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COMPARATIVE STUDY OF QUANTITATIVE EVALUATION OF ALAMBU FRUIT (*CUCURBITA MAXIMA* DUCH. EX LAMK.) GROWN BY VRIKSHAYURVEDA CULTIVATION METHOD AND CONVENTIONAL CULTIVATION PRACTICE

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ABSTRACT

The word *Vrikshayurveda* is derived from *vrikshah veda* means the science of plants life and longevity. In ancient time India had achieved a level of agricultural technology is equal to what the knowledge in modern times. This technique overcomes several issues concerning with plant life such as cultivation, preservation, processing of seeds before planting, preparation of pits, selection of soil, method of irrigation, nourishment, fertilizers and treatment of plant diseases. Hence there is a need to standardize all these ancient techniques on a global platform. Today it becomes evident that chemical inputs show dramatic short term benefits whereas in the longer run they adversely impact the soil, water and perhaps the nutritional quality of the plant which also prove hazardous to human body. Cancer is one of the serious side effect of chemical fertilizer can be seen on human body, it destroys the basal line cells of the body. Thus it is evident that there is great scope to integrate traditional practices for better productivity of quality planting material. All the species of Cucurbitaceae family have been universally accepted for their medicinal as well as nutritional value. Species of this family belonged to wild as well as edible variety which has medicinal and nutritional value. Hence *Alambu* (***Cucurbita maxima*** Duch. ex Lamk.) is one of the species from Cucurbitaceae family has been selected for the study.

Keywords: *Vrikshayrveda*, Cucurbita maxima, organic farming, Cultivation.

INTRODUCTION

The word *Vrikshayurveda* is derived from '*Vrikshah veda'*, means the science of plant life and longevity. It is the ancient science which deals with plant life. In *Ayurveda*, imbalance of the three *doshas* (*Vata, Pitta, Kapha*) are responsible for the diseased condition of body. In *Vrikshayurveda* these concept are applicable for plant as well. *Vrikshayurveda* is the science of plant life which deals with various cultivation methods for obtaining a superior quality of the yield. This science not only describes the cultivation techniques but also it believes in the *tridosha* theory of *Ayurveda*. This science is also concerned with the treatment of the plants. *Vrikshayurveda* includes the study of soil processing, seed processing, irrigation techniques, and propagation techniques and also significantly it gives references of biotechnological methods. The earliest references regarding *Vrikshayurveda* were found in Vedas especially in Rigveda and Atharvaveda has lots

of references regarding plants and environment. *Brihatsamhita of Varahamihira, Sharangdhar paddhatiby sharangdhar, Charak Samhita, Sushrut Samhita, Kautilya Arthashastra, Parashar, Puranas* has much valuable information regarding life of trees[1]. In ancient time India had achieved a level of agricultural technology is equal to what the knowledge in modern times. V*rikshayurveda* written by *Surapala* between 6th to 12th centuries A.D gives a complete knowledge about cultivation This technique overcomes several issues concerning with plant life such as cultivation, preservation, processing of seeds before planting, preparation of pits, selection of soil, method of irrigation, nourishment, fertilizers and treatment of plant diseases. Hence there is a need to standardize all these ancient techniques on a global platform. Today it becomes evident that chemical inputs show dramatic short term benefits whereas in the longer run they adversely impact the soil, water and perhaps the nutritional quality of the plant. Thus it is evident that there is great scope to integrate traditional practices for better productivity of quality planting material.

All the species of Cucurbitaceae family have been universally accepted for their medicinal as well as nutritional value. Species of this family belonged to wild as well as edible variety which has medicinal and nutritional value. Hence *Alambu* (***Cucurbita maxima*** Duch. ex Lamk.) is one of the specie from Cucurbitaceae family has been selected for the study. *Alambu* cultivation mentioned in *Vrikshayurveda* would give good yield[2]. Today use of chemical fertilizers and pesticides are most accepted parameters to increase the quality and quantity of plants as well as the yielding fruits, which prove hazardous. Organic farming is a recent trend now days which gives a crop its natural and pure form. Thus *Vrikshayurveda* can play a very important role to serve this purpose. Hence the topic aims to prove the effectiveness of *Vrikshayurveda* to the society which will definitely result in the decrease of its hazardous effects and was completely healthy.

