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Effect of organic manure and sulphur along with chemical fertilizer (RDF) on oil yield of tulsi (*Ocimum basilicum* L.) under *Acacia mangium* based multitier agroforestry system

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Abstract

Among the aromatic herbs sweet basil (*Ocimum basilicum*) has very good economic importance and its consumption both in nature is used for industrial processing. The essential oil is valued in the international market and widely used in the industries of condiments, cosmetics and medicinal. The present study entitled “Effect of Different Organic manure and Sulphur along with chemical fertilizer (RDF) on Oil yield of Tulsi (*Ocimum basilicum* L) under *Acacia mangium* based multitier Agroforestry system.” was executed at instructional farm of Forestry Department, IGKV, Raipur (CG) during 2018-19 in this experiment total 10 treatments were designed in various combination of manure and fertilizer and application of sulphur with intercropping of Tulsi under multitier agroforestry system and as a sole crop. Statistical designed was made as RBD (Random Block Design).the outcome showed that the highest herbage yield (3735.83 kg/ha) in first harvesting and the 2nd harvesting the highest herbage yield is (2307.5kg ha) Oil yield of *Ocimum basilicum* in T1 (27.23 kg /ha.) in first harvesting and (23.1 kg /ha) in 2nd harvesting was recorded in treatment. The T1 treatment contains Vermicompost @5t ha and sulphur 40 kg/ ha followed by T2, T3, (100% FYM 10 t/ ha + Karanj cake + sulphur kg/ ha), T4,T5,T6 (50% each Vermicompost + FYM + Karanj cake + Sulphur kg/ ha), T7 (RDF +sulphur), T8 (sulphur) as a sole crop, and T9 (RDF+ Sulphur) T10 sole crop found lowest herbage yield and oil yield in treatment T10 recorded. i.e. without tree there may be no fertilizer and manure are applied. The result of the present experiment indicated that the Vermicompost @ 5 ton/ha under multitier agroforestry system gave maximum herbage, oil yield and good economic returns to the farmers followed by FYM @ 10 tone.

Keywords: RBD, RDF, FYM, multitier agroforestry system

Introduction

The basil (*Ocimum basilicum* L.) is a widely known member of Lamiaceae family the genus *Ocimum* include about a dozen species and subspecies native to the tropical and sub tropical region of the world. This plant appreciated as an aromatic holy species and medicinal plant. Basil is an annual plant, which is originally from Asia before spreading to other part of the world. Basil is a Greek word (basileus) which means king. There are more than 150 basil species belonging to the genus *Ocimum*. The two most widely grown species for essential oil production are holy basil (*Ocimum sanctum* L) and sweet basil (*Ocimum basilicum* L) Essential oils extracted from fresh semi dried leaves and flowers can be used as aroma additives in food, pharmaceuticals and cosmetics. *Ocimum basilicum* is widely cultivated for the production of essential oils and is also marketed as an herb, fresh, dried or frozen. The essential oil of basil is used as an antifungal and insect-repelling and toxic activity the fresh leaves also used in salad. It is usually the leaves that are used in herbal medicine, but sometimes all of the aerial parts of the herb are used. It is preferable to use the herb fresh because it loses much of its flavor when dried leaves and flowers- raw and cooked. Used as a flavoring or as a spinach. Essential oil obtained from the plant is used as a food flavoring in mustards, sauces, vinegars etc. The objective of this study was “Effect of Different Organic manure and Sulphur along with chemical fertilizer (RDF) on Oil yield of Tulsi (*Ocimum basilicum* L) under *Acacia mangium* based multitier Agroforestry system.”

Materials and Methods

The experimental site Forestry research field is situated in the South- Eastern part of Chhattisgarh. It lies at 21°.76’ N latitude and 81°.36’E longitude having an altitude of 295 m

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above sea level. The experiment was started in the month of May 2018 and crop was 1st harvest in December 2018 and 2nd harvest in March 2019. The climate of the Raipur and experimental area is Dry Sub- Humid Tropical with an average rainfall of 1200- 1400 mm. The monthly maximum temperature ranges from 46 °C during summer to 8 °C during winter. Maximum Relative humidity varied from mid-June to September while, minimum relative humidity was recorded during April and May. The mean monthly data on different weather parameter viz. temperature, rainfall, relative humidity, sunshine hours and wind speed during the crop growing period (2018-19) the meteorological data during experiment observed maximum temperature 34.5°C and minimum temp. 24.8 °C, relative humidity 89.87%, sun shines 1.42 hours and the rainfall 328 mm was recorded during Transplanting time on August 2018 and the harvesting time temperature and sun shine was increased and Maximum temp. 34.5 °C and Min. temp. 19.5 °C relative humidity 30%, sun shine 8.2 hours recorded in month of March 2019.

