Original Research Article

Effect of agronomic management on micrometeorological parameters and root yield of Sida hemp (*Sida alnifolia*)

ABSTRACT

Agronomic management exhibits great influence on growth and yield of crops by modifying physical, chemical and biological properties of soil and plants. Field experiment was conducted during June - Dec, 2018 to assess the effect of agronomic management *viz*. light intensity, manuring and weed management on microclimatic variations and its consequent effects on root yield of Sida hemp (*Sida alnifolia* L.). The treatments included two levels of light intensity (open and 50 per cent shade), two levels of manuring (no manure and FYM@10 t ha^{-1}), and four weed management practices (black polythene mulching, organic mulching with paddy straw @ 5 t ha^{-1}, hand weeding at 1,3,5 MAP and no weeding). Higher soil temperature at 10cm depth was observed in open condition and under black polythene mulching throughout the growing period. Higher soil moisture content at 15 cm depth was recorded under shade and black polythene mulching. Black polythene mulching resulted in increase in soil temperature and soil moisture content by almost two percent as compared to bare soil. The highest root yield of 14.66 t ha^{-1} was noticed in plots with black polythene mulching with FYM under open condition. Soil temperature and light intensity showed positive correlation with root yield.

Key words : Sida hemp, *Sida alnifolia*, soil temperature, soil moisture, light intensity, root yield

1. INTRODUCTION

Plants accomplish a very vibrant role in sustaining and refining quality of human life. Plants which are commonly used for treating or preventing various ailments are generally considered as medicinal plants. Over the years, the use of medicinal plants has become an important part of daily life in spite of the progress in modern medical industry, which necessitated bringing them under cultivation rather than depending on wild collection.

Sida alnifolia is a species found in tropical and subtropical regions of India, belonging to the family Malvaceae. According to National Medicinal Plant Board (NMPB), Sida is the 3rd most widely consumed drug in Ayurveda pharmaceutical industry. Because of its high commercial value, the crop is included in the group of high volume traded medicinal plants sourced from waste lands. At present bulk of the present requirement is met in wild collection from natural habitats.

Management methods exhibit great influence on growth and yield of crops by way of modifying physical, chemical and biological properties of soil and plants. Organic manures provide a better environment for crop growth and root development by improving the soil structure, soil physical, chemical, biological properties and supplying plant nutrients including micronutrients. According to Upadhyaya et al.

(2010) [11], the yield, total phenol and total flavanoid contents of medicinal plant *Adhatoda vasica,* improved significantly by the application of organic manures

Light is a physical factor which can influence growth, yield and secondary metabolites production. Both deficient and excessive light intensities may be injurious to plants and it will affect plant growth, development and yield (Safeer et al. 2013)[8].

Crop-weed competition is a common interaction occurring in cropped field significantly influencing crop growth and yield. Mulching is a non chemical weed management method which modifies the plant microclimate by modifying soil temperature, soil moisture and evaporation and the modified microclimate in turn affects growth and development of crops. According to Lalitha et al. (2010) [7], moisture content, soil temperature and nutrient availability increased under plastic mulching. Gunasekaran and Shakila (2014) [4] reported significant influence of mulching on tuber characters such as number of tubers, tuber length, tuber girth, and fresh tuber weight of medicinal coleus *Coleus forskohlii.*

As the information on influence of management methods on Sida hemp (*Sida alnifolia* L.). is limited, the present study was undertaken to assess the effect of agronomic management *viz.* light intensity, manuring and weed management on microclimatic variations and its consequent effects on root yield of sida hemp (*Sida alnifolia* L.)

2. MATERIALS AND METHODS

The study was conducted at Agronomy farm, College of Horticulture, Kerala Agricultural University, Vellanikkara, Thrissur. The area located at 13^{o} 32'N latitude and 76^{o} 26'E longitude. The altitude of the place is 40 m above mean sea level. The experiment was laid out in Randomized Block Design (Factorial), with 3 factors and three replications. Factor A consisted of two light intensity (open and 50 per cent shade), factor B consisted of manuring (no manure and FYM@10 t ha^{-1}), and factor C consisted of four weed management practices (black polythene mulching, organic mulching with paddy straw @ 5 t ha^{-1}, hand weeding at 1,3,5 MAP and no weeding). One month old healthy, uniform sized seedlings were selected and transplanted in the main field at a spacing of 50 cm x 25 cm. Soil temperature at 10 cm depth and soil moisture at 0-15 cm depth were recorded at weekly intervals using soil thermometer and gravimetric method respectively. The observation on root yield was recorded six months after planting at seed maturation stage by uprooting of whole plants.

