

VEGETATIVE PROPAGATION OF VARIOUS PLANT SPECIES

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BOTANY



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DECLARATION

We hereby declare that the Research work presented in this Dissertation entitled “**Vegetative Propagation of various plant species**” is original work carried out by us under the supervision of **Dr. B. Sadasivaiah**, Department of Botany, Dr. BRR Government Degree College, Jadcherla during the period 2022-2023 for the award of the degree of Student Study Project in Botany. The research work is original and no part of the work has been submitted for the award of any degree or diploma of this College or any other College/University.

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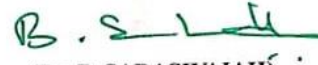



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*..... **Geetha, Sadiya Tabassum, Sumalatha, Pavani, Pavani***

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INTRODUCTION

The use of natural plant remedies around the world has created the need for information about the properties and uses of the medicinal plant. Standardization of plant and herbal materials is the activity of assigning a set of standard or inherent characteristics definitive qualitative and quantitative values which give the assurance of quality efficacy safety and reprehensibility. Proximate analysis for plants gives added information and help to access the quality of the plant raw material samples. It gives information on moisture content. ash content fixed carbon etc. Ash is the inorganic residue remaining after water and organic matter have been removed by heating which provides a measure of total amount of minerals within the drug. Ashes give us an idea of the mineral matter contained in a plant. Measuring it is important because mineral matter may be the cause of a pharmacological effects. The propagation and use of ornamental plants has been following the growing interest of the population in improving the quality of life increasing investment in Landscaping environment and generating a demand for particular production techniques of different species.

The genus *Costus* is of perennial tropical herbaceous flowering plants belong to the family Costaceae. It is widely cultivated in South India and also grows wild in many places. It is recently introduced by America as an herbal cure for diabetes; hence it is commonly known as insulin plant *C. pictus* is also well known for its medicinal value mainly antiseptic. Tonic aphrodisiac carminative stoma-chic and vermiform (Been and Reedy 2010).It is able to prevent the hair turning grey and it's root is anodyne antibacterial properties. It is widely used as a remedy for diabetes. Powdered leaves of *C. Pictus* known to possess therapeutic effects when supplemented to streptomycin induced diabetes rats is found to reduce blood glucose levels by 21% after 15 days of supplementation (Jayasri 2008). The methanolic leaf extract of *C. Pictus* is used to lower blood glucose levels in alloxan induced diabetic rats. (Jothivel, 2007). It's natural strands are fast disappeared due to its indiscriminate collection over exploitation natural resources for commercial purpose and to meet the requirements whereas convention propagation is hampered due to its poor seed viability low rate of germination and poor rooting ability or vegetative cutting. Therefore alternative propagation method would be beneficial in accelerating large scale multiplication improvement and conservation of the plant. The present study aims to develop the high frequency regeneration in *C. Pictus*.

Tinospora cordifolia (Willd.) Miers ex Hook. F & Thomas (Menispermaceae) is a large woody climber. The young stem is green cylindrical and smooth. The mature stem has warts on surface hanging aerial roots and peeling bark which is creamy white. Leaves are percolated cordate and percolated cordate and membranous. The flowers are small and yellow. The male flowers are clustered and female flowers are usually solitary. The fruits (drupes) are fleshy ovoid red single seeded and pea- sized the seeds are curved. Flowers grow during the summer and fruits during the winter.

Many plant species especially ornamental plants and some of the medicinal plants can be propagated through stem cuttings. Generally growth regulatory hormones like Auxins used for the growth. There no works done without growth regulatory hormones and there is no proper alternative to auxins. Hence, the present work was undertaken with the following objectives.

- To know the growth pattern of various plant species by using various natural substratum as growth regulator.
- To know the Axillary Bud Proliferation (ABP) of the species
- To know the leaf growth of the species
- To propose key strategies for effective vegetative propagation and alternate growth regulator for ornamental species and medicinal plants.

REVIEW OF LITERATURE

Leonardo (2022) worked on production of *Acalypha wilkesiana* seedlings using stem cuttings. The propagation and use of ornamental plants has been following the growing interest of life. Increasing improving the quality of life increasing investment in and spacing environments and gen-easing a demand for particular production techniques of different species (Alencar & Cardoso, 2015; Loss, 2015).