Review of Alambu (***Cucurbita maxima*** Duch. ex Lamk.):

Alambu (***Cucurbita maxima*** Duch. ex Lamk.) is a fruit bearing climber belonging to a well-known family Cucurbitaceae. In Ayurvedic literature it is termed under *Alaabu*. Common names are Autumn squash, marrow, pumpkin, squash, winter squash, turban gourd, buttercup squash. Species of this family belong to wild as well as edible variety which has medicinal and nutritional value. It is in flower from July to September, and the seeds ripen from August to October. The species is monoecious (individual flowers are either male or female, but both sexes can be found on the same plant) and is pollinated by Insects. The plant is self-fertile. Leaves are alternately arranged on the stem. The stems in some species are angular. All of the above-ground parts may be hairy with various types of trichomes, which are often hardened and sharp. Spring-like tendrils grow from each node and are branching in some species. *C. maxima* fruits are technically classified as berries; they are highly variable in shape, colour, and size. The shape can be an elongated cylinder, oval, flattened, globular, heart-shaped, or tapering to a curved neck on one or both ends[3]. The oval seeds can be white, cream, orange, or brown. Winter squashes are eaten as a vegetable, mashed or in purees, soups, or pies. The blossoms are also edible, and may be cooked into fritters. According to *Ayurveda* ripe pumpkins can reduce Pitta energy and also help balance Vata. Although pumpkin is somewhat cooling, this quality is reduced when it is cooked especially with ghee. Unripe pumpkins should be avoided as they can aggravate all three humours (*doshas*) and are hard to digest (*Guru*).[4] Pumpkins are detoxifying and thought to help clean the bladder and surrounding organs. Traditionally, pumpkins are believed to sharpen the intellect (*medhya*) and induce calm. Therefore, they are used for a variety of mental imbalances and to reduce stress and agitation. Pumpkins are also great for helping to balance out the metal element of the fall season and prevent illnesses. Weaknesses in the lungs and large intestine often arise during the fall as allergies, asthma and constipation. Pumpkins are sweet and grounding, corresponding to the earth element and can therefore relieve dampness and support digestive, respiratory and overall health. Seeds are high in protein and minerals, and are eaten raw, toasted, or pressed to make oil. Squash contain

mostly carbohydrates, little protein and almost no fat. As its yellow colour indicates, squash is filled with the mineral provitamin A, beta-carotene, as well as calcium and potassium[5]. Squash is filled with soluble vegetable fibre, which provides lasting satiation. The soluble fiber in squash provides a mild laxative effect, making it important for digestive health. Summer squash provides a huge supply of antioxidants, with the skin of squash being especially rich in antioxidants. Steaming and freezing, rather than boiling or microwaving, retains the nutrients within squash. Cooking squash with less water preserves the amount of phenolic compounds, which are associated with colour vibrancy and flavour in vegetables. The carotenoids lutein and zeaxanthin protect the eyes. In order to receive the full spectrum of nutrients that squash has to offer, eat skin, seeds and flesh. Squash consumption is recommended to regulate blood sugar and for those with type-2 diabetes.

Aim: To compare quantitative evaluation of Alambu (***Cucurbita maxima*** Duch. ex Lamk.) fruits grown by *Vrikshayurveda* cultivation method and conventional cultivation practice.

Objectives:

1. Cultivation of *Alambu (**Cucurbita maxima*** Duch. ex Lamk.) as per *Vrikshayurveda* method.
2. Cultivation of *Alambu (**Cucurbita maxima*** Duch. ex Lamk.) as per conventional practice.
3. Quantitative evaluation of *Alambu* (***Cucurbita maxima*** Duch. ex Lamk.) fruits grown by *Vrikshayurveda* cultivation method
4. Quantitative evaluation of *Alambu (**Cucurbita maxima*** Duch. ex Lamk.) fruits grown by conventional cultivation method.

