PERFORMANCE STUDY OF BETELVINE (*Piper betle* Linn.) CULTIVARS UNDER VARYING DOSES OF PHYTOHORMONE-TRIACONTANOL

ABSTRACT

Betel vine (*Piper betle* Linn.) belongs to the family Piperaceae. The experiment was carried out with two factorial randomized block design combining 3 replications and 18 no. of treatments. Adopted plant spacing was 50 cm x10 cm and plot to plot distance was 60 cm. Treatment Details: Factor 1: Triacontanol – 0.1% (T_1), Triacontanol – 0.05% (T_2), Triacontanol – 0% (T_3), Factor 2: Cultivars: Utkal Sudam, Kali Bangla, Kotki, Simurali Bhabna, Simurali Gol Bhabna, Chalani local . Nutrients were applied as FYM (10 tonnes ha^{-1}) and N:P:K::200:100:100 Kg $ha^{-1}year^{-1}$. Regarding the interaction effect of cultivar with the effect of Triacontanol, the cultivar Kotki treated with Triacontanol @ 0.1% (T_1) recorded highest average vine elongation per month (32.83 cm). Whereas both the cultivar Kotki and Kali Bangla, when treated with Triacontanol @ 0.1% (T_1) recorded maximum number of leaves per vine per year (4.60). The highest content of total Chlorophyll (3.89 mg/g) and essential oil (0.82%) was obtained from the cultivar Simurali Gole Bhabna treated with Triacontanol @ 0.1% (T_1). The cultivar Utkal Sudam with Triacontanol @ 0.05% (T_2) was observed highest Phenol content (142.58 mg GAE /100g). Maximum shelf life (18 days) was obtained from the cultivar Kali Bangla and Kotki treated with Triacontanol 0.1% (T_1). From this experiment, highest benefit:cost ratio (3.03) was obtained from the cultivar Kali Bangla treated with Triacontanol @ 0.1%(T_1) and lowest benefit:cost ratio (1.75) was recorded in cultivar Chalani local without the use of Triacontanol i.e. in controlplot.

Key words: Triacontanol, cultivars, Betel vine, leaf yield.

1. INTRODUCTION

Betel vine (*Piper betle* Linn.) is an evergreen, perennial, dioecious climbing herb and present itself as an important cash crop. Leaf is a rich source of eugenol, chavicol, methyl chavicol (used in perfumery and medicine) andin protein, minerals, vitamins and amino acids (Chatterjee, 1999). It is mainly cultivated in South-East Asian countries, viz., India, Bangladesh, Sri Lanka, Malaysia, Singapore, Thailand, Philippines, Taiwan and Papua New Guinea for its leaves, which are used as a masticatory. In India, it is grown on commercial scale as cash crop in the states such as Assam, West Bengal, Bihar, Uttar Pradesh, Meghalaya, Orissa, Karnataka, Kerala, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, and Tripura. There are about 100 varieties of betel vine(Guha, 1997; Maity, 1989). On an average about 66% of betel vine production is contributed by the state of West Bengal where it is cultivated on about 20,000 ha covering about 4-5 lakh *boroj* employing about the same number of agricultural families (Guha, 2006). That apart, a small *boroj* of about three decimal area can generate employment opportunity for an agricultural worker throughout the year (Bhowmick, 1997). Subsequently, leaves worth about Rs 30-40 million are exported to the countries like Bahrain, Canada, Great Britain, Hong Kong, Italy, Kuwait, Nepal, Pakistan, Saudi Arab and many other European countries (Jana, 1996; Singh *et al*., 1990).Contrary of production percentage, due to the huge utilization, the demand for quality planting material of betel vine is increasing day-to-day. However, current production of leaves is not enough for the fast-growing demand of local and international market.A survey over several years indicated between 125 to 150 local cultivars (landraces) of betel vines in India. Many of these varieties differ from each other in several properties. Variety with prefix Desi in their names invariably refer to the variety ‘Bangla’ in West Bengal, ‘Kapoori’ in Maharashtra and ‘Desawari’ in Madhya Pradesh (Balasubrahmanyam *et al.*, 1990). Betel vine is cultivated in a ‘boroj’, with a specific microclimate. Various climatic factors like temperature, relative humidity and canopy temperature play an important role on growth and yield of betel vine (Walker, 1965).

