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Role of different elements on growth & development of *Piper betle* Linn. in vivo

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Abstract : *Piper betle* Linn. is climbing shrub belongs to the family Piperaceae and commonly known as 'Paan'. It is economically and medicinally very important plant. In the present investigation, an attempt has been made to know the different elements which are responsible for better growth and developement of *Piper betle* L., so that it can be cultivated in large scale. 15 Plants were divided into 3 batches, first batch was used as control (only water and no nutition), second was sprayed with six elements (Ca+Mg+Mn+Fe+Cu+Zn), and third with MHS (Modified hoagland solution) for 120 days and continued upto 220 days and physical characteristics of leaves were observed during this period. Among three batches third batch (sprayed with MHS) was proved to be best for improvement of physical parameters where an average length of the leaves were increased 12.06% (after 120 days) and 14.34% (after 220 days), width 12.29 % (after 120 days) and 13.34 % (after 220 days), area 15.98 % (120 days) and 12.44 % (220 days), weight 16.36 % (120 days) and 12.18 % (220 days). Taste and color of the leaves were also improved.

Keywords : *Piper betle* L. , *in vivo,* Ca, Mg, Mn, Fe, Cu, Zn, MHS

INTRODUCTION

Piper betle Linn. is climbing shrub belongs to the family Piperaceae (Samba *et al.*)[1]. It is commonly known as Pan (in Hindi), Betel (in English) and Tamboola (in Sanskrit). *Piper betle* is propably native of Malaysia but cultivated in India. The habit of betel leaf chewing is common throughout India. It is widely cultivated in West Bengal, Orissa, Madhya Pradesh, Maharastra and Uttar Pradesh. It is cultivated in soils, which are black, friable, containing large proportion of organic matter. Some varieties of *P. betle* which are commonly grown in Bihar and Jharkhand are Maghi Paan, Mitha Patti, Sanchi and Kapurkath. *Piper betle* produces many biologically active compounds and they are medicinally used in different ways. Chavicol, Eugenol, Tanin (Duke,1992)[2], Tritriacontane (Parmer *et al.*,1998)[3], 4-Allyl resorcinol (Ghosh *et al.*,2001)[4], Ursonic acid (Saeed *et al*, 1993)[5], Piperine (Parmer *et al.*, 1998)[3] are some chemicals present in different parts of *Piper betle.* All parts of *Piper betle* is used as medicine like in foulness of mouth (Samba *et al.*,1987)[1], as contraceptive (Khosa and Singh, 1972)[6], in wounds, boils, wart and moles (Niazi and Niazi, 2001)[7], improved fragrance and flavour (Mitani *et al*., 2000)[8], as mouth freshener, antidiabetic (Challem *et al*., 2000)[9], anticancer (Joseph *et al*., 2001)[10], analgesic (Taylor, 2005)[11] etc.

Hence, *Piper betle* is economically and medicinally very important plant and it is essential to cultivate *P. betle* in large scale, but in Jharkhand the cultivation of *P. betle* is very dismal. Various factors can be responsible for the poor quality and low yield of *P. betle*. Das *et al*., worked on the role of growth regulators of betel vine cutting. IBA and NAA at 50-100 ppm were used singly or in combination to initiate rooting of betel vine in pots. Johari and Chourasia, 1998, were spray and drenching of potassium salt of

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phosphoric acid at monthly interval to check the leaf & foot rot diseases of *Piper betle*. Therefore, present study was conducted to know the different elements which are responsible for better growth & development of *P. betle* L., so that it can be cultivated in large scale in Jharkhand.

MATERIALS & METHODS

For *in vivo* morphogenic studies of *Pipes betle.*, 15 plants were divided into 3 batches and grown under controlled condition. Various elements essential for the plant were applied as foliar fertilizers. Their plantation was done while taking into consideration all physical parametres likeproper shade, temperature, humidity etc., which are essential for their growth. Out of 3 batches first batch was used as control (only watered and no nutrition), second batch was sprayed with a combination of six elements ($CaCl_2 . 2H_2O + MgSO_4 . 7H_2O + MnSO_4 . 4H_2O + CuSO_4 . 5H_2O + ZnSO_4 . 4H_2O + FeSO_4$) and third batch was sprayed with only modified Hoagland solution (MHS). All these elements were sprayed in 10 ppm concentration with an interval of 10 days and was observed for 120 days. The process of spray was then continued up to 220 days with an interval of 10 days. The physical characteristics like length, width and weight of leaves of all the batches were observed from early stage to after 220 days and measurement were taken accurately.