Acalypha wilkesiana also known as in addition to this function, so (2016) mention that red leaves of *Acalypha wilkesiana* can be implanted in the management of parasitic nematodes in agricultural crops, Nagamoto (2011), also highlight the possibility of using *Acalypha* in granulated baits to center leaf-cutting ants. The propagation of this species can be carried out by stem cutting (Lorenzo, 2015).

Fechnello (1995) mentioned that cuttings with larger diameters have higher levels of reserve also have high rates of shoots, impairing root formation. This may have occurred in this work, as the herbaceous type cuttings presented a higher NR compared to semi-woody and woody cuttings (Table 1). This is probably related to the fact that the highest concentrations of free auxin in plants are found in the apical meristems of the shoot and young leaves, as they are the main sites of biosynthesis of this.

Costus pictus

The genus *Costus* is of perennial tropical herbaceous flowering plants belongs to the family Costaceae. It is widely cultivated in South India and also grows wild in many places. It is a recently introduce by America as an herbal cure for diabetes; hence it is commonly known as 'insulin plant.' *C. pictus* is also well known for its medicinal value mainly antiseptic, tonic aphrodisiac, carminative, stoma-chic and vermifuge (Beena and Reddy, 2010). It is able to prevent the hair turning grey and its root is anodyne, antibacterial properties. It is widely used as a remedy for diabetes, powdered leaves of *C. pictus* known to possess therapeutic effect, when supplemented to streptozotocin induced diabetic rats, is found to reduce blood glucose level by 21% after 15 days of supplementation (Jayasri, 2008). The methanolic leaf extract of *C. pictus* is used to lower blood glucose level in alloxan induced diabetic rats (Jothivel, 2007).

Its natural strands are fast disappeared due to its indiscriminate collection, over exploitation, natural resources for commercial purposes and to meet the requirements whereas conventional propagation is hampered due to its poor seed viability, low rate of germination

and poor rooting ability of vegetative cuttings, Therefore alternative propagation methods would be beneficial in accelerating large scale multiplication, improvement and conservation of the plant. The present study aims to develop the high frequency regeneration in *C. pictus*.

Tinospora cordifolia (Willd.) Miers ex Hook.f. & Thoms. (Menispermaceae) is a large woody climber. The young stem is green, cylindrical and smooth. The mature stem has warts on surface, hanging aerial roots and peeling bark which is creamy-white. Leaves are petiolated, cordate and membranous. The flower are small and yellow. The male flowers are clustered and female flowers are usually solitary. The fruits (drupes) are fleshy, ovoid, red, single seeded and pea-sized. The seeds are curved. Flowers grow during the summer and fruits during the winter. It is popularly known as Giloy and is widely used in Ayurveda system of medicine. The various herbal products of Giloy are available in Indian market to lower down the diabetes and to boost up the immune system of the body.

METHODOLOGY

Before starting our project work three types of soil were taken. Namely black soil, cattle dung and red soil, were taken as three types of soil. All the three types of soil were placed

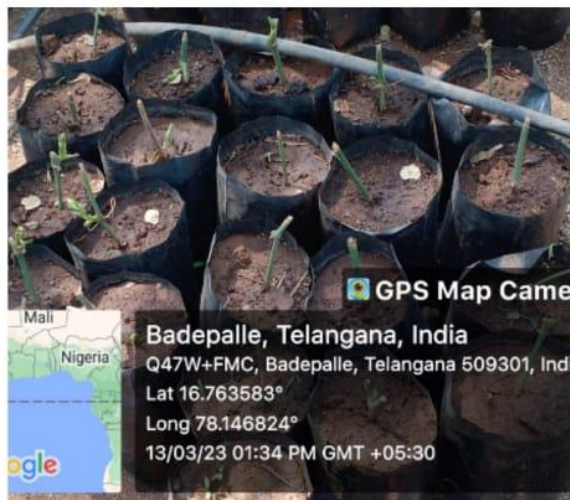
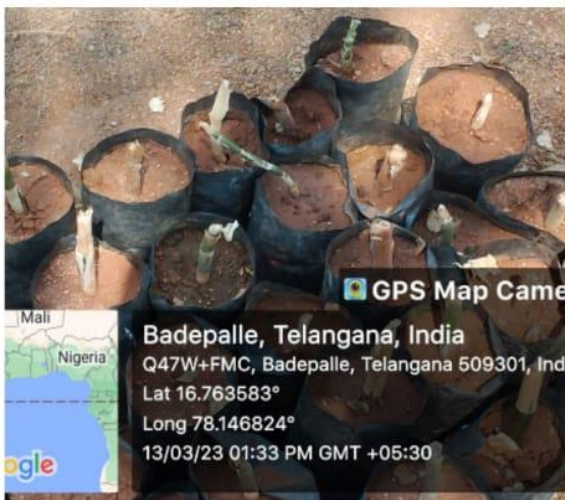
together about two 2:4:1 ratio of black soil, red soil and farmyard manure was taken and mixed. The mixture of these soils were used to fill in the selected polythene covers for plantation. The selected plants for the present study are *Acalypha wilkesiana*, *Tinospora cordifolia*, *Costus pictus* and *Ampelocissus latifolia*.