MATERIALS AND METHODOLOGY

1. Materials:

- Soil
- Cow dung
- *Tila* seeds (for preparation of soil)
- *Alambu* seeds *(**Cucurbita maxima*** Duch. ex Lamk.)
- *Tandul Mand* (rice-boiled watery part) } for Irrigation
- Water
- Other farming instruments
- *Gomutra* (Cow urine)
- *Ishtika Churna* (Brick powder)
- Leaves of *Agnimanth (Premna mucronata)* } as a pesticide
- Leaves of *Arka* (*Calotropis gigantean*)
- Leaves of *Sitaphal* (*Annona squamosa*)
- Leaves of *Neem* (*Azadirachta indica*)
- Leaves of *Beshram (Ipomoea carnea*)
- *Tila Khali* (sesame oil cake)
- Thimet (chemical fertilizer)
- Cocopit

➢ **Experimental study**

I. **Soil Preparation** (as per the reference in *Surapala's Vrikshayurveda*)

Soil should be cultivated with tila and when the flowering occurs, the tila plants should be uprooted and smashed in the same soil[6].

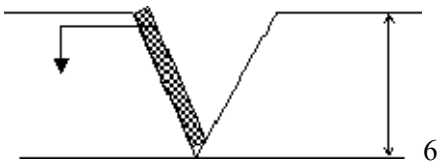
Tila Seeds were collected from local market in the month of July. Tila seeds were sown in the soil in August and after flowering the crops were uprooted in the month of November and mixed in the soil. The soil kept for further cultivation.

a. Soil testing:-

Unprocessed and processed soil was tested from renowned institute. Soil sample was collected in particular manner as-

Procedure for collection of soil sample

- First the land was divided into different homogenous units.
- Surface litter at the sampling spot was removed.
- A "V" shaped cut to a depth of 15 cm was made in the sampling spot by using spade.
- At least 10 to 15 samples were collected from each sampling unit and placed in a tray.
- Thick slices of soil from top to bottom of exposed face of the 'V' shaped cut were removed and placed in a clean container.



1 inch / 2.5 cm

- The samples were thoroughly mixed and foreign materials like roots, stones, pebbles and gravels were removed.
- The bulk was reduced to about half to one kilogram by quartering.
- Quartering was done by dividing the thoroughly mixed sample into four equal parts. The two opposite quarters were discarded and the remaining two quarters were remixed and the process was repeated until the desired sample size was obtained.
- Compartmentalization was done by uniformly spreading the soil over a clean hard surface and divided into smaller compartments by drawing lines along and across the length and breadth. From each compartment a pinch of soil was collected. This process was repeated till the desired quantity of sample is obtained.
- The sample was collected in a clean polythene bag.

Collection of *Alambu* seeds *(Cucurbita maxima* Duch. ex Lamk**.) -** Seeds of Alambu were collected from Dhule (Maharashtra) in the month of October

Seed processing with dry grass ash and cow dung ash

Seed floating test - Seed floating test was done for selection of healthy seeds.

Experimental study had following three groups

Table 1: Three groups with 2 different methods

Group	SEED	SOIL	COMPOST	IRRIGATION
A.	Processed Seeds of Alambu ***(Cucurbita maxima*** Duch. ex Lamk.)	Soil processed with Tila cultivation (Vrikshayurveda)	Cow dung	Water (Daily) + Rice boiled watery part (Tandul mand)- intervals of 7 days
B.	Unprocessed Seeds of Alambu ***(Cucurbita maxima*** Duch. ex Lamk.)	Soil processed with tila cultivation	Cow dung	Water (Daily)
C.	Unprocessed Seeds of Alambu ***(Cucurbita maxima*** Duch. ex Lamk.)	Unprocessed soil	Cow dung	Water (Daily)

Alambu seeds were kept in water, seeds which were floated on the water surface were discarded and re-placed by same number of seeds

Seed sowing in seedling trey

- **Group A – Cocopit + processed soil (*tila* cultivated soil) + cowdung.** Processed 30 seeds were sown in group A Trays
- **Group** B - **Cocopit + unprocessed soil + cowdung** were filled in third Treys. Unprocessed 30 seeds were sown in this Trays
- **Group C – Cocopit + unprocessed soil + cow dung** were filled in third Trays. Unprocessed 30 seeds were sown in these Treys.

Field Preparation:- for each group 5 pits were made.

- Group A and B – Processed soil and cowdung
- Group C- Unprocessed Soil and cowdung.