Preparation of Stock Solution :

Stock solution of six elements and MHS were being prepared and kept as stock solution in the following manner-

Preparation of Stock Solution of 6 Element:

For the preparation of 1000 ppm element solution, 1 gm of all the six elements were accurately weighed and dissolve in double glass distilled water and solution made one litre. The prepared solution was kept in a measuring botle inside refrigerator.

Preparation of Stock Solution of Modified Hoagland Solution (MHS):

The Hoagland solution is a hydroponic nutrient solution that was developed by Hoagland and Arnon in 1933. The Hoagland solution has a lot of N and K so it is very well suited for the development of large variety of plant species. In the present study MHS was prepared as described by Taiz and Zeiger (2000).

Weighing of sample:

The collected, washed and dried samples (leaves) were weighed using electronic balance. Fresh weight obtained was recorded.

Measurement of area of the sample:

Growth of plants were assessed in terms of leaves area only. The sample were washed in distilled water and area were measured by graph method.

RESULTS & DISCUSSION

In the present investigation, growth and development of leaves of *P. betle* were observed upto 220 days after the foliar spray of six elements and MHS. The initial length, width, area and weight (wet) of leaves of each plant of all batches are shown in Table:1. Cummulative size and weight of *P. betle* leaf in research area is shown in Table:2.

After 120 days an average length of leaf was increased from 4.68 cm to 5.06 cm (8.11%), width was 4.34 cm to 4.76 cm (9.67%), area was 18.18 cm^2 to 20.08 cm^2 (10.45%) and weight was 0.73 gm to 0.81gm (11.41%) in first batch sprayed with water (control). In second batch (sprayed with six elements), an average length of leaves was increased from 4.7 cm to 5.24 cm (11.49%), width 4.26 cm to 4.7 cm (10.32%), area 17.24 to 19.78 cm^2 (14.73%) and weight 0.71 gm to 0.79 gm (12.30%). In third batch sprayed with MHS, an average length increased from 3.98 cm to 4.46 cm (12.06%), width 3.74 cm to 4.2cm (12.29%), area 14.76 to 17.12 cm^2 (15.98%), and weight 0.55 gm to 0.64 gm (16.36%). (shown in table: 3, Graph:3.1).

Initial size and weight of *Piper bettle* Linn. leaf in research area –

Table:1

Batch	Sample	Size (cms.)		Weight (gms.)
		Length	Width	Wet
1	1	5.6cm	5.1cm	0.8186
	2	5.2cm	4.8cm	0.9902
	3	4.4cm	4.0cm	0.6318
	4	3.8cm	3.5cm	0.5554
	5	4.4cm	4.3cm	0.702
2	1	5.5cm	4.8cm	0.5674
	2	3.7cm	3.5cm	1.0192
	3	5.4cm	5.1cm	0.5804
	4	4.8cm	4.1cm	0.6365
	5	4.1cm	3.8cm	0.7435
3	1	3.5cm	3.1cm	0.357
	2	3.9cm	3.5cm	0.7023
	3	4.4cm	4.1cm	0.3548
	4	4.1cm	4.1cm	0.6891
	5	4.0cm	3.9cm	0.6415

Cumulative size and weight of *Piper bettle* Linn. leaf in research area –

Table : 2

Batch	Size (cms.)		Area (cm^2)	Weight (gms.)
	Length	Width		Wet
1	4.68	4.34	18.18	0.73
2	4.7	4.26	17.24	0.71
3	3.98	3.74	14.76	0.55

Cumulative effect of trace elements on the growth of *Piper bettle* Linn. leaf in research area from initial to after 120 days.

