International Journal of Research in Agricultural Sciences
Volume 7, Issue 4, ISSN (Online): 2348 – 3997

Effect of Light Intensity, Date of Planting and Mulching on Growth and Yield of Iruveli (*Plectranthus vettiveroides*)

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Date of publication (dd/mm/yyyy): 27/08/2020

Abstract **– In India, about 7500 species of medicinal plants are being used in different traditional systems of medicines like Ayurveda, Siddha, Unani, Homeopathy, folklore etc. In medicinal plant cultivation, both yield and quality are equally important, and therefore, it is necessary to identify optimum growth factors that can ensure high yield and quality. Plectranthus vettiveroides (K.C. Jacob) N.P. Singh and B.D. Sharma (Syn. Coleus vettiveroides) is an important herbaceous medicinal plant belonging to the family Lamiaceae, where the root is the major economic part. A field experiment was conducted to study the effect of light intensity, date of planting and mulching on yield and quality of Plectranthus vettiveroides commonly known as Iruveli. The treatments consisted of two shade levels (open and 50 per cent shade), four dates of planting (15th May, 15th June, 15th July and 15th August), and three mulching practices (no mulching, organic mulching with paddy straw and black polythene mulching). Greater plant height was observed under 50% shaded condition, while more branching was in open condition. The biomass yield was influenced by different shade levels, planting dates and mulching. The highest biomass yield was obtained in open condition (10382 kg/ha), May planting (15694 kg/ha), and with black polythene mulching (16235 kg/ha). Higher root yield was obtained when planted on 15th May under open condition with black polythene mulching (4221 kg/ha). Essential oil content was higher when planting was done in May under open condition with black polythene mulching (2.35 %) which was on par with June planting with black polythene mulching under open condition (2.08 %).**

Keywords **– Black Polythene Mulch, Date of Planting, Iruveli, Light Intensity, Organic Mulch, *Plectranthus vettiveroides*.**

I. INTRODUCTION

Plectranthus vettiveroides commonly known as *Iruveli* is a medicinal plant having great importance in the traditional systems of medicine. The plant belonging to the family Lamiaceae is endemic to South India and is now extinct in the wild. Major economic part of Iruveli is the root, which is used against skin diseases, rheumatism, bronchitis and chronic allergies. It is also used as a stimulant and carminative. It is a chief ingredient of many ayurvedic preparations like *iruvelikashayam*, *devashtagandha*, *snanachoornam* etc. [1]. About 40 herbal drugs are currently available in the global/local markets, which contain *Plectranthus vettiveroides* solely or as an ingredient. Growing environment not only affects plant growth but also influences production of secondary metabolites responsible for the medicinal properties of plants. In medicinal plant cultivation, both yield and quality are equally important, and therefore, it is necessary to identify the optimum light intensity, time of sowing and management practices such as mulching, that can ensure high yield and quality. Therefore an experiment was conducted to assess the effect of light intensity, dates of planting and mulching on yield and quality of *Iruveli*.

II. MATERIALS AND METHODS

The present experiment was conducted during May - November 2018 at Agronomy farm, Department of Agr-

-onomy, College of Horticulture, Vellanikkara. The experimental site was situated at 13° 32'N latitude and 76° 26'E longitude, at an altitude of 40 m above mean sea level. The soil of the experimental site was strongly acidic (pH 4.45), medium in organic carbon (1.12%), low in available N (196.50 kg/ha), medium in available P (22.56 kg/ha) and medium in available K (194.83 kg/ha). The experiment was laid out in RBD (factorial), with three replications and the gross plot size was 3.0 m x 2.1 m. The treatments comprised two shade levels (open and 50 per cent shade), four dates of planting (15th May, 15th June, 15th July and 15th August) and three mulching practices (no mulching, organic mulching with paddy straw @ 5t/ha and black polythene mulching). FYM was applied @ 10 t/ha at the time of land preparation. One month old, two node rooted stem cutting was used as planting material. Planting was done at a spacing of 30 cm x 30 cm. Observations on plant height, number of branches, biomass yield and root yield were taken at harvest stage. Essential oil content of roots at the time of harvest was estimated by hydro distillation method, using Clevenger apparatus as per AOAC [2] and expressed in percent. The data recorded were subjected to analysis of variance using the statistical package 'OPSTAT'.

III. Results and Discussion

3.1. *Plant Height*

The result showed that all the three factors *viz.*, growing condition, planting date and mulching significantly influenced the plant height of *Pletranthus vettiveroides* (Table 1). At the time of harvest, the tallest plants were observed under 50 percent shaded condition (71.12 cm). Significant decrease in the intensity of light may be the main cause of the increase in height under shade. Similar result of increase in plant height of *Plectranthus vettiveroides* under shaded condition was reported in 2013[3].

