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LEAF CHARACTERISTICS OF BETELVINE (*PIPER BETLE* L.) AS INFLUENCED BY CLIMATE

H. MOHANTA* AND A. PARIARI
Department of Spices and Plantation Crops,
Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur - 741 252, West Bengal, INDIA
e-mail: hrisita.mahanta@gmail.com

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***Corresponding author**

ABSTRACT
To study the effect of various climatic factors on betelvine, in an established boroj, a field experiment was conducted during December 2012 to November 2013. Temperature and RH were found to be the most important factors for variation in leaf characters in different cultivars. The experiment was designed in Completely Randomized Design with eight treatments and five replications. SimuraliJhal showed superior performance with respect to leaf length (16.45 cm^2), leaf breadth (13.76 cm^2) and leaf area (274.35 cm^2) in rainy season. But according to storability, CARI-2 (57.75 %) perform better in winter season. In rainy season the growth and chlorophyll content (SimuraliSanchi - 2.58 mg g^{-1} tissue) of betel leaves was maximum, but storability was minimum (SimuraliJhal - 31.75 %).

INTRODUCTION

Among the cash crops, betelvine is an important evergreen, perennial, dioecious creeper, cultivated all over India for leaf which is used as chewing stimulant. It is cultivated in an area of about 55000 ha in India, with an annual turnover of worth Rs. 9000 million providing livelihood to millions of people (Guha, 2006). Betel leaf stalk extract is found potent antimicrobial agent (Chanda *et al*., 2013).

The experiment was conducted in an established boroj. Water plays a key role in photosynthesis, stomatal opening, growth and expansion of leaf (Acharya *et al*., 2013). Soil application of Azospirillum with NPK and FYM was good for sustainability of the crop. Similar findings were recorded by Hnamte *et al*., (2013) on coriander. As leaves are consumed directly as masticatory, usage of biofertilizer was very essential, because the insoluble phosphate which was not directly available to plants usually comprises 95-99% of the total soil phosphorus (Anitha *et al*., 2015). Various climatic factors like temperature, relative humidity and canopy temperature play an important role on growth, chlorophyll content and keeping quality of betelvine leaves. Pariari and Imam, (2012) evaluated 14 cultivars of betel vine in the gangetic alluvial plains of West Bengal and indicated that there was a wide variation among them for leaf parameters. Sheet (2002) observed that cv. Chandrakona was superior with respect to most of the leaf characters compared to other cultivars.

Though there are some constraints of betelvine cultivation like lack of information, high labour cost, low producer price (Suranse and Bhople, 2004) but it is a perennial source of employment (Prasad and Prasad, 2003). Leaf is the economic part in betelvine. Keeping this point in mind, the present study was conducted to identify the most suitable season for the best growth of betel leaf and to identify the climatic factors influencing vegetative parameters of betelvine significantly.

MATERIALS AND METHODS

The experiment was carried out throughout the year from December 2012 to November 2013 at Horticultural Research station, Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia, West Bengal, India. Eight cultivars like SimuraliJhal, Halisahar Sanchi, Jabalpur, SimuraliBhabna, Kalipatti, SimurailSanchi, CARI-6 and CARI-2 were considered as treatment. The experiment was laid out in Completely Randomised Design with five replications. During the experimental period several leaf parameters like leaf length, leaf breadth, leaf area, chlorophyll content, storage capacity of betel leaves were recorded. Data were recorded from the leaf of 8^{th} node of the vine from the top regarding leaf length, leaf breadth of five plants in each of 8 cultivars at an interval of 15 days and average data is presented (Pariari and Imam 2012). Chlorophyll content in leaf was analysed through 80% acetone by the method suggested by Arnon (1959). Depetiolated leaves were stored in bamboo basket lined with green banana leaves (Saikia and Dutta 1993). On the other side maximum and minimum temperature, relative humidity and canopy temperature inside the boroj were recorded through thermometer and hygrometer.