Composting – cow dung was used and repeated with the interval of one month

Irrigation mentioned in *Surapala's Vrikshayurveda* (*Tandul mand* irrigation gives more fruiting)[7]

Group A – water daily and Tandul mand with the intervals of 7 days. Out of 1250 ml of mand 250 ml was irrigated to one plant.

Tandul mand Preparation - 90gm rice + 16 litre of water (1:14 ratio mand)

Group B and Group C was irrigated by the available tap water source

Procedure for Preparation of *Mand*: Rice: Water ratio 1:14 was taken. It was boiled and the upper starchy layer was used for irrigation (Stale rice-water)

Management of Insect Attack: Treatment mentioned for Insect Attack in Vrikshayurveda[8]

Climbers were infected with insects; they were irrigated with *khalika jala* (sesame seeds cake mixed in water). The spray of *Bhasma (Gomay)* and *ishtika churna* (powder of brick) was sprinkled on affected parts of the climber.

- **Folklore Pesticide[9]**

To control the pest, one pesticide was prepared by using five different leaves of medicinal plants and *gomutra*. Fresh leaves of *Agnimantha (Premna mucronata*), *Sitaphal (Annona squamosa), Arka (Calotropis gigantean), Neem (Azadirachta indica), Beshram (Ipomoea carnea)* were used and collected from institutes herbal garden and nearer source field. *Gomutra* was collected from available *goshala*.

- **Procedure of making pesticide :-**
- All the leaves were taken 5gm each and soaked them in 3 litre of water and 1litre of *gomutra* and kept it 7 days for decomposition.
- After 7 days the mixture were heated and decoction were prepared.
- The decoction was refined by using cloth. ½ litres (500ml) of pesticide were mixed in 1 litre of water and sprayed on climbers.
- It was applicable for Group A and B
- For group C thimet (organophosphate) as an insecticide was used.

Harvesting – It was done when the fruits were green and tender.

1. Observations and Results:

Soil testing – Above table shows increased level of ferrous sulphate, potassium, Alkali, and Zinc in processed soil. Copper, phosphorus, organic carbon, Manganese were decreased in processed soil. pH- Both the soil had medium alkaline in nature.

Table 2: Soil Analysis of Processed and Unprocessed

Sr. No.	Parameters/Micro Nutrients	**Unprocessed soil**	Remark	**processed soil**	Remark
1.	Copper (cu)	2.44	Enough	2.10	Enough
2.	Ferrous sulphate (Feso4)	2.20	Less	9.96	Enough
3.	Zinc (zn)	1.62	Enough	6.56	Enough
4.	Manganese (Mn)	2.76	Enough	1.86	Less
5.	pH	8.12	Medium alkaline	8.14	Medium alkaline
6.	Alkali	0.18	Average	0.23	Average
7.	Organic carbon	0.81	More	0.72	More than average
8.	Phosphorous	7.84	Less	6.58	Very less
9.	Potassium	692.84	Abundant	725.58	Abundant

Germination Time – Germination was seen earlier in Group A than Group B and Group C.

Table 3: Germination time

Group	**A**	**B**	**C**
DAYS	**3rd**	**5th**	**5th**

Germination Rate – Group A has 93% Group B has 83% and Group c has 80% germination rate. Germination rate of Group A>Group B>Group C

Table 4: Germination Rate

Sr. No.	Name of the seed	Cucurbita maxima Duch. ex Lamk. Duch. ex Lamk. Duch. ex Lamk.		
1.	Treatments	A	B	C
2.	No. seeds planted	30	30	30
3.	No. seeds that germinated	28	25	24
4.	Fraction of seeds that germinated	28/30	25/30	24/30
5.	Fraction with denomination of 100	93/100	83/100	80/100
6.	Percentage of seed that germinated	93%	83%	80%

Flowering time – Flowering time is the onset of flowering so only first flowering was recorded of each group. Average flowering time was calculated as below**.** On an average flowering was seen earlier in group A followed by group B and then in Group C.

