

Comparative Study of Properties of Tulasi (Ocimum Sanctum) by using Various Plant Nutrients

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Abstract

'Vrikshayurved'- ancient Indian Sanskrit text has large variety of innovative practices regarding plant-nutrient methods.¹ Cow-milk is the best rejuvenating & easily endurable nutritive substance for mankind and plant. Krishna Tulasi (Ocimum sanctum) is one of the important medicinal plants used in various respiratory disorders such as bronchial asthma. Four Groups comprising 6 saplings of Tulasi in each Group were formed according to type of nourishment. Group-A was nourished with water (250 ml). Group-B nourished with Cow-milk (10 ml), Group-C nourished with Cow-ghee (2 ml) and Group-D nourished with Cow-milk - 10ml + Cow-ghee 2 ml daily. This experiment was done up to efflorescing of Ocimum sanctum which was observed after 45 days. The plant gets nourishment in its own digestible manner from soil nutrient. The test of soil revealed increase in amount of phosphorus which is directly responsible for photosynthesis. Leaf extract was examined to study changes in its chemical component 'Eugenol' with help of HPLC method. The organoleptic examination revealed that the plant nourished with milk had best growth in height, no. of leaves and luster compared to other Groups. The result shows Eugenol content in Group B is 0.00513 mg/100g and that of in Group A is 0.0047 mg/100g.

Keywords: Eugenol, Tulasi, Ocimum sanctum, Cow Milk, Cow Ghee

I. INTRODUCTION

Plants are the real treasure and wealth of any country. The Mother Nature should be protected from its impairment and destruction. The devastation of land should be earnestly stopped to save the mankind from rising threats. Unfortunately due to many historical and social causes such treasure is deviating from us. To conserve such precious wood riches; Indian ancient Sages have already explored many ways of nurturing the plants. These methods are natural and time tested. There are many such references which are scattered in many ancient 'Sanskrit' books. All these references are compiled in an ancient Sanskrit text 'Vrikshayurved' written by 'Surapala'. There are many important methods explained in it like selection of soil; time of plantation of trees; Specific plant nutrients; the time

and method of plucking the tree parts, its diseases and its Ayurvedic treatment. Such experiments should be practically observed to see its efficacy in scientific way. Also this knowledge can benefit the tree cultivators. Hence it was decided to undertake this research work to observe the changes materialized in the plant due to specific nutrients and observe its growth. The growth can be observed by two ways i.e. external features like its height; leaves or flowers (Pharmacognocny) and the another way is by testing its chemical composition (pharmacokinetic) If these experiments will enhance the active principles in the Ayurvedic herbs it can boost the medicinal value also. Hence the study was planned to get better yield of better medicinal value. Since no such study is performed yet on the plants; it was intended to do comparative study of all nutrients and compare the effect of each nutrient on the plant in Pharmacognocny and pharmacokinetic point of approach. Tulasi was selected for the experimental study. Tulasi is pungent and bitter in taste. It has hot potency. It is Ruksha in attribute & excellent as expectorant. It is good medicine in fever; cough; enteric worms; chest pain due to asthma. It has many species. Amongst them Krishna Tulasi (Ocimum Sanctum) was selected for the experimental study as it has more pungent and medicinal value.²

II. AIM

To accomplish comparative study of properties of Tulasi (Ocimum sanctum) by using various plant nutrients.

III. OBJECTIVES

1. To assess properties of Tulasi by using cow milk, cow ghee & cow milk & ghee together as a nourishing agent.
2. To compare properties of Tulasi, nourished with water with Group of cow milk & cow ghee as nutrient

IV. METHODOLOGY

24 Tulasi saplings (cultivated from same mother plant) of 18 to 20 cm height (Ocimum sanctum) and 4 months old were brought from a standard herbal garden. The saplings were planted in the *poiyata* soil which has mixture of coarse and fine

particles. The earthen pots (unglazed potter’s clay) having height of 30 cm and width of 20 cm were purchased for comfortable growth of plants. 3/4 of the pot was filled with soil. They were Grouped in four Groups. Plantation ceremony was carried out on the holy occasion of prevalence of *RohiniNakshatra* i.e. on 20th August 2014 in morning at 10 am.³

Group A- First 6 pots were grouped as Group A1; A2; A3; A4; A5; A6. All these saplings were nourished only with water. Considering the viability and natural variation of plants instead of one sapling; 6 saplings of same species (*Osimum Sanctum*) were planted.