The stem cuttings of above plants were collected from Telangana Botanical Garden, Dr. BRR Government Degree College, Jadcherla. The length of the stem cuttings was 15cm each for all the species. All the stem cuttings were soaked in the extract of *Aloe vera* for 15 minutes and planted in the covers and the tips of the stem cuttings were closed with cow dung. Water was given every day. After 15 days the plants were observed for Axillary Bud Proliferation (ABP) and the initiation of Leaves. To know the vegetative growth analysis it selected plants Drava Jeevamrutham, vermicompost, DAP, Farmyard manure and control were selected as different Fertilizer categories and 20 stem cuttings were planted in 4x8cm polyethylene cover. The Axillary Bud Proliferation (ABP) and the number of leaves were counted on every 15 days interval. The photographs showing methodology in **Plate-1, 2**.

Plate 1: Methodology



Plate 2: Methodology



RESULTS OF DISCUSSIONS

The selected species for vegetative propagation are *Acalypha wilkesiana* (Euphorbiaceae), *Ampelocissus latifolia* (Vitaceae), *Costus pictus* (Costaceae) and *Tinospora cordifolia* (Menispermaceae). The detailed descriptions of the selected species are mentioned below.

Acalypha wilkesiana Muell. Arg. in DC. Prodr. 15(2): 817. 1866. Pax in Engl., Pflanzenreich 4. 147. 16: 153. 1924.

A much-branched monoecious shrub up to 4.5 m. Young shoots tomentose, later puberulous. Petioles (1-) 2-5 (-9) cm long. Leaf-blade broadly ovate, 5-17 (-25) x 5-13 cm, shortly obtusely or acutely acuminate, rounded-cuneate to cordate, crenate-serrate, 7-11-nerved from the base, sparingly pubescent above and beneath at first, especially along the midrib and main veins, later subglabrescent, often copper- or bronze-coloured, sometimes white- or pink-margined (var. *marginata* Mill.) or variegated. Stipules subulate, 1-1.5 cm long. Inflorescences axillary, solitary, unisexual, spicate; the males up to 7 cm long, fairly dense-flowered, with a pubescent axis and lanceolate bracts c. 1 mm long; the females up to 12 cm long, lax-flowered, with a puberulous axis; female bracts 7-13-partite, the median lobe broadly ovate and accrescent to 5 mm long and 3 mm wide, the laterals smaller and narrower, 1-flowered. Male flowers sessile; buds tetragonal, pubescent. Female flowers sessile; sepals 3-4, ovate-lanceolate, 1 mm long, acute; ovary subglobose-trilobate, 1 mm diam, densely pubescent; styles united at the base, (5-) 7-9 mm long, lacinate, yellowish-or greenish-white, occasionally reddish. Fruits trilobate, 1.5-2 mm long, 4 mm diam., smooth, pubescent.

The growth analysis of *Acalypha wilkesiana* are presented in **Table-1**. The analysis shows that the average Axillary Bud Proliferation (ABP) was observed more in DAP (9) followed by Drava Jeevamrutham (5), Vermicompost (4) Farmyard manure (2) and control (1) in first 15 days.

