

COMPARATIVE EFFICACY OF DIFFERENT ORGANIC MANURES AND FERTILIZERS ON GROWTH AND YIELD OF KAPOOR TULSI (*OCIMUM KILIMANDSCHARICUM* GUERKE) UNDER MID-HILL CONDITION OF HIMACHAL PRADESH

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Abstract: The present studies were conducted on Kapoor Tulsi (*Ocimum kilimandscharicum* Guerke) during the season of 2017-18 at the experimental farm of Department of Forest Products, Dr. YSP University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (India). In this experiment ten treatments viz., T₁: Control, T₂: FYM (15t/ha), T₃: NPK (120:60:60 kg/ha), T₄: FYM+NPK (15 t/ha + 120:60:60 kg/ha), T₅: Jeevamrutha-desi cow (125 l/ha, 3%), T₆: Jeevamrutha-jersey cow (125 l/ha, 3%), T₇: Panchagavya-desi cow (50 l/ha, 5%), T₈: Panchagavya-jersey cow (50 l/ha, 5%), T₉: Vermicompost (3t/ha) and T₁₀: Vermicompost + NPK (3 t/ha + 120:60:60 kg/ha) were evaluated in RBD design with three replications on growth and yield of Kapoor tulsi. The results revealed that the combined application of Vermicompost and NPK (3 t/ha + 120:60:60 kg/ha) produced highest growth and yield followed by T₄>T₃>T₂>T₇. The Benefit Cost Ratio (BCR) among the various treatments shows that the NPK (T₃) (120:60:60 kg/ha) was found best (1.69) due to lowest cost and higher yield followed by T₇>T₈>T₅>T₄.

Keywords: Manure, Tulsi, Herbage, Essential oil, Growth, Yield

INTRODUCTION

Ocimum kilimandscharicum also known as Kapoor tulsi is one of the species of the genus *Ocimum* that is native to East Africa and was introduced and cultivated in India and some parts of Turkey. It is an evergreen aromatic perennial under shrub belonging to Lamiaceae family. The plant has pubescent quadrangular branchlets with simple leaves that are opposite and oblong, narrow at the base and deeply serrated (Warrier, *et.al.*, 1996). Aqueous extract of leaves contain camphor, 1,8-cineole, limonene, trans-caryophyllene, camphene, 4-terpeneol, myrtenol, αterpineol, endo-borneol and linalool. It also contains flavonoids, tannins, saponins, sterols, carbohydrates, proteins and triterpenoids. Its essential oil contains oxygenated monoterpenes (95.8%), like camphor (64.9%), limonene (8.7%), camphene (6.4%) and (E)-ocimene (3.0%) (Kashyap *et al.*, 2011). This plant attracted attention as a source of camphor (Soni *et al.*, 2012). Extracted oil from leaf is used as an insecticide and mosquito repellent. Kapoor tulsi shows various activities such as antimalarial (Kweka *et al.*, 2009), anti-inflammatory (Ezekwesili *et al.*, 2004), anti-diarrhoeal (Soni *et al.*, 2012), antimicrobial (Tewari *et al.*, 2012). It is also recommended in the management of various ailments including colds, coughs, abdominal pains, measles, bronchitis, anorexia and memory disorders (Aggarwal and

Goyal, 2012). While the ointment is used for the fast relief of muscular strain, rheumatism, arthritis, fibrositis, lumbago, neuralgia and sciatica (Ligare, 2010).

MATERIALS AND METHODS

The experiment was conducted under Randomized Block Design (RBD) with three replications and ten treatments as suggested by Panse and Sukhatme (1978). The plants were transplanted during April month at 45 cm x 30 cm spacing between row and plants. The experiment was conducted with ten treatments viz. T₁: Control (No manure), T₂: FYM (15t/ha), T₃: NPK (120:60:60 kg/ha), T₄: FYM+NPK (15 t/ha + 120:60:60 kg/ha), T₅: Jeevamrutha-desi cow (125 l/ha, 5%), T₆: Jeevamrutha-jersey cow (125 l/ha, 5%), T₇: Panchagavya-desi cow (50 l/ha, 3%), T₈: Panchagavya-jersey cow (50 l/ha, 3%), T₉: Vermicompost (3t/ha) and T₁₀: Vermicompost + NPK (3 t/ha + 120:60:60 kg/ha). Inter-culture operations were carried out as and when required. The data were recorded on growth and yield attributes viz. plant height (cm), number of branches per plant, number of leaves per plant, fresh herbage yield (q/ha), dry herbage yield (q/ha), oil content (%), oil yield (l/ha) and analyzed statistically. Benefit Cost Ratio (BCR) was also calculated on the basis of cost of cultivation and returns on per hectare basis. The cost of cultivation includes all the inputs like

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seedling costs, labour involved in bed preparation, intercultural operations till final harvesting of the crop. Similarly while calculating the return, the total dry plant biomass obtained was multiplied by the average of prevailing market rate of *Ocimum kilimandscharicum*. Cost and return are two most important indicators to evaluate the economic feasibility of an activity (Gittinger, 1982).