Group B- another 6 pots were grouped as Group B1; B2; B3; B4; B5; B6. These plants were nourished by Cow milk. The exact dosage of plant nutrient is not mentioned in the texts like *VrikshaAyurveda*. Hence it was also one of the objectives of the research to decide the dosage of milk as a small plant nutrient.

Hence 2 plants (B1 and B2) were nourished with 5 ml of cow milk daily in the morning at 10 am along with enough quantity of water.

2 plants i.e. B3; B4 were dribbled with 10 ml of milk. Another 2 plants i.e. B5 and B6 were nourished with 15 ml of cow milk. Daily fresh cow milk was purchased from *Katraj Milk Parlor, Pune (India)*.

Group C-Group c was nourished with cow Ghee. Cow ghee is oily and heavy substance. Also it might coat roots. The dosage of ghee is not mentioned in *VrikshaSamhita*. Hence C1 and C2 Plants were poured with 1 ml of cow ghee. C3 and C4 plants were poured with 2 ml cow ghee and C5 and C6 were nourished with 3 ml of cow ghee daily along with sufficient water that is around 200 ml daily in the morning once at 10 am.

Group D- To see combined effect of Milk and Ghee both the nutrients were together poured daily to the Group D saplings. D1 and D2 plants were poured with 5 ml cow milk and 1 ml cow ghee. D3 and D4 plants were poured with 10 ml cow milk and 2 ml cow ghee. D5 and D6 plants were poured with 15 ml of cow milk and 3 ml of cow ghee.

All the plant nutrients were added to plants daily at 10 am once in the morning.

The plants were watered daily from the plantation date- 20/08/2014. The roots of plants were allowed to get acquainted with the soil and environment for ten days. The project experiment was started on 01/09/2014. The pots containing plants were kept in college building terrace under the green cotton mesh to pass adequate sunrays but to avoid harsh sunrays.

A chart was prepared to record the daily observation of the growth of all 6 plants of the 4 Groups. Height of each plant was recorded in centimeters. No of leaves were also recorded per every week. The width of the leaves was also recorded along with luster.

V. OBSERVATIONS

The plants in Group B were flourished. Height of all plants in this group was seen maximum amongst all the groups. The leaves were maximum in number and its surface area also was good. It had a lush green colour. This Group of plants had maximum number of flowers.

Plants of Group A were also good in condition. Their growth and other features were not so excellent but moderate in comparison with Group B.

The plants of Group C and D which contained ghee as a nutrient had growth problem. The ghee which was poured one week earlier was visible on soil even after one week. It was inferred that biodegradation of the oily and sticky fluid like ghee is very slow. The Ghee is an excellent nutrient but it is tolerable by the shrub only once in six months and that too when it is mixed with other nutrients like cow urine. In this experiment, the daily dosage of ghee had blocked the root pours of plant. The soil was saturated with ghee which blocked the root pours. Hence the water poured daily was not absorbed in the plant. Hence the leaves of plants of this group were dried in second week. They turned into dark and purple colour and had ripened in short time. After a few days it shredded and the plant also dried in 4th week. As the soil was saturated due to the heavy and oily nature of ghee the plants uprooted and collapsed.

TABLE-I HEIGHT OF PLANTS IN GROUP‘A’

Date (week)/ Height in centimeter	Group ‘A’ Water					
	A1	A2	A3	A4	A5	A6
01/09/15 – 1 st week	13	6	14	21.5	24	21.5
07/09/15 – 2 nd week	22	6	23	28	33.5	33.5
15/09/15- 3 rd week	34	11.5	30	32	39.5	35
23/09/15- 4 th week	35	20	36	39	42	38

06/10/15	44	28	41	41	45	40
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TABLE-II HEIGHT OF PLANTS IN GROUP ‘B’

Date (week)/ Height in centimeter	Group ‘B’ Milk					
	B1	B2	B3	B4	B5	B6
01/09/15 – 1 st week	18	19.5	19	15	12.5	15
07/09/15 – 2 nd week	27	31	28	23	19	23.5
15/09/15- 3 rd week	33	32.5	33.5	33	31.5	29
23/09/15- 4 th week	39	40	36	40	33	39
06/10/15	44	50	47	49	45	51

TABLE-III HEIGHT OF PLANTS IN GROUP ‘C’

Date (week)/ Height in centimeter	Group ‘C’ Ghee					
	C1	C2	C3	C4	C5	C6
01/09/15 – 1 st week	19	18	22	20.5	15.5	18
07/09/15 – 2 nd week	27.5	30	27	31	18.5	25.5
15/09/15- 3 rd week	36	35	30	38	30	33
23/09/15- 4 th week	35	34	29	29	28	30
06/10/15	35	34	32	36	28	30