Table. 1: Vegetative growth analysis of *Acalypha wilkesiana*

Date	Drava Jeevamrutham	Vermicompost	DAP	Farmyard Manure	Control
01-03-2023	0	0	0	0	0
15/3/2023	ABP- 5	ABP- 4	ABP- 9	ABP- 2	ABP- 1
	L-5-6	L-2-3	L-2-5	L-0	L - 0
01-04-2023	ABP-8	ABP-6	ABP-11	ABP-5	ABP-3
	L-6-22	L-4-24	L-3-29	L-9-18	L -13-19
15/4/2023	ABP-10	ABP-6	ABP-11	ABP-6	ABP-4
	L-12-28	L-13-30	L-9-30	L-13-20	L -15-19
01-05-2023	ABP-15	ABP-12	ABP-12	ABP-8	ABP-7
	L-4-34	L-12-44	L-16-36	L-3-30	L -8-20
15/5/2023	ABP-18	ABP-15	ABP-18	ABP-10	ABP-13
	L-12-46	L-11-49	L-22-39	L-9-32	L-8-48

Under Drava Jeevamrutham fertilizer *Acalypha wilkesiana* shows gradual increase of Axillary Bud proliferation from 5-18 and the total Leaf count from 5 to 46 within 75 days. Under Vermicompost category the Axillary Bud Proliferation was also has gradual increase from 4 to 15 and the Leaf count was also improved from 2-49 leaves. Under DAP category the ABP was high in first 15 days and gradually decreasing. After 75 days the ABP was resulted 18 and the leaf count was from 2-39 leaves. Under Farmyard manure category the gradual Increase of axillary bud proliferation was observed from 9-10 and the leaf count was from 5-32 leaves. In the control category, the ABP was initially less with 1 sprouting and increased with time up to 13 axillary bud proliferation. The leaf count was increased rapidly in one month period and it increased up to 48 leaves.

Totally *Acalypha wilkesiana* is not showing positive correlation with various fertilizers, because control also showing good number of ABPs and leaf count after the study period i.e 15 days. The photographic representation of *Acalypha wilkesiana* growth analysis presented in **Plate-3**.

Plate 3: *Acalypha wilkesiana*



Ampelocissus latifolia (Roxb.) Planch. in Journ. Vigne Am. 1884: 374. 1884. in DC., Monogr. Phaner. 5:370. 1887; Yasuiti Momiyama in Ohashi, Fl. E. Him. 3:80. 1975.

A weak herbaceous climber, with a tuberous root stock; stem and branches hollow more or less glabrous, young parts puberulous. Leaves orbicular or broadly cordate 7-15 x 8-15 cm, 3-7 lobed, lobes acute, serrate-dentate, \pm glabrous on both sides; petiole 3-5 cm long, stipules minute, deciduous. Inflorescence a compact thyrsoid cyme; peduncle 6-7 cm long, ending in a long bifurcate tendril. Flowers numerous, deep reddish. Calyx truncate or obscurely 5-toothed. Petals 5, oblong. Ovary 10-lobed at apex, sunken in the disc, style absent; stigma cup-shaped. Berry globose, black, 6-7 mm, 2

seeded, rarely 3 seeded. Seeds elliptical, margin rugose, transversely with a linear tubercle on the back and bluntly ridged on the face.

The vegetative growth analysis mentioned below in Table 2 and Plate 4.

Table 2: Vegetative growth analysis of <i>Ampelocissus latifolia</i>					
Date	Jeevamrutham	Vermicompost	DAP	Farmyard Manure	Control
01-03-2023	0	0	0	0	0
15/3/2023	0	ABP- 1	0	0	0
	L-1-	L-2-6	L-3-5	L-5-9	L - 2
01-04-2023	0	ABP- 1	0	0	0
	L-1-2	L-4-10	L-1-10	L-2-11	L - 1-3
15/4/2023	0	ABP-2	ABP-01	ABP- 2	ABP- 1
	L-3	L-6-13	L-6-11	L-9-11	L - 1- 6
01-05-2023	ABP- 1	ABP-2	ABP-01	ABP-4	ABP-3
	L-3-5	L-5-15	L-10-11	L-10-13	L - 10-13
15/5/2023	ABP- 1	ABP- 4	ABP-01	ABP-5	ABP-3
	L-6-8	L-5-36		L-28-35	L - 10-35

According to **Table 2**, the average axillary bud proliferation was observed more in DAP (9) followed by Drava Jeevamrutham (5), Vermicompost (4) Farmyard manure (2) and control (1) in first 15 days.

Under DAP Category the gradual Increase of axillary bud proliferation was observed from 1-3 and the leaf count was from 1-35 leaves. Under Vermicompost category the axillary bud proliferation was also has gradual increased from 4 to 15 and the leaf count was also improved from 2-49 leaves. Under DAP category the ABP was high in first 15 and gradually decreasing. After the 75 days the ABP was resulted 18 and the leaf count was from 2-39 leaves. Under Farmyard manure Category the gradual Increase of axillary bud proliferation was observed from 9-10 and the leaf count was from 5-32 leaves. In the control category, the axillary bud proliferation was initially less with 1 ABP and increased with time up to 3 ABPs. The leaf count was increased rapidly in one month period and it increased up to 35 leaves. *Ampelocissus latifolia* is showing positive correlation with farmyard manure in terms of ABP and Leaf count.