The data obtained from each cultivar were analysed statistically by the analysis of variance method. The significance of different sources of variation was tested by error mean square by Fisher

-Sendecors F test at probability levels of 0.05. For determination of Critical Difference (C.D) at 5 % level of significance, the statistical table formulated by Fisher and Yates (1979) was consulted.

RESULTS AND DISCUSSION

Leaf Length

In all the seasons, SimuraliJhal was found to produce the longest leaf, whereas, Jabalpur produced the shortest (Table 1).In rainy season, SimuraliJhal (16.45 cm) was at par with CARI-2 (15.79 cm) and SimurailSanchi (15.75 cm) Pariari and Imam (2012) in their experiment in Gangetic alluvial plains also found that variation of leaf length was from 11.17 cm to 16.73 cm among the 14 genotypes and they also observed the shortest leaf length in Jabalpur.

Leaf Breadth

In rainy season, cultivars showed maximum leaf breadth, whereas, minimum in winter. In each season SimuraliJhal and Jabalpur produced the longest and the shortest leaf breadth (Table 1). In winter season, leaf breadth of SimuraliJhal (9.79cm), CARI-6 (9.66cm), CARI-2 (9.49cm) and SimurailSanchi (9.30cm) did not vary with each other. Leaf breadth of 27 genotypes of betelvine cv. varies from 4.2 to 11.6 cm (Rahaman *et al*., 1997).

Leaf Area

Significant variation in leaf area among the cultivars was recorded andhighest leaf area was recorded in SimuraliJhal whereas, Jabalpur did not perform well in all the seasons (Table 1). In autumn season, HalisaharSanchi (72.65 cm^2) was at par with Jabalpur (68.78 cm^2). Rahaman *et al.,* (1997) also reported significant variation in leaf area from 22 cm^2to147.20 cm^2among 27 genotypes of betelvine.

Effect of climatic factors on leaf characteristics

The maximum leaf length was observed in rainy season and it was decreased in winter. Maximum temperature did not play any role for leaf length increment (Table 2). Relative humidity

Table 1: Leaf length, Leaf breadth, leaf area, total cholorophyll content, storage life of different cultivars in different seasons

Cultivars	Leaf length (cm)				Leaf Breadth (cm)				Leaf Area(cm^2)			
Winter	Summer	Rainy	Autumn	Winter	Summer	Rainy	Autumn	Winter	Summer	Rainy	Autumn	
SimuraliJhal	13.18	14	16.45	14.75	9.79	10.8	13.76	11.71	139.9	162.5	274.35	158.14
HalisaharSanchi	9.19	9.68	11.95	11.06	8.01	8.63	10.97	9.26	61.87	78.51	97.4	72.65
Jabalpur	8.31	9	11.22	9.95	7.6	8.15	9.88	8.53	58	65.56	82.38	68.78
SimuraliBhabna	11.39	12.81	14.4	13.35	8.17	8.98	11.2	10.79	102.4	112.58	140	125.02
Kalipatti	10.3	11.27	13.41	11.55	8.14	8.97	10.9	9.5	72.61	82.54	120.67	97.45
SimuraliSanchi	12.59	13.35	15.75	14.5	9.3	10.15	12.8	11.54	129.56	148.25	178.31	149.97
CARI-6	12.37	13.82	14.97	14	9.66	10.62	13.58	12.33	120.09	139.5	168.89	145.89
CARI-2	11.94	12.77	15.79	14.19	9.49	10.34	13.28	11.36	131.87	150.27	182.24	164.2
SEm (±)	0.13	0.3	1.27	1.17	0.11	0.18	0.16	0.36	1.24	1.57	1.75	1.17
C.D at 5%	0.4	0.1	0.42	0.38	0.32	0.54	0.48	0.53	4.25	4.68	5.05	4.16

Table 1: Cont.....