A natural plant growth regulator, Triacontanol found in epicuticular waxes which is used to enhance the crop production. Researchers have reported the Triacontanol mediated improvement in growth, yield, photosynthesis, protein synthesis, uptake of water and nutrients, nitrogen-fixation, enzymes activities and contents

of free amino acids, reducing sugars, soluble protein, and active constituents of essential oil in various crops (Naeem *et al.*, 2012).Verma *et al.*, (2022) also found the same results and suggested that the activity of this hormone varied with the different concentration. The foliar application of Triacontanol was also found to enhance the level of L-adenosine which elicits many physiological responses like plant growth (Olsson and Pearson, 1998; Ries *et al.*, 1993)

Keeping the above facts in view, a field experiment was carried out at the research plot (boroj) under the Department of Plantation Crops & Processing, Faculty of Horticulture, Uttar Banga Krishi Vishwavidyalaya, Pundibari, Cooch Behar to study the performance of six cultivars under varying levels of a phytohormone i.e. triacontanol in respect of their growth and leaf yield.

2. MATERIAL AND METHODS:

The experiment was carried out at the research plot (boroj) under the Department of Plantation Crops & Processing, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. The vines of six cultivars viz. Utkal Sudam, Kali Bangla, Kotki, Simurali Bhabna, Simurali Gole Bhabna and Chalani local was used as planting material. The experimental field was situated in *Terai* agro-climatic zones of West Bengal at 26.52^0N latitude and 89.10^0E longitude. It was laid out in two factor randomized block design with three replications andeighteen number of treatments. Single node cuttings of six different cultivars were planted during 2018 followed single row system of planting with a row to row spacing of 50 cm, plant to plant spacing of 10 cm and plot to plot distance was 60 cm, accommodating sixty plants per plot of 3 m × 1.8 m size. FYM (10 t ha^{-1}) and Vermicompost (6 t ha^{-1}) was applied along with N:P:K:: 200:100:100 kg ha^{-1}. The data was recorded at three months interval in a year starting from June in the starting year of the experiment to Mayin the next year. Growth parameters like vine elongation, petiole length,length of internodes, leaf areaand yield parameters like leaf yield $vine^{-1}$ and estimated leaf yield, fresh and dry weight of 100 betel leaves etc. was recorded.Triacontanol was applied by diluting in water. To make 0.1% Triacontanol, 5 ml of Triacontanol was mixed with 5 litre of water and was sprayed at monthly interval. Simultaneously to make 0.05% Triacontanol, 2.5 ml was added with 5 litre of water.The control plot were kept untreated i.e. no application of Triacontanol.

The observations were subjected to statistical analysis by using two factor randomized block design as described by Panse and Sukatme (1985). Treatment variations were tested for significance under different treatments performed using of critical difference at 5% level of significance ($p \leq 0.05$).

3. RESULTS AND DISCUSSION:

3.1 Vine elongation

Data presented in Table 1, represents the effect of triacontanol on vine elongation and internodal length of different varieties during the period of experiment. It was found that among the four quarters, the maximum vine elongation (35.05 cm) was observed in second quarter (Sept-Nov) with the application of treatment T_1 (0.1% triacontanol). Similarly, Pariari and Imam (2012a) also reported that during September–November the vine length was significantly higher (107.05 cm) in Simurali Sanchi.The minimum vine elongation (24.09 cm) was recorded in first quarter with treatment T_3 under control condition, which was statistically *at par* with same treatment application in third quarter (25.70 cm). It had also been observed that within the four quarters, among all the varieties the significant vine elongation was observed highest in cultivarChalani local (36.37 cm) in the month of September-November in second quarter which was statistically *at par* with Kali Bangla (35.88 cm) in the first quarter. The minimum vine elongation has been observed in variety Utkal Sudam (18.03 cm) during the month of June- August (1^{st} quarter).