Among the different dates of planting, the May planted crop recorded the tallest plants (58.32cm), however, other three planting dates were on par (51.67 cm, 50.51 cm and 50.83 cm respectively during June planting, July planting and August planting respectively). Significant influence of seasonal variations on plant height of medicinal plant *Andrographis paniculata* was reported [4]. With respect to effect of mulching on plant height, taller plants were observed under black polythene mulching (63.66 cm) followed by organic mulch (49.28cm). Reported the improvement in height of plants of *Solanum* due to mulching with polythene [5]. According to [6] mulching would improve the physical condition and moisture status of soil which would in turn increase the growth of crops.

3.2. *Number of Branches per Plant*

At harvest stage, the number of branches was higher in open condition than in shaded condition (Table 1). The higher light intensity and temperature in open condition might have favoured the production of more lateral buds resulting in more number of branches, while shaded condition favoured apical dominance and increased plant height. At harvest, August planting recorded higher number of branches (11.97), which was on par with June planting (11.26). A variation in number of branches in fennel due to difference in planting dates was reported [7]. Influence of mulching on increasing number of branches in tomato was reported earlier by [8].

3.3. *Total Biomass Yield*

The effect of different shade levels, dates of planting and mulching on biomass production of *Plectranthus ve-*

-*ttiveroides* was significant. The open condition resulted in the highest biomass yield (10382 kg/ha) compared to shade (7472 kg/ha) (Table 1). Also observed higher biomass production of *Plectranthus vettiveroides* under open condition than under 50 percent shaded condition [3]. Intensity of light could affect rate of photosynthesis, which in turn influence photosynthetic capacity and production of biomass [9]. According to them, at different light intensities, plants change their morphology and allocation of photosynthates to biomass.

Among different dates of planting, May planting recorded the highest total biomass yield of 15694 kg/ha. The lowest yielded treatment was August planting (3315 kg/ha) which was only 21.12 per cent of the highest yield. The highly unfavourable weather condition which prevailed during initial stages of crop growth might have led to the lowest yield in August planted crop. A high rainfall of 629 mm was recorded in the initial planting week of August crop (Fig. 1). This might have affected the total biomass yield of later sown crop detrimentally.

There was significant difference in biomass yield between treatments with black polythene mulch (16235 kg/ha) and without mulch (4072 kg/ha). As per [10], plastic mulch induced early crop emergence, and so it increased the biomass production of the crop.

3.4. *Total Root Yield at Harvest*

The total root yield followed the same trend of total biomass yield. Root yield was higher under open condition (1216 kg/ha). Increased root yield under open condition might be due to better allocation of photosynthates to roots under open condition. According to [9] compared to shaded crops, plants under open condition would concentrate more dry weight in roots. Among the different dates of planting, May planted crop recorded the highest root yield (2508 kg/ha). Root yields were lower in July (414 kg/ha) and in August planted crops (468 kg/ha), which were16.50 per cent and 18.66 per cent of the highest yield respectively.

Comparing the mulches, as in biomass yield, the black polythene mulched crop recorded the highest root yield (1827 kg/ha). According to [11], black polythene mulch effectively increased the tuber yield of medicinal coleus (*Coleus forskholli*) in terms of number of tubers per plant, tuber length, girth, volume and fresh weight. The next best treatment was organic mulching, which yielded 987 kg/ha of root. Reported that organic mulching could buffer soil temperature and preserve soil moisture and increase available nutrients in the soil, which further improved soil fertility and crop growth [12]. Also the polythene cover could act as a physical barrier between soil and outside environment and could reduce the compaction of the soil. This might have helped the deep penetration of roots into the soil compared to other two mulches and thereby increased the root yield.

Interaction effect of combination of three factors, growing condition, mulching and date of planting on total root yield was significant with the highest root yield of 4221 kg/ha in May planted crop with black polythene mulch under open condition. The same date of planting with black polythene mulching under shaded condition was the next best treatment with respect to root yield (3884 kg/ha).

3.5. *Essential Oil Content*

The essential oil analysis of *Plectranthus vettiveroides* revealed significant influence of light on essential oil content. Highest oil content was obtained under open condition (1.77 per cent) compared to shade (1.31 per cent). According to [13] change in light intensity could cause change in morphological and physiological characters which in turn affected the quality of produce. As per [14] change in light could alter the secondary metabolite production in herbs. Planting dates also showed significant influence on essential oil content. Crop

planted in May showed the highest oil content (1.73per cent). Observed variations in production of secondary metabolite andrographolide, in *Andrographis paniculata* due to changes in planting season [15]. According to him environmental factors *viz.* temperature, humidity, light intensity, and the supply of water, influenced the growth of a plant and secondary metabolite production.