The data collected were subjected to analysis of variance using the statistical package 'OPSTAT' (Sheoran et al. 1998) [10].

3. RESULTS AND DISCUSSION

3.1 Soil temperature

The average soil temperature at 10 cm depth during the experiment period ranged from 24.1^{o}C to 28.5^{o}C. Throughout the growing period higher soil temperature was observed in open condition as compared to shaded condition (Fig. 1). As per Abu-Hamdah (2003) [1], the soil temperature differs according to the amount of solar radiation from the sun that reached on the soil surface and amount that absorbed by the soil. Geiger et al. (2003) [3] also reported increase in soil temperature with increased solar radiation that reached the soil surface. Significant influence of manuring on soil temperature could not be observed in this experiment.

Among different weed management practices, black polythene mulched soil recorded higher temperature (Fig. 2).The rise in soil temperature may due to solar energy trapped inside the mulch material through green house effect (Hu et al., 1995) [5].

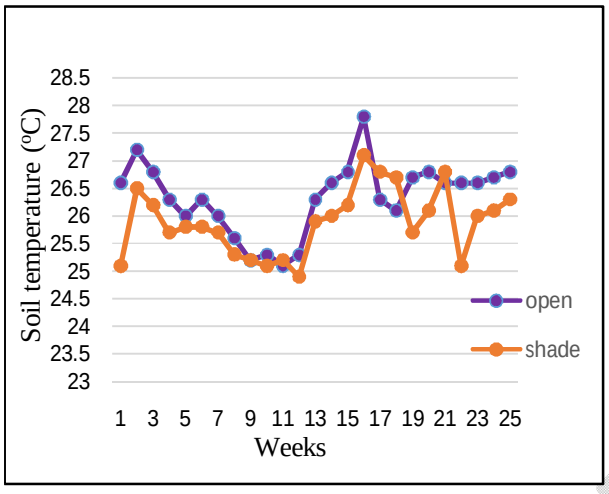

Fig. 1. Effect of growing condition on soil temperature (°C) at 10 cm depth

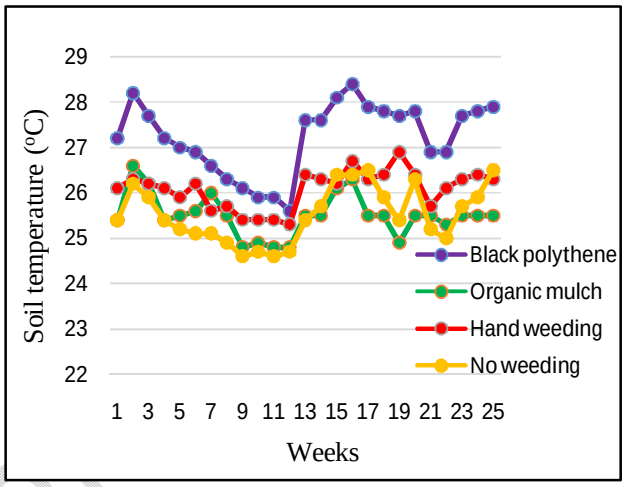

Fig 2. Effect of weed management on soil temperature (°C) at 10 cm depth

3.2 Soil moisture

The average soil moisture at 15 cm depth ranged from 12.7 per cent to 33.5 per cent throughout the growing season. Plots under shade recorded higher soil moisture content at 15 cm depth except from 2nd week to 13th week (Fig. 3). This exception was due to monsoon rains received during this period. Dodd *et al.* (2005) also observed higher soil moisture under shaded condition. Soil moisture content was unaffected by manuring. Weed management practices significantly influenced the soil moisture content at 15 cm depth. Black polythene mulching recorded higher moisture content as compared to other weed management practices except from 2nd week to 13th week (Fig. 4). According to Sandal and Acharya (1997) [9], mulching with black polythene sheet conserved soil moisture by reducing rate of evaporation.