The significant variation of vine elongation was observed amongst the varieties in relation with the treatment combination during the different quarters (Table 1). Among all the varieties, variety Chalani local (39.08 cm) showed maximum vine elongation with the application of growth regulator triacontanol @ 0.05% during the second quarter which was statistically at par with the Kali Bangla (38.33 cm) and Kotki (38.13 cm) in the first and second quarter respectively. Similarly,Pariari and Imam (2012a) in their experiment also reported that vine length showed significant variation among different cultivars which may be due to the climatic changes. In another study, Mohanta and Pariari (2016) also noted similar observation on vine elongation that differs at monthly interval with respect to temperature, rainfall, relative humidity.

The minimum vine elongation was observed in variety Utkal Sudam (17.41cm) in the first quarter with the application of treatment T_1 (0.1%).

Internodal length:

Whereas in case of internodal length, it had been found that there was a significant variation in the internodal length in different treatments whereas maximum internodal length (6.77 cm) was found in the treatment T_1 (0.1% triacontanol) i.e., in the first quarter which is statistically *at par* with the treatment T_2 (6.68 cm) and T_3 (6.54 cm). It was also observed that there was a significant variation in internodal length among the varieties, such as Chalani local (7.27 cm) showed maximum internodal length in the month of September-November which was statistically *at par* with Kali Bangla (7.00 cm) and Kotki (7.05 cm) in the same months. The minimum internodal length was found in variety Utkal Sudam (4.26 cm) during the month of December-February (3^{rd} quarter).

It has also been observed that maximum internodal length was found in the second quarter in comparison with the all four quarters. It is apparent from Table 1, that variety Kotki is showing maximum internodal length i.e., 7.49 cm during the third quarter under the control condition subsequently followed by Chalani local (7.61 cm and 7.36 cm) with the application of triacontanol 0.1 and 0.05 percent respectively which was statistically *at par* with Kali Banga i.e., 7.24 cm. The minimum internodal length was obtained during the first quarter in variety Utkal Sudam with 4.24 cm under control plot which was statistically *at par* with treatment T_1 i.e., 4.33 cm after the application of 0.1% triacontanol in the same variety Utkal Sudam.According to Pariari and Imam (2012)the longer vine with shorter internode is a desirable character in betel vine which produced maximum number of leaves due to increased number of nodes.

3.2 Petiole length

The longest petiole length was found in variety Utkal Sudam i.e., 9.31 cm during the second quarter. Pariari and Imam (2012)also reported that cultivar Chamundali Bhabna recorded significantly longest petiole (10.60 cm). Whereas the shortest petiole length was obtained in the variety Utkal Sudam (5.53 cm) during the first quarter. In case of Tricontanol treatment, T_1 showed maximum petiole length in the third quarter

i.e., during the months of December-February whereas, minimum effect was found during the first quarter in T_3 i.e., 6.20 cm.

Data recorded on the table 2, represents the effect of different treatment on petiole and leaf area of the individual cultivars in different quarters. Significant variation on petiole length increment was recorded among the cultivars and the longest petiole length (9.91cm and 9.85 cm) was recorded in cultivar Utkal Sudam in both second and third quarter with respect to the application of treatment T_1 which is followed by Kotki (9.61 cm). Reddy (1996) also reported that petiole length of betel leaves varied significantly among cultivars (6.6–5.2 cm).

3.3 Leaf area increment

The leaf area was measured variety wise accordingly in respective of four quarters whereas maximum leaf area was found in variety Simurali Gole Bhabna in both first and fourth quarter (120.30 cm^2 and 119.15 cm^2) respectively. A field experiment conducted by Saikia *et al.* (1995) at Assam Agricultural University reported that maximum leaf area of 116.41 cm^2 was found in cultivar Local Bangla. The minimum leaf area was found in variety Simurali Bhabna (109.20 cm^2) during the second quarter which was *at par* with the cultivar Kali Bangla (117.30 cm^2). Among three treatments, treatment T_1 (0.1% triacontanol) has recorded maximum effect on leaf area during the month of March-April (4^{th} quarter) and minimum effect was recorded under control condition in the month of September-October (2^{nd} quarter). Rahaman *et al.* (1997)reported significant variation in leaf area from 22 sq.cm to 147.20 sq.cm among 27 genotypes of betel vine.