The soils of Raipur belonging in four different orders viz., Entisoles, Vertisoles, Inceptisols, and Alfisols. The black clayey soil of experimental field is Vertisols which is locally called Kanhar. The Kanhar soil are characterized by fine texture, sticky nature, angular blocky structure, medium to low Nitrogen, Potassium content is high and Phosphorus is low to medium with low amount of Organic matter. The soil of experimental site is rich in organic carbon and other nutrient because of the addition of litter every year in the soil.

Methods for oil extraction

A net area of 12 m² for each plot was harvested manually through plucking the leaves and twigs for fresh weight to record herbage yield and then dried in room temperature for two to three days then leaves were dried in room temperature for extracting the oil. Sample of the leaves was dried for 72 hours by spreading the leaves in shade sheet and the oil content was determined using Clevenger's apparatus 100 gm. of dried leaves was taken from each sample and subjected to its oil extraction by applying temperature of 80 to 100 °C of boiler. The extracted and collected oil was weighed of each sample and recorded for further statistical analysis/ ha calculation.

Statistical analysis of data

Crop parameters, herbage yield and extracted *Ocimum basilicum* oil data were tabulated and analyzed statistically to test the significance of treatments under study using simple randomized block design. Critical differences (CD) were calculated at 5% level of significance to observe the different treatment and conditions as sole crop and intercrop in multitier Agroforestry system.

Result and Discussion

The result of the present study have been presented and

discussed under the following headings:

Herbage yield of *Ocimum basilicum*

Herbage yield of Tulsi *Ocimum basilicum* showed statistically significant ($P < 0.05$) results of maximum and minimum herbage yield in case of organic manure and combination of various fertilizer treatments in multi-storey agroforestry system and in sole crop was presented in table. After harvesting the highest herbage yield was recorded in treatment T1 (3735.83 kg/ha) Vermicompost @5t ha and sulphur 40 kg/ ha followed by T2 (2080.42 kg/ha.) 100% FYM 10 t/ ha + Karanj cake + sulphur kg /ha, in T4, (1571.43kg/ha.) (50% each Vermicompost + FYM + Karanj cake + Sulphur kg/ ha), in T8, (1244.86 kg/ha.) (Sulphur) as a sole crop, respectively at 1st harvest under shade condition however, minimum herbage yield was observed in treatment T10 (1053.19 kg/ha) as a sole crop.

During second harvest, maximum herbage yield was observed in T1 (2307.5kg/ha) 100% Vermicompost @5t ha and sulphur 40 kg/ ha, followed by T2 (1816.94kg/ha) 100% FYM 10 t/ ha + Karanj cake + sulphur kg/ ha, T4 (1546.67kg/ha) (50% each Vermicompost + FYM + Karanj cake + Sulphur kg/ ha), T8 (1235.83 kg/ha) (Sulphur) as a sole crop and lowest herbage yield was observed in sole crop cultivated plots in treatment T10 (922.5 kg/ha.) Overall the herbage yield make obvious that significant effect of *Acacia Mangium* based multitier agroforestry system. When different treatment was apply and observe the maximum herbage yield was received in organic manure (vermicompost) and lowest yield was recorded in sole crop without tree and without any organic manure and fertilizer. Similar result found by Suvera *et al.* (2015) [13] also reported that higher fresh herbage and oil yields could be obtained under Silvi-medicinal system (Karanja + *Ocimum* spp.) as compared to sole cropping open field cultivation. Anwar *et al.*, Patra *et al.* (2000) and Chand *et al* (2001) [3] in menthol (*Mentha arvensis*). A similar trend was observed with respect to dry matter yield in the present investigation confirms the findings Similarly reported by Bari and Rahim (2012) [2]. The highest yield of *Asparagus racemosus* (14.61 Mg ha⁻¹) was recorded in coconut + lemon based multistory Agroforestry system and the lowest yield was recorded in sole crop with reduction by 31.95% Therefore, the results regarding herbage yield of *Ocimum basilicum* are in confirmatory with findings of above workers experimental results.