Cultivars	Total cholorophyll content (mg g^{-1} tissue)				Storage life (%)			
	Winter	Summer	Rainy	Autumn	Winter	Summer	Rainy	Autumn
SimuraliJhal	1.56	1.96	2.09	1.75	52.76	42.56	31.75	40.85
HalisaharSanchi	1.86	2.2	2.32	2.13	53.65	43.12	34.58	36.56
Jabalpur	1.45	1.71	1.78	1.56	51.78	41.93	33.78	41.78
SimuraliBhabna	1.94	2.25	2.4	2.13	52.64	40.85	32.46	40.62
Kalipatti	1.86	2.24	2.45	2.12	55..12	37.98	34.16	44.02
SimuraliSanchi	1.95	2.46	2.58	2.2	57.45	40.22	32.59	43.77
CARI-6	1.52	1.78	1.85	1.68	56.23	39.86	32.75	43.58
CARI-2	1.57	1.83	1.84	1.65	57.75	41.98	32.86	42.98
SEm (±)	0.04	0.03	0.03	0.01	1.05	0.86	0.58	0.69
C.D at 5%	0.05	0.04	0.04	0.02	2.58	2.01	1.78	1.24

Table 2: Correlation between climatic factors and various leaf characteristics

Cultivars	Leaf length				Leaf Breadth			
	MaxTemp(^{0}c)	MinTemp(^{0}c)	RH (%)	C.T (^{0}c)	MaxTemp(^{0}c)	MinTemp(^{0}c)	RH (%)	C.T (^{0}c)
SimuraliJhal	0.39	0.90**	0.76**	0.55*	0.55*	0.79**	0.73**	0.59*
HalisaharSanchi	0.10	0.73**	0.91**	0.15	0.48	0.69**	0.63*	0.55*
Jabalpur	0.39	0.87**	0.84**	0.46	0.43	0.66*	0.57*	0.50
SimuraliBhabna	0.47	0.84**	0.78**	0.56*	0.39	0.71**	0.85**	0.45
Kalipatti	0.52	0.91**	0.69**	0.58*	0.38	0.57*	0.66*	0.44
SimuraliSanchi	0.37	0.94**	0.81**	0.59*	0.40	0.68**	0.75**	0.45
CARI-6	0.57	0.81**	0.78**	0.61*	0.57*	0.76**	0.68**	0.62*
CARI-2	0.41	0.92**	0.81**	0.60*	0.47	0.74**	0.70**	0.60*

* = Significant at 5 % level ** = Significant at 1% level

inside the boroj had positive effect on leaf breadth variation, observed almost all the betelvine cultivars (Table 2). Hovenden *et al*. (2012) reported that leaf characters are strongly affected by RH. High humidity results in larger, narrower and thicker leaves than those from low humidity regardless of plant accession. Due to low humidity, leaf area of cultivars was reduced (Shimizu *et al*., 1996). Variation of temperature results in changes in subsequent rate of photosynthesis, which related to leaf growth (Wilson and Cooper, 1969). Maximum and minimum temperature and relative humidity were also involved significantly for predicting leaf length and breadth variation in different seasons (Das, 2011).

Chlorophyll content in a leaf

Total chlorophyll content of different cultivars varies with different seasons. Among the four seasons, in rainy season total chlorophyll content was more and less in winter season probably due to low temperature stress and moisture content. In all the seasons, maximum and minimum chlorophyll content was observed in SimurailSanchi and Jabalpur (Table 1). The observation records the same trend as obtained by Das (2011).

Storage Behaviour

Senescence is an irreversible process in which disappearance of chlorophyll is treated as loss of quality of betel leaves. In winter season, CARI-6(65.2%) showed highest percentage of storability (Table 1) which was at par with SimurailSanchi (64.82%), whereas, SimuraliJhal showed the minimum (52.76%). In rainy season, cv. Halisahar Sanchi (34.58%) can store for longest time. Dey *et al*. (2004) observed that storage life of betel leaves was more in winter season and less in rainy season. Banana leaves packing was found superior than other type of packing (Imam, 2008).

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