In case of interaction effect, that maximum leaf area (133.39 cm^2) was recorded in cultivar Simurali Gole bhabna in respect of treatment T_2 (0.05%triacontanol) which is statistically *at par* with Simurali bhabna (129.17 cm). The minimum leaf area was recorded in cultivar Kotki (98.2 cm) under the control plot in second quarter. Pariari and Imam (2012) reported that the highest leaf area (167.82 sq.cm) was recorded in Ghanagette, which was at par with Simurali Jhal (166.45 sq.cm) and Chamundai Bhabna (164.37 sq.cm).

Fresh weight and dry weight of 100 leaves.

Table 3 represent significant variation of fresh weight of 100 leaves among different cultivars. The maximum fresh weight of 100 leaves was recorded in cv. Simurali Bhabna (444.45 g) during the month of March-April followed by cv. Kotki (406.89g) which was *at par* with Kali Bangla (394.00 g). Significantly higher fresh leaf weight (364.38g) was observed in Simurali Sanchi (Pariari and Imam 2012).The minimum fresh weight (304.40 g) of leaves were recorded in Chalani Local. Table 3 also recorded the significant variation in dry weight of 100 leaves among the cultivars and the maximum dry weight (88.33 g) were recorded in Chalani local. It has also been observed that application of treatment T_1 (0.1% triacontanol) gives higher fresh weight (426.56 g) as well as maximum dry weight (183.33 g) during the March- April month.

Significant variation effect of triacontanol on fresh as well as dry weight of 100 leaves has been recorded between two seasons among the cultivars (Table 3). Significantly higher fresh leaves weight (472.67 g) was recorded in cultivar Utkal Sudam in the month of March-April (spring season) with respect to the application of treatment T_1 (0.1%) which was statistically *at par* with cv. Kotki (452 g) with the same treatment effect. Experiment conducted by Das *et al.* (1995) on evaluation of eight cultivarsfrom Bengal regarding maximum fresh weight and dry weight of 100 fresh leaves reported that cultivar Ghanagette recorded maximum fresh (380.75 g) and dry weight (44.60 g). The minimum significant variation of dry leaves weight (98.0 g) was recorded in cv. Chalani local during the months of October- November with respect to the application of T_1. The minimum fresh and dry weight (324.47 g and 109.97 g) were recorded under the T_3 during the month of October-November.

3.4 Projected leaf yield (lakh/ha)

The projected yield was estimated by converting the monthly leaf yield data into hectare per year.It is apparent from Table 3 that application of treatment T_1 (Triacontanol @ 0.1%) produced maximum leaf yield (5.90 lakh) and in respect of cultivar highest leaf number was observed in Kali Bangla (5.74 lakh) which was statistically *at par* with both cv. Simurali Bhabna and Kotki (5.56 lakh) respectively.Regarding projected yield, Pariari and Imam

Cultivars	Vine elongation (cm)	Internodal length (cm)

(2012) reported that the cultivar Simurali Deshi recorded significantly higher leaf number (60.32 lakh ha-1).The lowest leaf number were recorded in Chalani local (5.28 lakh). As par the interaction effect cv. Kotki treated with Triacontanol @0.1% (T_1) recorded the highest leaf yield (6.14 lakh) which was statistically *at par* with Kali Bangla (6.13 lakh) with same treatment doses. The cultivar Chalani local produces the lowest leaf yield (4.95 lakh) without application of Triacontanol(T_3).Chatterjee (1999) also reported the similar finding that application of Triacontanol increased leaf yield by 12-18%.

Table 1. Varietal performance and triacontanol effect on vine elongation (cm) and internodal length (cm) of betelvine.