RESULTS AND DISCUSSIONS

Growth Characteristics

Effect of different organic manures and fertilizers were found to be significant for plant height (cm), number of branches per plant and number of leaves per plant shown in Table 1. Maximum plant height (cm), number of branches per plant and number of leaves per plant were observed in T₁₀ i.e. 118.33 cm, 35.00 and 384.33 which were 47.88 % , 68.80 % and 41.80 % respectively higher than the control. The treatment combination of Vermicompost (3 t/ha) + NPK (120:60:60 kg/ha) have given significant increase in the plant height, number of branches per plant and number of leaves per plant at harvesting time which is at par with the treatment combination of FYM (15t/ha)+NPK (120:60:60 kg/ha) which may be due to the activity of the basic plant nutrient which are in readily available form for the plant as nitrate, phosphate and potash in both organic and inorganic fertilizers to the plant during the whole growing period which might have contributed in increasing more number of axillary buds leading to development of lateral branches in the plant. Vermicompost application has increased the uptake of mineral such as nitrogen and phosphorus that might have positive effect on proper biomass production. Similar results are reported by (Munnu, 2011) in *Pelargonium graveolens* where combination of Vermicompost @ 5 t/ha + 50% recommended

NPK fertilizer (100:25:25 kg/ha) have given significantly better growth and high fresh herbage yield with at par value for full dose of fertilizer NPK (200:50:50 kg/ha).

Yield Characteristics

Different organic manures and fertilizers were found to be significant for estimated total fresh herbage yield per hectare (q), estimated total dry herbage yield per hectare (q), total essential oil content (%) and estimated total essential oil yield per hectare (l) shown in Table 1. The same trend was found in the yield characteristics as compare to the growth characteristics. Maximum estimated total fresh biomass yield (q/ha), estimated total dry herbage yield (q/ha), total essential oil content (%) and estimated total essential oil yield (l/ha) were observed in T₁₀ i.e. 97.31, 26.79, 0.434 and 27.93 which were 55.03 % , 52.89 % , 9.68 % and 59.26 % respectively higher than the control. The increase in the production and yield of the plant may be due to the availability of the nutrients. These nutrients are made available by the treatment combination of organic and inorganic based fertilizers during the whole cropping period. Inorganic fertilizers provide immediate ready available nutrients to the plants for its gradual development whereas organic manures provides moisture to the soil, improve structure and texture of soil and also help to release the nutrients in later stage for continuous growth without interruption during whole period of growth cycle. The significant results have been reported by Azza and Hendawy (2010) in their studies on the efficiency interaction of Vermicompost and NPK in the herb production and yield of lovage plant (*Levisticum officinale*). Similarly Singh and Guleria (2012) have reported significant increase in the herbage production of Rosemary with the combined application of Vermicompost and NPK.