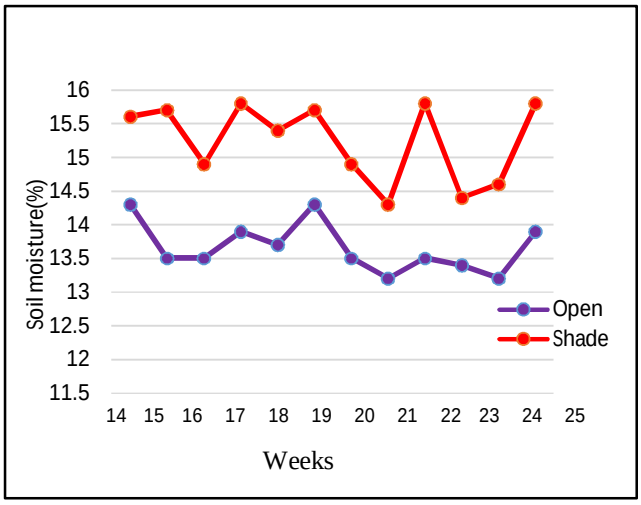

Fig. 3 Effect of growing condition on soil moisture (%) at 0-15cm depth

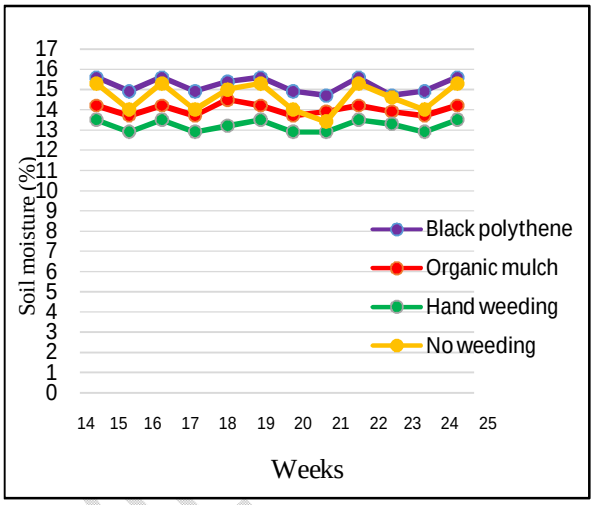

Fig.4 Effect of weed management on soil moisture (%) at 0-15cm depth

3.3 Total root yield

The highest root yield of 14.66 t ha^{-1} was recorded in treatment combination, black polythene mulching with FYM under open condition followed by black polythene mulching without manure under open condition (Table 1). The lowest root yield was recorded in no weeding plots without manure under 50 per cent shade (5.14 t ha^{-1}). Under best treatment combination of manuring and weed management (FYM @ 10 t/ha x black polythene mulching), by altering only growing condition, a yield increase of 4.84 t ha^{-1} could be observed. This indicates the sun loving nature of *Sida alnifolia*. Optimum micro meteorological conditions in this combination might have contributed to higher root yield.

Table 1. Effect of growing condition, manuring and weed management on root yield of Sida hemp

Treatments	Root yield (t ha^{-1})	
	Harvest	
	Open	50 per cent shade
No manuring x Black polythene	11.92	8.06
No manuring x Organic mulch	7.45	5.95
No manuring x Hand weeding	7.09	5.50
No manuring x No weeding	6.05	5.14
FYM @ 10 t/ha x Black polythene	14.66	9.82
FYM @ 10 t/ha x Organic mulch	8.85	6.18
FYM @ 10 t/ha x Hand weeding	7.67	6.10
FYM @ 10 t/ha x No weeding	6.89	5.87
CD (0.05)	2.09	

3.4 Correlation studies

Correlation between microclimatic factors and yield at vegetative and harvest stages is depicted in Table 2. At both stages, positive correlation was observed between light intensity, soil temperature and root yield. However, a negative correlation was observed between soil moisture and light intensity (-0.628 and -0.533 at vegetative and harvest stages respectively). Positive correlation between soil temperature and total yield using plastic mulch and row covers on cucumber was reported by Ibarra Jiménez *et al.* (2004) [6].

Table 2. Correlation between microclimate factors and yield at vegetative and harvesting stage

Vegetative stage

	Soil temperature	Soil moisture	Light intensity	Yield
Soil temperature	1.000			
Soil moisture	-0.391**	1.000		
Light intensity	0.180	-0.628**	1.000	
Yield	0.373**	-0.041	0.449**	1.000

Harvesting stage

	Soil temperature	Soil moisture	Light intensity	Yield
Soil temperature	1.000			
Soil moisture	-0.357**	1.000		
Light intensity	0.254	-0.533**	1.000	
Yield	0.596**	0.161	0.452**	1.000

4. CONCLUSION

From the present study, the combination of open condition, application of FYM @ 10 t/ha and weed management by black polythene mulching can be recommended as optimum agronomic management for better microclimatic parameters and root yield of Sida hemp.

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