Plate 4: Vegetative growth analysis of *Ampelocissus latifolia*



Costus speciosus (J. Koenig) Smith in Trans. Linn. Soc. London 1: 2499 1800; FBI 6: 249. 1892; Fischer in Gamble 3: 1490. 1928; FAP 3: 923. 1997 Banksea speciosa J. Koenig in Retz., Obs. Bot. 3: 75. 1783.

Plants to 2 m tall. Stem twisted. Leaves spiral, to 25 x 7 cm, elliptic- acuminate, pubescent; sheaths tubular, ca. 5 cm long; ligules indistinct. Flowers in terminal, globose heads; bracts oblong-obtuse, mucronate, ca. 3 cm long, reddish. Corolla white; labellum yellow at the centre. Capsules globose. Rare, in moist localities in deciduous forests.

The vegetative growth analysis of *Costus pictus* was mentioned in **Table 3** and the pictures presented in **Plate 5**.

Table 3: Vegetative growth analysis of *Costus pictus*

Date	Jeevamrutham	Vermicompost	DAP	Farmyard Manure	Control
01-03-2023	0	0	0	0	0
15/3/2023	0	0	0	0	0
	0	0	0	0	0
01-04-2023	ABP-3	ABP-4	ABP-1	ABP-3	ABP-0
	L-2-5	L-2-5	0	0	0
15/4/2023	ABP-5	ABP-6	ABP-3	ABP-3	ABP-0
	L-2-4	L-2-3	L-2-3	L-1-2	L1-3
01-05-2023	ABP-10	ABP-12	ABP-10	ABP-9	ABP-3
	L-3-6	L-2-4	L-3-5	L-2-4	L -2-3
15/5/2023	ABP-18	ABP-17	ABP-17	ABP- 16	ABP-18
	L-9-12	L-8-15	L-8-13	L-6-15	L -6-14

There is no Axillary Bud Proliferation (ABP) was observed more in first 30 days. An average ABP was recorded in Vermicompost (4), DAP (1), Drava Jeevamrutham(3), Farmyard manure(3), and control (0)in first 15days. Under vermicompost fertilizer *Costus pictus* shows gradual increase of Axillary bud proliferation from 4-17 and the leaf count from 5-15 within 75 days. Under Jeevamrutham category the Axillary Bud Proliferation was also has gradual increase from 3-18 and the leaf count was also improved 3-12 leaves. Under Farmyard manure category the Axillary Bud Proliferation was high in first 30 days and gradually increasing. After the 75 days the Axillary bud proliferation resulted 16 and the leaf count was from 1-15 leaves. Under DAP category from gradual increase of Axillary bud proliferation was observed from 1-17 and the leaf count was from 2-13 leaves. In the control category there no ABP was overserved up to 60 days and within next 15 days with 18 ABPs and 14 leaves. The ABP was very less and after 60 days ABP rapidly increased up to 14-18 in next 15 days with 14 leaves.

Costus pictus is not showing positive relation with various fertilizers, because control is also showing good number of Axillary bud proliferation and leaf count after the study period. The photographic representation *Costus pictus* was presented in **Plate 5**.

Plate 5: *Costus pictus*



Tinospora cordifolia

A tall climber. Stem c. 6.5 cm in diameter, smooth, shining, lenticellate, bark light grey, papery, branches pubescent. Leaves c. 7.5-13.8 cm long, 9-17 cm broad, broadly ovate or orbicular, deeply cordate at the base, 7-nerved, subacuminate, young pubescent above, tomentose beneath; petiole 5-12.3 cm long, thickened and twisted at the base. Flowers greenish yellow in racemes 7-14 cm long, pedicels slender, usually solitary in the female, clustered in the male. Male flowers: sepals 6 in 2 series, the outer ones small, ovate-oblong, obtuse, concave, the inner large suborbicular, membranous, flat, 2.5-4 mm long, 2-3 mm broad; petals

subequal, 2-3 mm long, 1.2-1.8 mm broad, clawed, membranous, smaller than the sepals; stamens 6, filaments free, 2.5-3 mm long, thickened at the apex. Female flowers: sepals and petals as in the male flowers; staminodes 6; carpels 3. Drupes 1-3, ovoid, 6-9 mm long, 4-5 mm broad, smooth, crimson, endocarp tubercled.