Table : 3

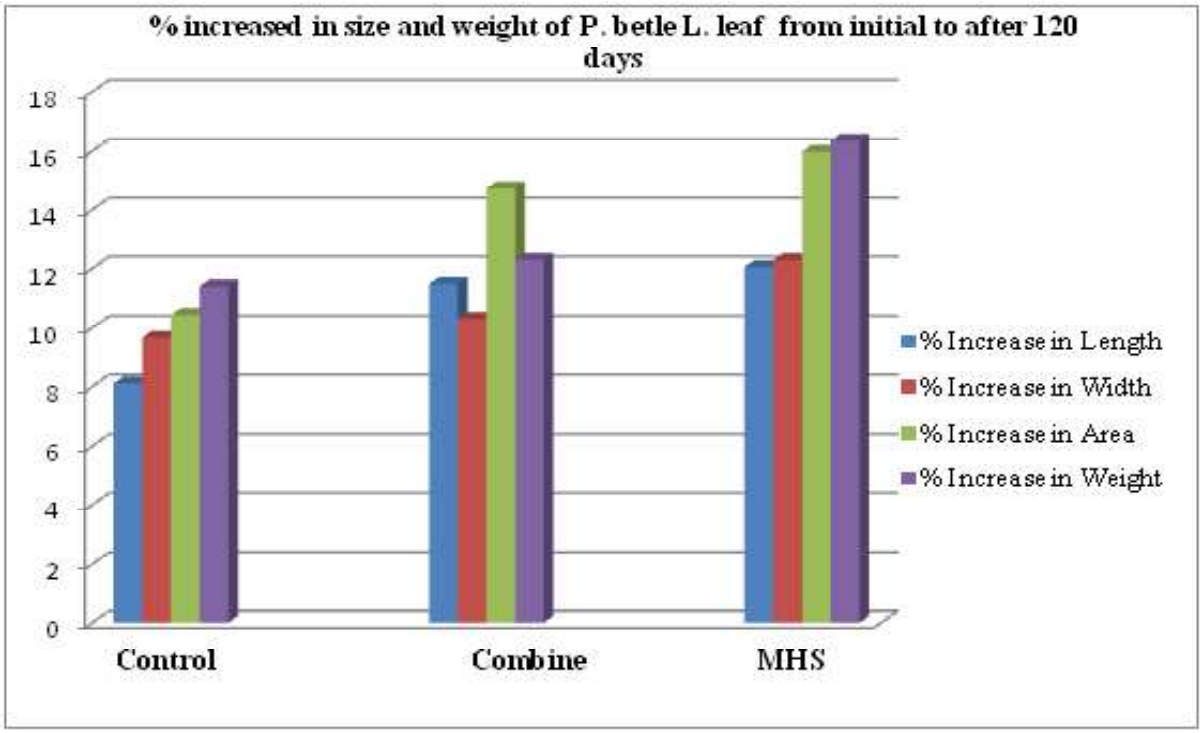
Batch	Element Sprayed	Size (Cms.)		Area (Cm^2)	Weight (gms.)	% Increase in			
		Length	Width			Length	Width	Area	Weight
1.	Control	5.06	4.76	20.08	0.81	8.11	9.67	10.45	11.41
2.	Combine (1-6)	5.24	4.7	19.78	0.79	11.49	10.32	14.73	12.30
3.	MHS	4.46	4.2	17.12	0.64	12.06	12.29	15.98	16.36

Control = Water

Combine= ($CaCl_2 . 2H_2O + MgSO_4 . 7H_2O + MnSO_4 . 4H_2O + CuSO_4 . 5H_2O + ZnSO_4 . 4H_2O + FeSO_4$)

MHS = Modified Hoagland Solution

Graph: 3.1



After 220 days an average length of leaves increased from 120 days to 220 days, in case of first batch (control) was 5.06 cm to 5.5 cm (8.69%), width was 4.76 cm to 5.26 cm (10.50%), area was 20.08 cm^2 to 22.02 cm^2 (9.66%) and weight was 0.81 gm to 0.88 gm (9.50%). In second batch (combine) , length of leaves were increased from 5.24 cm to 5.96 cm (13.74%), width 4.7 cm to 5.24 cm (11.48%), area 19.78 to 22.00 cm^2 (11.22%) and weight 0.79 gm to 0.89 gm (10.65%). In third batch (MHS) an average length increased from 4.46 cm to 5.1 cm (14.34%), width 4.2cm to 4.76 cm (13.74%), area 17.12 to 19.25 cm^2 (12.44%), and weight 0.64 gm to 0.71 gm (12.18%). (shown in table:4, Graph:4.1).