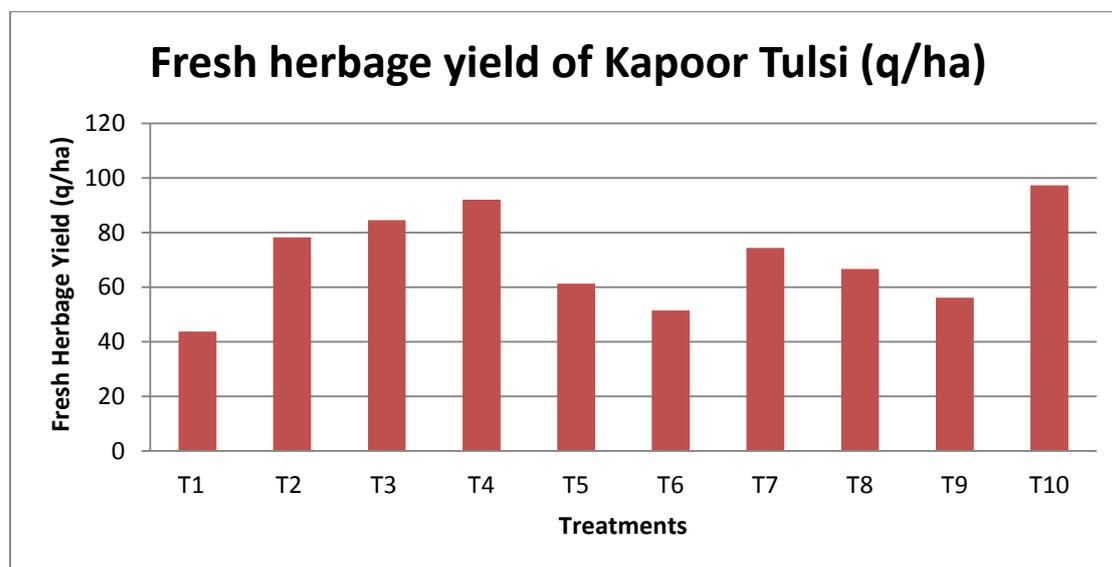
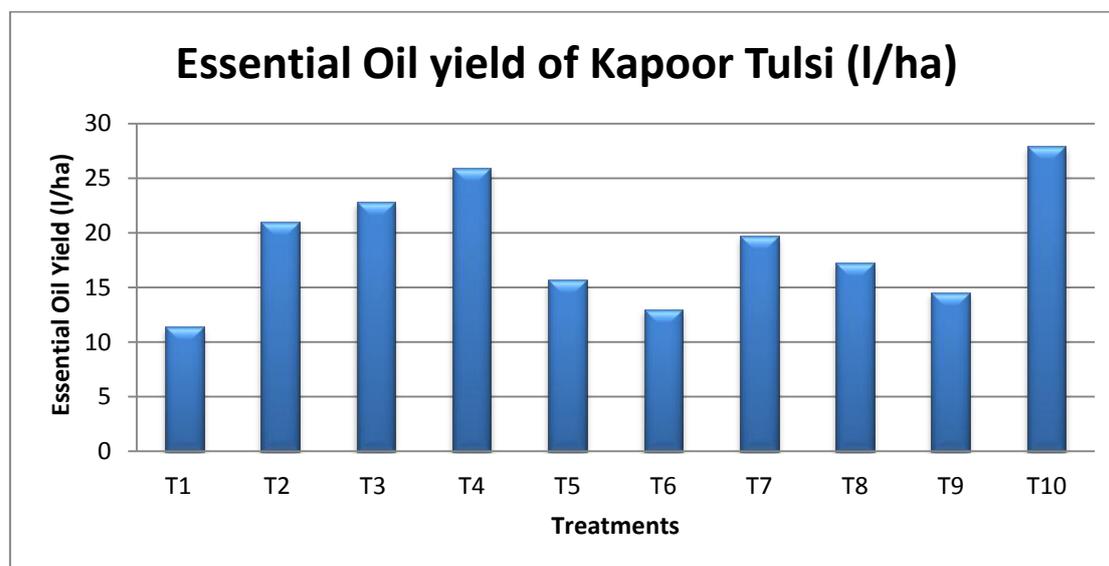


Figure 1. Fresh herbage yield of Kapoor Tulsi (*Ocimum kilimandscharicum*)

Table 1. Effect of different organic and inorganic manures on growth and yield Kapoor tulsi (*Ocimum kilimandscharicum*)