The vegetative growth analysis of *Tinospora cordifolia* is shown in **Table 4** and the pictures shown in **Plate 6**.

Table 4. <i>Tinospora cordifolia</i>					
Date	Drava Jeevamrutham	Vermicompost	DAP	Farmyard Manure	Control
03-01-2023	0	0	0	0	0
15/3/2023	0	0	0	ABP- 2	ABP-0
	L-3-3	L-3-5	L-9-5	L-1-1	L - 1-3
01-04-2023	0	ABP- 1	ABP-1	ABP-4	ABP-0
	L-4-8	L-1-7	L-2-17	L-6-14	L - 1-6
15/4/2023	ABP- 1	ABP-2	ABP-3	ABP-4	0
	L-4-15	L-6-8	L-4-19	L-10-15	L - 2-8
01-05-2023	ABP-2	ABP-2	ABP-3	ABP-9	0
	L-8-20	L-8-14	L-12-25	L-9-17	L -2- 8
15/5/2023	ABP-3	ABP-5	ABP-5	ABP-15	ABP-1
	L-2-34	L-13-14	L-22-24	L-26-37	L - 13

According to Table 1, the average axillary bud proliferation was observed more in Farmyard Manure (20) followed by Drava Jeevamrutham (0), Vermicompost (0) farmyard manure (0) and control (0) in the first 15 days. Under farmyard Manure category the gradual increase of axillary bud proliferation was observed from 4-15 and the leaf count was from 1-37 leaves. Under Vermicompost category the axillary bud proliferation was also gradually increased from 1-5 and the leaf count was also improved from 3-14 leaves. Under DAP category the axillary bud proliferation was high in the first axillary bud proliferation days and gradually decreasing. After 75 days the axillary bud proliferation was 5 and the leaf count was from 5-24 leaves. Under Jeevamrutham Category the gradual increase of axillary bud proliferation was observed from 1-3 and the leaf count was from leaves. In the control category, the axillary bud proliferation was initially less with 1 sprouting and increased with

time up to 1 axillary bud proliferation. The leaf count was too increased rapidly in one month period and it increased up to 13 leaves.

Totally *Tinospora cordifolia* is not showing positive correlation with various fertilizers, because control also showing good number of axillary bud proliferation and leaf count after the study period i.e 15 days. The photographic representation of *Tinospora cordifolia* growth analysis dictated.

Plate 6: *Tinospora cordifolia*



SUMMARY & CONCLUSIONS

Under Drava Jeevamrutham fertilizer *Acalypha wilkesiana* shows gradual increase of Axillary Bud proliferation from 5-18 and the total Leaf count from 5 to 46 within 75 days. Under DAP category the ABP was high in first 15 days and gradually decreasing. After 75 days the ABP was resulted 18 and the leaf count was from 2-39 leaves.

Under DAP Category the gradual Increase of axillary bud proliferation was observed from 1-3 and the leaf count was from 1-35 leaves in *Ampelocissus latifolia*. Under Vermicompost category the axillary bud proliferation was also has gradual increased from 4 to 15 and the leaf count was also improved from 2-49 leaves.

There is no Axillary Bud Proliferation (ABP) was observed more in first 30 days in *Costus pictus*. An average ABP was recorded in Vermicompost (4), DAP (1), Drava Jeevamrutham(3), Farmyard manure(3), and control (0)in first 15days. Under vermicompost fertilizer *Costus pictus* shows gradual increase of Axillary bud proliferation from 4-17 and the leaf count from 5-15 within 75 days. The ABP was very less and after 60 days ABP rapidly increased up to 14-18 in next 15 days with 14 leaves.

The average axillary bud proliferation was observed more in Farmyard Manure (20) followed by Drava Jeevamrutham (0), Vermicompost (0) farmyard manure (0) and control (0) in) First 15 days. Under farmyard Manure category the gradual Increase of axillary bud proliferation was observed from 4-15 and the leaf count was from 1-37 leaves. Under Vermicompost category the axillary bud proliferation was also has gradual increased from 1-5 and the leaf count was also Improved from 3-14 leaves.

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