	1st	2nd	3th	4th	1st	2nd	3th	4th
Utkal Sudam	18.03	30.36	27.56	27.39	4.60	5.03	4.26	5.35
Kali Bangla	35.88	33.45	24.79	27.28	5.99	7.00	6.26	6.38
Kotki	27.56	35.09	26.90	26.75	6.30	7.05	6.52	6.29
Simurali Bhabna	31.70	34.37	25.75	27.29	6.54	6.76	6.81	6.81
Simurali Gole Bhabna	27.26	32.67	24.81	27.11	6.52	6.86	6.47	6.74
Chalani local	22.19	36.37	26.76	27.27	6.30	7.27	6.21	6.66
S.Em. (±)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
CD at 5%	0.021	0.02	0.021	0.019	0.021	0.02	0.021	0.019
Triacontanol								
T_1	29.93	35.05	26.81	27.86	6.15	6.77	6.27	6.47
T_2	27.30	33.18	25.77	27.10	5.90	6.68	6.08	6.44
T_3	24.09	32.92	25.70	26.59	6.08	6.54	5.91	6.21
S.Em. (±)	0.238	0.21	0.20	0.197	0.005	0.005	0.005	0.005
CD at 5%	0.687	0.63	0.58	0.567	0.015	0.014	0.015	0.013
Cultivar× Triacontanol								
Utkal Sudam x T_1	19.19	37.32	28.61	27.61	4.33	5.39	4.56	5.38
Kali Bangla x T_1	38.33	31.51	24.53	28.32	6.45	7.24	6.41	6.88
Kotki x T_1	34.61	38.13	27.61	30.17	6.39	6.74	6.54	7.04
Simurali Bhabna x T_1	36.94	37.46	27.41	28.34	6.73	6.93	7.14	6.64
Simurali Gole Bhabna x T_1	27.14	30.35	25.43	26.55	6.47	6.69	6.77	6.72
Chalani local x T_1	23.38	35.54	27.29	26.16	6.55	7.61	6.21	6.17
Utkal Sudam $_x$ T_2	17.41	28.46	26.39	26.70	5.24	5.07	3.94	5.64

Kali Bangla x T_2	36.60	33.31	25.3	27.29	5.92	7.06	6.43	6.42
Kotki x T_2	24.59	29.51	26.56	24.71	5.86	6.94	6.66	6.59
Simurali Bhabna x T_2	30.11	32.27	25.40	27.02	6.23	6.61	6.70	6.75
Simurali Gole Bhabna x T_2	30.70	36.48	25.61	26.58	5.94	7.05	6.54	6.55
Chalani local x T_2	24.38	39.08	25.39	30.31	6.19	7.36	6.23	6.67
Utkal Sudam $_x$ T_3	17.50	25.32	27.70	27.88	4.24	4.63	4.27	5.02
Kali Bangla x T_3	32.72	35.52	24.54	26.23	5.59	6.72	5.93	5.85
Kotki x T_3	23.49	37.63	26.52	25.39	6.65	7.49	6.36	5.25
Simurali Bhabna x T_3	28.06	33.40	24.45	26.51	6.66	6.74	6.59	7.05
Simurali Gole Bhabna x T_3	23.93	31.17	23.41	28.21	7.17	6.84	6.11	6.94
Chalani local x T_3	18.81	34.50	27.60	25.34	6.16	6.85	6.19	7.14
S.Em.(±)	0.583	0.5	0.49	0.481	0.012	0.012	0.012	0.011
CD at 5%	1.683	1.54	1.43	1.39	0.036	0.034	0.036	0.033

1 – 1st quarter (June- Aug). 2 - 2nd quarter (Sept-Nov.). 3 -3rd quarter (Dec-Feb) and 4- 4th quarter (March-May).

5- T_1 (Triacontanol 0.1%). 6- T_2 (Triacontanol 0.05%) and 7-T_3 (Control i.e. 0%).

Table 2. Varietal performance and triacontanol effect on petiole length(cm) and leaf area (sq.cm) of betelvine.