Comparing essential oil content under different mulching treatments, significantly higher oil content was recorded from plants with black polythene mulching (1.81 per cent) and was minimum in no mulch condition. According to [16] sweet basil plants grown with mulching recorded higher phenol content than the plants grown in open condition. Variations in physico - chemical properties of fruits due to changes in dates of planting and application of mulches in strawberry under polyhouse condition was reported [17].

The interaction effect of three factors on total essential oil content of the crop at harvest was found significant with higher essential oil content of 2.35 per cent in May planted crop with black polythene mulch under open condition and was on par with June planted crop with black polythene under open situation (2.09 per cent).

IV. CONCLUSION

From the findings it can be concluded that planting on 15th May in open condition under black polythene mulch is the optimum requirement for growth, yield and oil content in *Plectranthus vettiveroides.*

Table 1. Effect of treatments on plant height, number of branches, biomass yield, root yield and essential oil content of *Plectranthus vettiveroides.*

Treatments	Plant Height (cm)	Number of Branches	Biomass Yield (kg/ha)	Root Yield (kg/ha)	Essential Oil (%)
Growing condition					
Open	34.54	13.19	10382	1216	1.77
50% Shade	71.12	7.81	7472	985	1.31
CD (0.05)	3.45	1.02	593	110	0.04
Date of planting					
May 15	58.32	9.18	15694	2508	1.73
June 15	51.67	11.26	10362	1012	1.60
July 15	50.51	9.59	6336	414	1.46
August 15	50.83	11.97	3315	468	1.37
CD (0.05)	4.88	1.44	1122	850	0.06
Mulching					
No mulch	45.55	6.20	4072	565	1.32
Organic mulch	49.28	8.82	6474	953	1.49
Black polythene mulch	63.67	16.48	16235	1786	1.81
CD (0.05)	4.23	1.25	972	380	0.05

Table 2. Interaction effect of growing condition, date of planting and mulching on total root yield (kg/ha) and essential oil content (%) of *Plectranthus vettiveroides.*

Treatments	Total root yield (kg/ha)		Essential oil (%)	
	Harvest		Harvest	
	Open	50% Shade	Open	50% Shade
May x No mulch	1667	1117	1.78	1.23
May x Organic mulch	2244	1916	1.83	1.37
May x Black polythene mulch	4221	3884	2.35	1.80
June x No mulch	395	352	1.67	1.03
June x Organic mulch	924	858	1.73	1.42
June x Black polythene mulch	2201	1340	2.08	1.69
July x No mulch	240	207	1.47	1.09
July x Organic mulch	460	348	1.51	1.31
July x Black polythene mulch	712	518	1.82	1.52
August x No mulch	310	228	1.55	0.75
August x Organic mulch	481	385	1.68	1.06
August x Black polythene mulch	737	669	1.79	1.39
CD (0.05)	320.45		0.37	

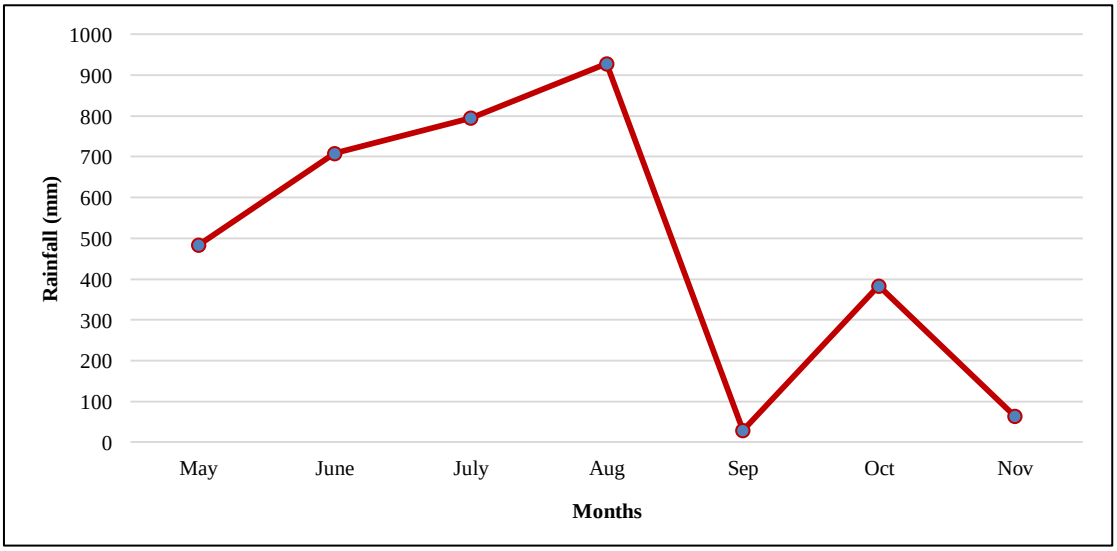

Fig. 1. Rainfall (mm) received during the crop growth period.

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