| Parameters Treatments | Plant height at harvest (cm) | No of branches/plant at harvest | No. of leaves/Plant | Fresh herbage yield (q/ha) | Dry herbage yield (q/ha) | Essential oil content (%) | Estimated essential oil yield (l/ha) |
|--|------------------------------|---------------------------------|---------------------|----------------------------|--------------------------|---------------------------|--------------------------------------|
| T ₁ : Control (No manure) | 61.67 | 12.67 | 223.67 | 43.76 | 12.62 | 0.392 | 11.38 |
| T ₂ : FYM @ 15 t/ha | 85.00 | 24.33 | 353.33 | 78.26 | 22.01 | 0.421 | 21.05 |
| T ₃ : NPK @ 120:60:60 kg/ha | 89.00 | 27.00 | 364.67 | 84.50 | 23.24 | 0.426 | 22.82 |
| T ₄ : FYM + NPK @ 15 t/ha + 120:60:60 kg/ha | 102.00 | 31.67 | 375.67 | 92.06 | 25.23 | 0.429 | 25.89 |
| T ₅ : Jeevamrutha-desi Cow @ 125 l/ha (5%) | 69.33 | 17.67 | 287.00 | 61.32 | 18.49 | 0.407 | 15.75 |
| T ₆ : Jeevamrutha-jersey Cow @ 125 l/ha (5%) | 63.67 | 14.33 | 247.33 | 51.47 | 15.34 | 0.393 | 12.99 |
| T ₇ : Panchgavya-desi Cow @ 50 l/ha (3%) | 77.00 | 22.33 | 322.33 | 74.37 | 20.76 | 0.420 | 19.74 |
| T ₈ : Panchgavya-jersey Cow @ 50 l/ha (3%) | 73.33 | 21.00 | 303.33 | 66.68 | 19.95 | 0.422 | 17.26 |
| T ₉ : Vermicompost @ 3 t/ha | 65.33 | 16.00 | 280.67 | 56.15 | 16.71 | 0.397 | 14.53 |
| T ₁₀ : Vermicompost + NPK @ 3 t/ha+ 120:60:60 kg/ha | 118.33 | 35.00 | 384.33 | 97.31 | 26.79 | 0.434 | 27.93 |
| S.Em ± | 1.47 | 0.98 | 5.91 | 1.02 | 0.37 | 0.009 | 0.46 |
| C.D. (5%) | 4.41 | 2.93 | 17.70 | 3.04 | 1.10 | 0.004 | 1.38 |
| C.V. (%) | 3.17 | 7.63 | 3.26 | 2.49 | 3.17 | 1.255 | 4.22 |

**Figure 2.** Essential oil yield of Kapoor Tulsi (*Ocimum kilimandscharicum*)

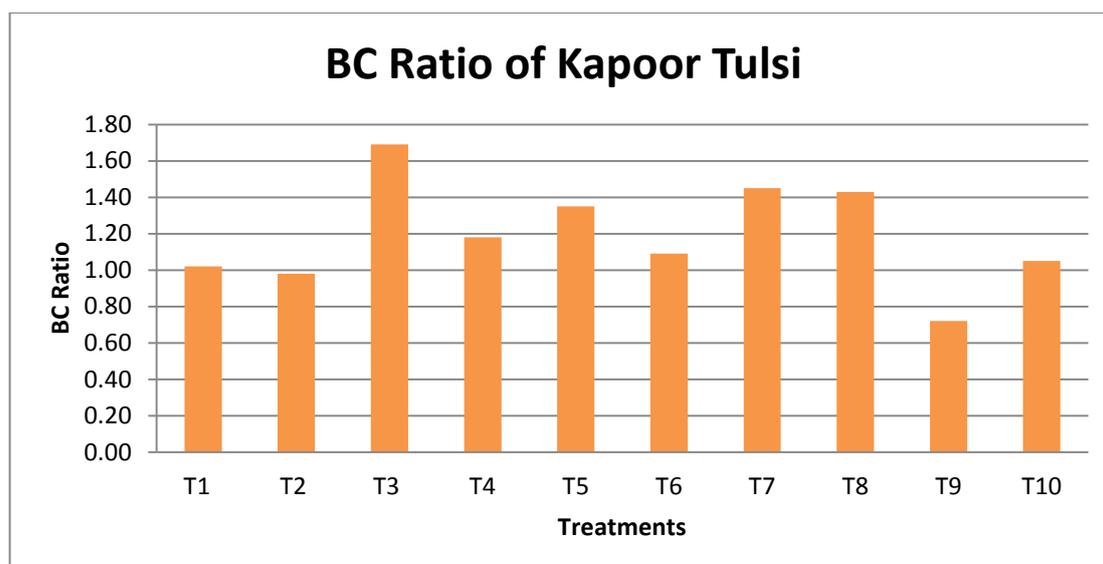


Figure 3. Benefit Cost Ratio of Kapoor Tulsi (*Ocimum kilimandscharicum*)

Bio-economic Appraisal

It can be inferred from the Table 2 that the highest benefit-cost ratio of 1.69 was observed in (T₃) NPK (120:60:60 kg/ha). Minimum was observed in (T₉) Vermicompost-3t/ha (0.72). This might be due to high cost of Vermicompost and lesser yield of herbage. These results are in consonance with the report of Payeng *et al.* (2018) reported that the maximum BC ratio (2.00) was observed in NPK (60:30:45 kg/ha) followed by NPK (40:20:30 kg/ha)

and minimum in 2t Vermicompost (0.69). The maximum BC ratio was observed in NPK (60:30:30 kg/ha) (3.65) followed by FYM + PSB (5t: 5kg) (2.65) and minimum in FYM + Vermicompost (5t: 2t) (1.62) in *Asparagus racemosus* Wild. instead of high yield in FYM + Vermicompost + PSB (5t: 2t: 5kg) followed by NPK (60:30:30 kg/ha) due to high cost of cultivation resulted from high cost of Vermicompost (Thakur, 2016). These results are in line with the present findings.