Cultivars	Petiole length(cm)				Leaf area (sq.cm)			
	1st	2nd	3th	4th	1st	2nd	3th	4th
Utkal Sudam	5.35	9.31	9.14	9.01	115.53	110.59	112.61	117.06
Kali Bangla	6.38	8.77	8.79	8.62	115.06	113.69	117.30	115.35
Kotki	6.29	8.61	8.98	8.99	111.20	110.00	108.45	111.38
Simurali Bhabna	6.81	8.71	9.19	8.77	119.14	109.28	115.16	114.60

Simurali Gole Bhabna	6.74	8.65	8.80	8.84	119.15	116.85	116.74	120.30
Chalani local	6.66	8.74	8.49	8.42	111.23	114.06	110.45	112.49
SEm(±)	0.007	0.007	0.042	0.008	0.352	0.35	0.387	0.319
CD at 5%	0.019	0.019	0.122	0.022	1.10	1.012	1.116	0.920
T1	6.47	8.98	9.20	8.99	117.90	116.25	114.82	118.58
T2	6.43	8.73	8.83	8.98	116.28	113.60	114.04	114.79
T3	6.20	8.69	8.66	8.35	111.48	107.38	111.50	112.24
SEm (±)	0.005	0.005	0.030	0.005	0.249	0.248	0.273	0.225
CD at 5%	0.013	0.014	0.086	0.016	0.719	0.715	0.789	0.650
Cultivar×Triacontanol								
Utkal Sudam x T_1	5.38	9.85	9.91	9.43	118.74	120.05	115.47	122.46
Kali Bangla x T_1	6.88	9.04	8.71	8.64	119.54	120.07	118.64	116.39
Kotki x T_1	7.04	8.56	9.61	8.95	122.68	116.19	107.32	122.51
Simurali Bhabna x T_1	6.64	8.87	9.30	9.26	115.45	112.46	118.47	115.20
Simurali Gole Bhabna x T_1	6.72	8.74	9.23	9.15	120.55	113.28	120.66	119.33
Chalani local x T_1	6.17	8.82	8.46	8.53	110.41	115.43	108.35	115.58
Utkal Sudam $_x$ T_2	5.64	8.94	9.04	9.15	105.33	105.13	110.05	104.90
Kali Bangla x T_2	6.43	8.43	8.85	8.61	113.36	110.49	111.50	115.22
Kotki x T_2	6.59	8.71	8.49	9.40	110.64	115.67	111.14	110.40
Simurali Bhabna x T_2	6.75	8.82	9.21	9.22	129.17	111.51	121.70	116.30
Simurali Gole Bhabna x T_2	6.55	8.46	8.80	9.14	133.39	119.57	115.36	130.44
Chalani local x T_2	6.67	9.04	8.57	8.40	105.80	119.28	114.46	111.49
Utkal Sudam $_x$ T_3	5.02	9.16	8.47	8.47	122.49	106.50	112.32	123.82

Kali Bangla x T_3	5.85	8.85	8.81	8.61	112.28	110.51	121.75	114.44
Kotki x T_3	5.25	8.56	8.83	8.64	100.28	98.15	106.88	101.24
Simurali Bhabna x T_3	7.05	8.45	9.06	7.83	112.79	103.87	105.30	112.33
Simurali Gole Bhabna x T_3	6.93	8.75	8.36	8.24	103.52	117.70	114.21	111.15
Chalani local x T_3	7.14	8.37	8.44	8.34	117.47	107.47	108.55	110.43
SEm(±)	0.011	0.012	0.073	0.013	0.61	0.607	0.67	111.15
CD at 5%	0.033	0.034	0.211	0.038	1.76	1.752	1.933	110.43

1 – 1st quarter (June- Aug). 2 - 2nd quarter (Sept-Nov.). 3 -3rd quarter (Dec-Feb) and 4- 4th quarter (March-May). 5- T_1 (Triacontanol 0.1%). 6- T_2 (Triacontanol 0.05%) and 7-T_3 (Control i.e. 0%).