The similar finding observed in present experiment that under Agroforestry system yield of crop was higher. Treatment T1 With Vermicompost 100% reported significantly higher dry herbage yields under the multi-tier agroforestry system at first harvest and slightly reduced second than other organic manure at the increased output of dry herbage could be attributed to increased yield of fresh herbage under the Agroforestry scheme. The results are similar with the findings of Radhakrishnan *et al.* (1991) [8].

Table 1: Herbage yield of *Ocimum basilicum*

Treatment	Herbage yield kg/ha. 1 st harvest	Herbage yield kg/ha. 2 nd harvest
T1	3735.83	2307.5
T2	2080.42	1816.94
T3	1956.39	1912.22
T4	1588.75	1546.67
T5	1571.43	1539.72
T6	1511.98	1493.33
T7	1473.06	1394.44

T8	1335.97	1235.83
T9	1244.86	1032.77
T10	1053.19	922.5
F-Teat	S	S
S.Em (±)	371.62	91.24
CD (at 5%)	1104.14	271.11

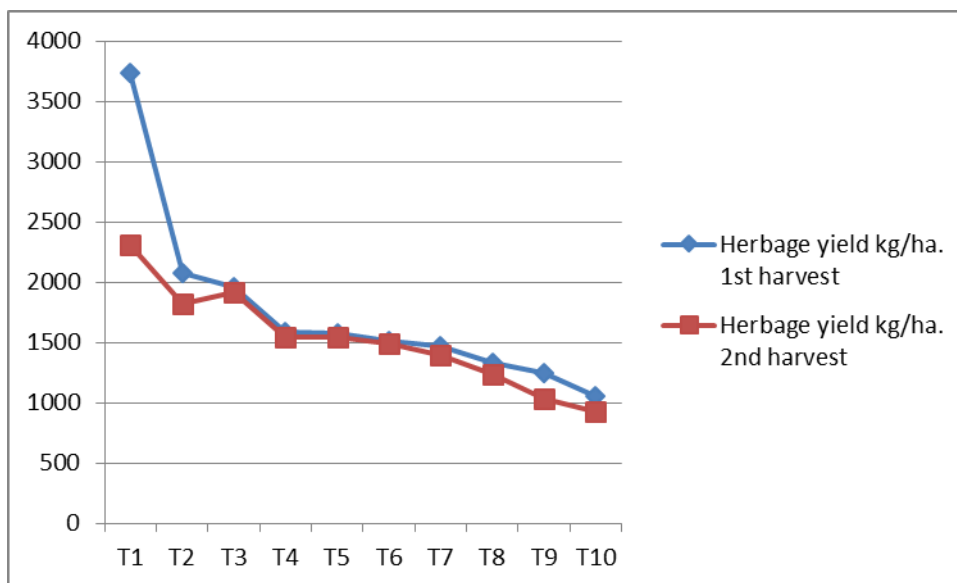


Fig 1: Herbage yield of *Ocimum basilicum*

Oil yield of *Ocimum basilicum*

Oil -yield of Tulsi Sweet Basil showed statistically significant (P<0.05) results on organic manure and combination of other fertilizer treatments in agroforestry system and open field plot condition as a sole crop the data depicted in (Table 2 and Fig 2)

1st harvesting

Highest oil yield at first harvest recorded in treatment T1 (27.23kg/ha) 100% vermicompost+ sulphur, followed by T2 (26.10 kg /ha.) 100% FYM 10 t/ ha + Karanj cake + sulphur kg/ ha, in T4, (21.1kg/ha) 50% each Vermicompost + FYM + Karanj cake + Sulphur kg/ ha, in T8 (13.3kg /ha.) sulphur, respectively under tree situation. However, lowest oil yield was noted in treatment T10 (9.5 kg/ha) is a sole crop

2nd harvesting

In second harvest, highest essential oil yield was recorded in T1 (24.1 kg/ha) 100% vermicompost+ sulphur followed by