TABLE-IV HEIGHT OF PLANTS IN GROUP ‘D’

Date (week)/ Height in centimeter	Group ‘D’ Milk + Ghee					
	D1	D2	D3	D4	D5	D6
01/09/15 – 1 st week	18	18.5	20.5	19.5	19	19
07/09/15 – 2 nd week	27	28.5	29.5	28.5	25	24.5
15/09/15- 3 rd week	35	34	36	36	30	30
23/09/15- 4 th week	32	35	36	-	-	-
06/10/15	32	35	36	-	-	-

TABLE-V: COMPARISON OF HEIGHT OF PLANTS OF ALL GROUPS*

Sr. No.	Plant Code	Height of plant in CM
1	A5	45
2	B6	51
3	C4	36
4	D4	36

TABLE-VI:NO OF LEAVESIN GROUP‘A’:

Week /No. of leaves	Group ‘A’ Water					
	A1	A2	A3	A4	A5	A6
2 nd Week	96	67	135	124	136	69
4 th Week	102	72	133	136	189	79
6 th week	115	87	143	169	204	103

TABLE-VII:NO OF LEAVESIN GROUP‘B’:

Week /No. of leaves	Group ‘B’ Milk					
	B1	B2	B3	B4	B5	B6
2 nd Week	175	177	105	201	289	192
4 th Week	185	178	198	223	289	198
6 th week	201	182	205	278	328	245

TABLE-VIII:NO OF LEAVESIN GROUP‘C’:

Week /No. of leaves	Group ‘C’ Ghee					
	C1	C2	C3	C4	C5	C6
2 nd Week	90	94	87	98	88	83
4 th Week	95	83	85	88	82	79
6 th week	80 [#]	74 [#]	45 [#]	74 [#]	45 [#]	34 [#]
#All leaves Dried						

TABLE-IX:NO OF LEAVESIN GROUP‘D’:

Week /No. of leaves	Group ‘D’ Milk + Ghee					
	D1	D2	D3	D4	D5	D6
2 nd Week	122	135	145	128	130	132
4 th Week	60	65	72	58	60	63
6 th week	#	#	76 [*]	#	#	#
#All leaves Dried, * Shrunk						
<i>Observation – All leaves plants belonging to Group D were started turning yellowish brown. Slowly they dried up, destroyed and shredded off. Also these plants collapsed in 2nd week. We tied them with ropes.</i>						

TABLE-X:COMPARISON OF LEAVES OF PLANTS OF ALL GROUPS*:-

Sr. No.	Plant Code	Number of Leaves
1	A5	189
2	B5	289
3	C1	95
4	D3	72

**In each Group the best fully grown Tulasi sapling was selected. It was counted for height and number of leaves.*

TABLE-XI:COMPARISON WEIGHT OF LEAVES OF PLANTS OF ALL GROUPS*:-

Group	Nutrient	Weight of leaves (in gms)
A	Water	30
B	Milk	80
C	Ghee	No fresh leaves available
D	Ghee + Milk	No fresh leaves available

TABLE-XII: COMPARISON OF PARAMETERS OF SOIL:

Sr. No	Parameter	Soil with water	Soil with Ghee	Soil with Milk	Normal Range	
					Specification	Remark
1	Fat	< 0.5	0.85	< 0.5		
2	pH	8.66	8.4	8.32	4.51 - 5.50	Acidic
					6.51 - 7.50	Normal
					7.51 - 8.50	Alkaline
3	Total Nitrogen	727.83	703.01	715.59	281-420	Normal
					421-560	More than required
					561-700	High
4	Exchangeable Acidity	Nil	Nil	Nil		
5	Potassium as K	550.0	461.9	549.4	< 100	Very Less
					> 301	Very High
6	Phosphorous as P (Kg/Hector)	0.5	<10	49.86	< 7	Very Less
					7.01-14	Less
					14-21	Normal

It is observed that Phosphorous content in soil was remarkably increased in soil having milk and ghee. There was no significant change in the other parameters if compared to soil nourished by only Water.

Eugenol-

Another important test for testing the quality of Tulasi leaves is the active principle Eugenol.⁴ It is present in the Bay Leaves, Cinnamon leaves, Nutmeg, clove and Tulasi leaves. The eugenol was tested from Leaves of all four Groups. Standard Eugenol (C01P060 – Ocimum Sanctum) 250 mg. was brought from Natural Remedies private limited, Bangalore, Karnataka. (Invoice No. MU1/1516/NMF/00977)

TABLE-XIII: TULASI PLANT NOURISHED BY MILK-

Sr No	Parameter	Results	Units	Test Method
1	Eugenol content	0.0019	g/100g	HPCL run of extract in comparison with eugenic oil.