Fruiting Time - Fruiting time is the onset of fruiting so only first fruiting time was recorded of each group. On an average fruiting time was seen earlier in Group A than Group B and Group C

Table 5: Average flowering and fruiting time

Groups	A	B	C
Average flowering time (days)	61st	62nd	63rd
Average fruiting time (days)	82th	83rd	84th

Number of Flowers - Number of flowers was recorded group wise at the interval of seven days and it was observed until the first fruit was appeared in the respective group**.** In group A, Group B and Group C 19, 17, 14 flowers were observed respectively.

Flowering rate – flowering rate Group A was maximum than that Group B and Group C i.e. Group A > Group B > Group C

Number of Fruits - Number of fruits was recorded group wise at the interval of seven days and it was observed until the first fruit was appeared in the respective group**.** In group A, Group B and Group C 10, 7, 7 fruits were observed respectively.

Fruiting Rate: Fruiting rate of Group A was maximum than Group B and Group C

Table 6: Flowering Rate and fruiting rate

Groups	A	B	C
Total flowers	19	17	14
Flowering rate	38%	34%	28%
Total no. Of fruits	10	7	7
Fruiting rate	41%	29%	29%

Yield: Average yield was found to be more in Group A as compared to Group B and Group C.

Table 7: Average yield

Groups	**No. of Fruits**	**Weight of the fruits**	**Average Weight of fruits**
A	10	11788gm	1178.8gm
B	7	7856gm	1122.2gm
C	7	7345gm	1049.2gm

DISCUSSION

In processed soil ferrous sulphate, zinc, Alkali content, potassium was increased. Copper, manganese, phosphorous, organic carbon content decreased in processed soil. pH of both the soil sample was medium alkaline and it was slightly raised in processed soil. *Tila* contains most of these micronutrients. Due to soil processed with *tila* cultivation these results were observed.

Seed processing is not only effective for fast germination but also it is effective for higher germination percentage. In *Vrikshayurveda* various seed processing methods are mentioned. In this method dry grass ash and cow dung ash was used for seed processing. This process widely used for preservation of seeds. In ancient days Ash was used by farmers as a preservative medium for the storage of seeds. This can be because ash contains anti insect or pesticide properties which prevents insect attack on the seeds. Beside this ash also contains various micronutrients in itself. This helps in the germination of the seeds. In Group A processed seeds were used but in group B and group C unprocessed seeds were used. For better germination this process can be performed.

All cucurbits are prone to powdery mildew. Plants absorb nutrients from soil but due to sticky coating, plants may be unable to get the nutrients. This may be the reason behind more pests to the Group A. Various types of pesticide were used for the three groups. In Group B insect attack was decreased by *Vrikshayurveda* method. This may be happened due to use of Bhasma (*Gomay*). In Group A this method was not worked because of sticky coating of soil.

The second treatment (folklore method) proved effective for Group A and Group B may be due to all those medicinal plants having *Krimighna* effect and *Gomutra* also having antifungal property. In case of Group A *Tandul mand* was stopped, it may have been helpful to control the pests. *Gomutra* also acts as a plant growth enhancer[10-15].

Thimet (organophosphate compound) is a type of chemical pesticide was used for group C.

Yield was recorded in terms of Number of fruits and average weight of the fruits. Result of yield (as shown in table no.7) group A had more number of fruits than group B and group C. All fruit were weighed individually and average weight of each group calculated separately. Yield was observed more in group A than group B and C (as shown in table no.7), may be due to the effect of technique mentioned in *Vrikshayurveda* for *Alambu* irrigation (*Tandul mand*). Because rice contains amino acids, vitamin B and vitamin E, minerals like phosphorous, calcium, iron, zinc, magnesium, and potassium. These minerals are required for overall growth of plants and more yield.

CONCLUSION

On the basis of flowering fruiting and yield, Group A (*Vrikshayurveda* method irrigation technique) showed good results than Group B (*Vrikshayurveda* Soil processing) and Group C (Conventional practice). Hence, Quantitatively *Vrikshayurveda* cultivation method showed good results than conventional cultivation practice.

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Photos of Cultivation of Alambu:

Figure 2 Soil preparation with tila cultivation

Figure 1 Seed germination

Figure 4 Group A flowering and fruiting

Figure 5 Group B flowering and fruiting

Figure 3 Group C flowering and fruiting

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