(22.1kg/ha) in T2, (15.46 kg/ha) 100% FYM 10 t/ ha + Karanj cake + sulphur kg/ ha, in T4, (12.9 kg/ha.) (50% each Vermicompost + FYM + Karanj cake + Sulphur kg/ ha), in T8 (7.6 kg/ha) sulphur, Whereas, lowest oil yield was observed under Tulsi as a sole crop in treatment T10 (6.96 kg/ha) The oil yield of *Ocimum basilicum* in first harvesting is higher as compare with second harvesting Similar findings were reported by Priyanka Tripathi 2012 has observed that the maximum oil yield reported that The data pertaining to oil yield of *Ocimum sanctum* was also higher (50.62 l/ha) in T3 use of vermicompost followed by T6 and lower (26.66 l/ha) in T10 (control). Under peach based agroforestry system.

The results of above worker confirms the results obtained under this experiment Oil yield is directly related with the herbage yield and moisture content available in the leaves. The better microclimate and suitable nutrient with good soil moisture responsible for the high herbage and oil yield in sweet basil under agroforestry system.

Table 2: Oil yield kg/ha Ist Harvest (15-105 Day) & IInd Harvest (105-150 day)

Treatment	Oil yield in kg/ha-1 st harvesting	Oil yield kg/ha.2 nd harvesting
T1	27.23	23.1
T2	26.10	22.1
T3	25.4	21
T4	21.1	15.46
T5	17.9	12.9
T6	16.8	11.03
T7	14.8	9.1
T8	13.3	7.6
T9	10	6.98
T10	9.5	6.96
F- test	S	S
S.Em (±)	0.14	0.007
CD (at 5%)	0.11	0.02

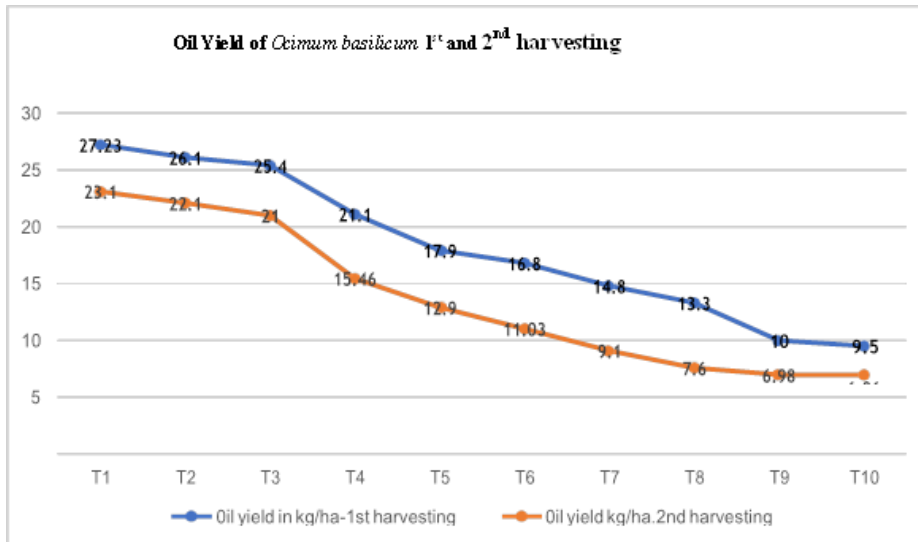


Fig 2: Oil Yield. Of *Ocimum basilicum*



Plate 1: *Ocimum basilicum* Oil Extraction Process



Plate 2: Extracted oil Sample of *Ocimum basilicum*

Conclusion

In view of its uses, sweet basil has excessive market demand for its oil and there is a need to improve the package of

practice with various doses of organic Manure in different quantity and also fertilizer treatments to produce good quality oil with better fragrance. As sweet basil showed better

performance, productivity and oil yield under Agroforestry system with the use of sulphur. It can be concluded that the oil and aroma both was found better as compared with sole crop therefore, this crop may be recommended to cultivate under Agroforestry system with organic manure. Consequently, And the recommended dose of fertilizers and as a sole crop the plant growth is not up to the marks and it turned into lowest growth and oil yield. The maximum oil yield both the harvesting 50.33 Kg /ha and cultivated as sole crop it was 16.46 Kg/ha it is three times less. It can be concluded that the sweet basil can be cultivated under Agroforestry system and provide three times more yield and money.

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