Cumulative effect of trace elements on the growth of *Piper bettle* Linn. leaf from 120 days to after 220 days.

Table : 4

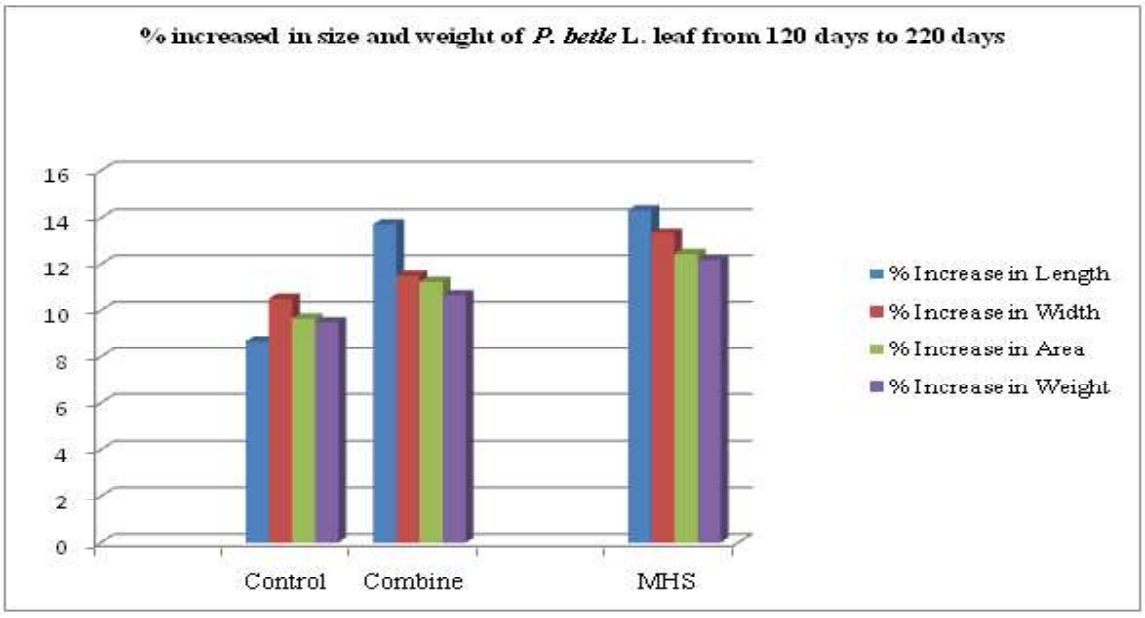
Batch	Element Sprayed	Size (Cms.)		Area (Cm^2)	Weight (gms.)	% Increase in			
		Length	Width			Length	Width	Area	Weight
1.	Control	5.5	5.26	22.02	0.88	8.69	10.50	9.66	9.50
2.	Combine (1-6)	5.96	5.24	22.00	0.89	13.74	11.48	11.22	10.65
3.	MHS	5.1	4.76	19.25	0.71	14.34	13.34	12.44	12.18

Control = Water

Combine = ($CaCl_2 . 2H_2O + MgSO_4 . 7H_2O + MnSO_4 . 4H_2O + CuSO_4 . 5H_2O + ZnSO_4 . 4H_2O + FeSO_4$)

MHS = Modified Hoagland Solution

GRAPH :4.1



The studies carried out by Das *et al*., on the role of growth regulators of betel vine cutting, only improves the development of roots of the plant . The spray and drenching of potassium salt of Phosphoric acid could check the diseases of betel vine infected by *Phytophthorapalmivora* (E) Butler *(*Johri *et al*., 1998) but it is not improved the quality of leaves. In the present investigation, the result shows the improvement in physical parameters of leaves. Among three batches third batch (sprayed with MHS) was proved to be the best (Fig:1). The taste and colour of the leaves of this batch were also improved according to habitual paan chewers.

Initial **After 120 days** **After 220 days**

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