TABLE-XIV: TULASI PLANT NOURISHED BY WATER-

Sr No	Parameter	Results	Units	Test Method
1	Eugenol content	0.0047	g/100g	HPCL run of extract in comparison with eugenic oil.

Since Milk Group and water Group have more number of leaves, leaves of these two Groups were sent to find out Eugenol percentage. Leaves weighing Minimum 25 gms were required for lab analysis. Since Group C

and D were not having sufficient leaves for lab analysis their Eugenol percentage could not be counted.

The percentage of Eugenol in Group A is (0.0047g/100g of EugenolX (Total wt. of leaves) 30 gms =) 0.141 gm

The percentage of Eugenol in Group B is (0.0019 g/100g of EugenolX 80gms (Total wt. of leaves) =) 0.152gm

Hence the total Eugenol content of the Group B is more than Group A.

Component	Gr. A	Gr. B
Eugenol	0.141 gm	0.152gm

VI. DISCUSSION

The Milk might have increased microbial flora in the soil, which has ultimately increased yield of Group B plants. The Milk Rejuvenates and is called as Rasayan in Ayurved for Human beings. Similarly it has enhanced the plant growth and has flourished the Krishnatulasi plants. Even After removal of all the leaves from all plants of Group A and B for lab testing, the shrub was totally bare. But the plants from Group B had again abundant leaves within 15 days compared to the leaves of Gr. A. Group C and D plants were already shrunken and dead; so those had no leaves and no change. Percentage of Phosphorus in Soil of Group B was considerably high compared to Group A and C. Phosphorus enhances the plant growth. Vriksha Ayurved has mentioned Ghee and milk as an excellent plant nutrients but it has not explained the exact dose of the nutrients. To decide and standardize the dose of plant nutrient was also the objective of this project. The ghee can be poured in soil once in one to three months to a plant in addition to other nutrients. Ghee should not be poured daily to the plant because its excess use coats and blocks the micro root drizzles. Due to the blockage of pores the plant cannot absorb the water by osmosis. Hence the plants of Group C and D were died due to lack of absorption of water. The plants nourished by milk have maximum height; no of leaves, surface area of leaves and the luster of leaves. Eugenol percent of Gr. B was more compared to other Groups. The increased Phosphorus might have enhanced the plant growth by increasing photosynthesis. Milk has a good source of phosphorus which might have increased Phosphorus contents of soil. The milk might also have developed good microbial threshold in the soil. The microbes convert free nitrogen into plant nutrient in the soil. Thus the total outcome was plants nurtured by milk had best yield of Tulasi.

VII. CONCLUSIONS

This research work reveals that ghee if poured daily to the small shrubs coats the root drizzles and stops water absorption and hence ghee should not be poured singly and daily to the small shrubs. It was found in the experiment that milk increases soil phosphorus if added daily to soil. Eugenol content of the Tulasileaves nurtured by milk was found maximum. The plants nurtured by milk has double yield of leaves and inflorescence in compared to plants nurtured by water. Milk is the best plant nutrient for Krishna Tulasi (Ocimum Sanctum).

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ACKNOWLEDGMENT

Authors acknowledge Bharati Vidyapeeth Deemed University, College of Ayurved, Pune (India) for the funds and Department of Dravyaguna Vigyan, BVDU, College of Ayurved, Pune for technical support.

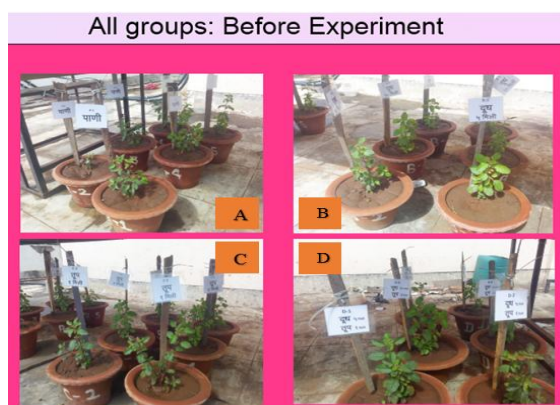


Photo 1: Groups of Tulasi Before Experiment



Photo 2: Groups of Tulasi After Experiment

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