Table 2. Economics of Kapoor tulsi (*Ocimum kilimandscharicum*)

| Parameters Treatments | Cost of cultivation (Rs/ha) | Total dry herb yield (kg/ha) | Gross income (Rs/ha) | Net income (Rs/ha) | Benefit cost ratio |
|--|-----------------------------|------------------------------|----------------------|--------------------|--------------------|
| T ₁ (Control) | 70151.68 | 1192.10 | 71526.00 | 1374.32 | 1.02 |
| T ₂ (FYM) | 128121.68 | 2091.11 | 125466.60 | -2655.08 | 0.98 |
| T ₃ (NPK) | 78757.28 | 2211.85 | 132711.00 | 53953.72 | 1.69 |
| T ₄ (FYM+NPK) | 129907.28 | 2364.57 | 141874.20 | 22930.12 | 1.18 |
| T ₅ (Jeevamrutha- desi cow) | 78096.76 | 1760.87 | 105652.20 | 27555.44 | 1.35 |
| T ₆ (Jeevamrutha- jersey cow) | 78096.76 | 1412.47 | 84748.20 | 6651.44 | 1.09 |
| T ₇ (Panchagavya- desi cow) | 79805.08 | 1929.39 | 115763.40 | 35958.32 | 1.45 |
| T ₈ (Panchagavya- jersey cow) | 79805.08 | 1898.15 | 113889.00 | 34083.92 | 1.43 |

| | | | | | |
|--------------------------------------|-----------|---------|-----------|-----------|------|
| T ₀ (Vermicompost) | 132771.68 | 1597.90 | 95874.00 | -36897.68 | 0.72 |
| T ₁₀ (Vermicompost + NPK) | 134557.28 | 2547.29 | 152837.40 | 7316.92 | 1.05 |

Rate: 60 Rs/kg Dry biomass (Panchang)



Plant



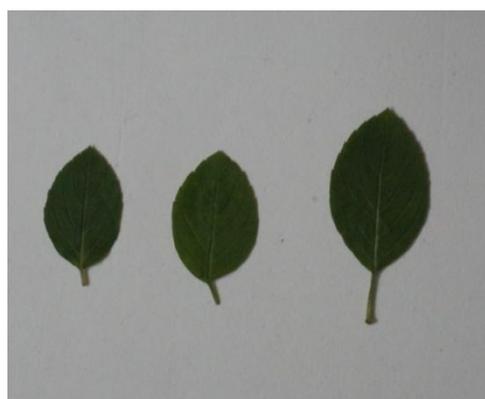
Terminal twig



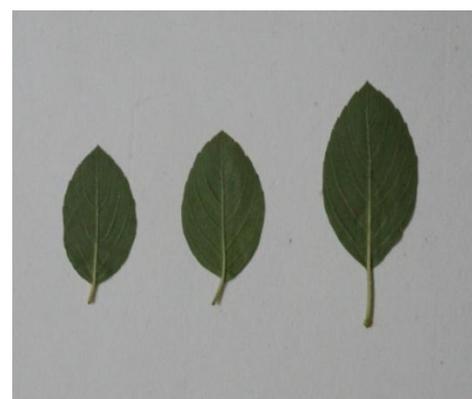
Inflorescence



Flower



Adaxial side of Leaf



Abaxial side of Leaf

Plate 1. Different plant parts of Kapoor tulsi (*Ocimum kilimandscharicum*)

CONCLUSIONS

The results of the study showed that application of Vermicompost + NPK (3 t/ha + 120:60:60 kg/ha) showed the higher growth and yield than the others

treatments. Though Vermicompost + NPK treatment gives maximum productivity but its BC Ratio is very low due to the high cost of Vermicompost @ Rs 15 per kg which is not economical feasible to the farmers unless or until the Vermicompost is

produced the farmer itself. The highest BC ratio (1.69) was found in T₃: NPK (120:60:60 kg/ha) among the all treatments due to its low cost and high productivity. In order to maintain good soil condition as well as environment, it would be the best advice to farmers to use NPK fertilizer @ 120:60:60 kg/ha in an appropriate dose followed by Panchgavya-desi cow @ 50 l/ha (3%) with BC Ratio (1.45) for the cultivation Kapoor tulsi.

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