12.58	5.66	19.54	64.16	39.91
St. Dev.	15.61	0.71	1.67	0.49	3.29	14.35	5.43
CV (%)	10.48	04.68	13.32	8.68	16.85	22.37	13.61

The shoot height was recorded to be maximum (168.71 cm) with drip irrigation and green plastic mulch at 120% level of irrigation as compared to drip irrigation with silver/black plastic mulch and furrow irrigation with or without plastic mulch. Almost similar results were reported by Kachwaya *et al.* (2016) of their study.

It was also observed that the shoot height of *Semialata* increases with increase in level of irrigation from 80% to 120% with drip irrigation and green plastic mulch. Girth of shoot was also recorded to be highest (16.24 mm) at 120% level of irrigation with drip irrigation and green plastic mulch as compared to drip irrigation with silver/black plastic mulch *and* furrow irrigation with or without plastic mulch (Fig. 1). Almost similar results were reported by Kachwaya *et al.* (2016) of their study.

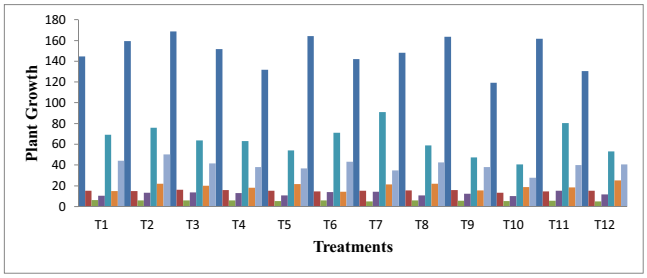

Fig. 1: Growth parameters under different irrigation and mulch treatments

*Legends: 1. Blue from top to bottom = First shoot height, Second shoot girth, Third no. of flowers, Fourth Leaf area, Fifth no. of pods, 2. Red= No. of shoots, 3.Yellow= no. of leaves.

The seed yield of *Semialata* is highest (16.50 gm/plant) with furrow irrigation and silver/black plastic mulch followed by seed yield of 15.86 gm/plant with drip irrigation and green plastic mulch, at 100% level of irrigation (Fig. 2). However, increase in seed yield of *Semialata* with furrow irrigation and silver/black plastic mulch is only 4% as compared to 50% higher water consumption (Table 2), almost similar results were reported by Sankarnarayanan *et al.* (2011) in ICAR Technical bulletin no. 1/2011.

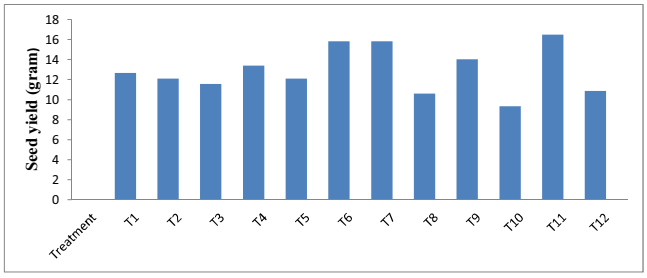

Fig. 2: Seed yield (gram) under different irrigation and mulch treatments

Change in gross weight of seed was estimated under different irrigation levels and different mulch conditions. Maximum reduction (67.58%) in weight of grass is found with drip irrigation and silver/black plastic mulch at 80% level of irrigation as compared to drip irrigation with green plastic mulch and furrow irrigation with or without plastic mulch (Table 2).

Table 2: Effect of different treatments on seed yield and percentage changes in gross weight of seed of *Semialata*

Treatments	Seed yield (gm)	% Decrease in gross weight
1	12.68	58.07
2	12.11	57.75
3	11.99	60.62
4	13.41	64.92
5	12.10	61.45
6	15.86	46.12
7	15.83	60.79
8	10.63	67.58
9	14.05	33.64
10	9.35	-
11	16.50	51.14
12	10.88	-
Avg.	12.94	51.08
St. Dev.	2.25	18.52
CV (%)	17.39	36.25

CONCLUSIONS

Semialata is one of the most important leguminous species for intensive lac production in India. This lac host plant is not suitably grown under excessive water holding land conditions. Water scarcity at critical growth stages of plants affect plant growth and reduces seed yield. So, irrigation of plants during water stress period is essential to obtain optimum plant growth and higher economic yield. Irrigation through advance technology (like drip irrigation) and mulch conditions saves water; control weeds & insects-pests infestation on crops, increase plant growth and finally induces seed production

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