Table 3. Varietal performance and triacontanol effect on fresh weight and dry weight of betel leaves and projected leaf yield in hectare of betelvine.

Cultivar	**October-November**	**October-November**	**March-April**	**March-April**	**Projected leaf yield (lakh/ha)**
	Fresh wt. (g)	**Dry wt. (g)**	**Fresh wt. (g)**	**Dry wt. (g)**	
Utkal Sudam	376.51	137.53	383.78	177.56	5.46
Kali Bangla	338.45	142.38	394.00	182.00	5.74
Kotki	368.93	120.40	406.89	182.89	5.56
Simurali Bhabna	378.11	144.84	444.45	189.33	5.56
Simurali Gole Bhabna	331.02	130.93	390.67	171.11	5.54
Chalani local	304.40	88.33	363.56	170.22	5.28
SEm(±)	0.122	0.140	1.823	1.084	0.012
C.D.	0.353	0.405	5.263	3.128	0.034

T_1	382.77	137.30	426.56	183.33	5.90
T_2	341.68	134.94	386.11	180.22	5.53
T_3	324.27	109.97	379.00	173.00	5.14
SEm(±)	0.086	0.099	1.289	0.766	0.008
CD at 5%	0.250	0.286	3.721	2.212	0.024
Cultivar×Triacontanol					
Utkal Sudam x T_1	395.40	158.80	472.67	190.00	5.75
Kali Bangla x T_1	377.00	177.20	422.67	186.67	6.13
Kotki x T_1	395.20	115.20	452.00	189.33	6.14
Simurali Bhabna x T_1	372.60	113.00	451.33	190.00	5.86
Simurali Gole Bhabna x T_1	385.20	168.60	391.33	174.00	5.97
Chalani local x T_1	371.20	91.00	369.33	170.00	5.54
Utkal Sudam $_x$ T_2	347.13	148.60	309.33	173.33	5.59
Kali Bangla x T_2	303.13	123.00	370.67	189.33	5.75
Kotki x T_2	425.00	155.20	404.00	190.00	5.43
Simurali Bhabna x T_2	376.93	163.07	432.00	188.00	5.45
Simurali Gole Bhabna x T_2	331.07	131.20	430.00	170.00	5.62
Chalani local x T_2	266.80	88.60	370.67	170.67	5.35
Utkal Sudam $_x$ T_3	387.00	105.20	369.33	169.33	5.05
Kali Bangla x T_3	335.20	126.93	388.67	170.00	5.34
Kotki x T_3	286.60	90.80	364.67	169.33	5.12
Simurali Bhabna x T_3	384.80	158.47	450.00	190.00	5.37
Simurali Gole Bhabna x	276.80	93.00	350.67	169.33	5.01

T_3					
Chalani local x T_3	275.20	85.40	350.67	170.00	4.95
SEm(±)	0.212	0.243	3.158	1.877	0.020
CD at 5%	0.611	0.701	9.116	5.418	0.059

T_1 (Triacontanol 0.1%). 6- T_2 (Triacontanol 0.05%) and 7-T_3 (Control i.e. 0%).

3.5 Qualitative parameters:

Significant variation in qualitative parameters of leaf in different betelvine cultivars were also observed in this finding. The highest content of total Chlorophyll (3.89 mg/g) and essential oil content (0.82%) was obtained from the cultivar Simurali Gole Bhabna treated with Triacontanol @ 0.1% (T_1). On the other hand cultivar Utkal Sudam treated with Triacontanol @ 0.05% (T2) was observed highest Phenol content (142.58 mg GAE /100g), and cultivar Kali Bangla treated with Triacontanol @ 0.1%(T_1) was observed lowest Phenol content (67.58 mg GAE /100g). Regarding shelf life of betel leaves, maximum (18 days) was obtained from the cultivar Kali Bangla and Kotki treated with Triacontanol 0.1%(T1).

Fig.1.

(a). Phenol content (mg GAE /100 g) in betelvine leaves of different cultivars under varying levels of Triacontanol.

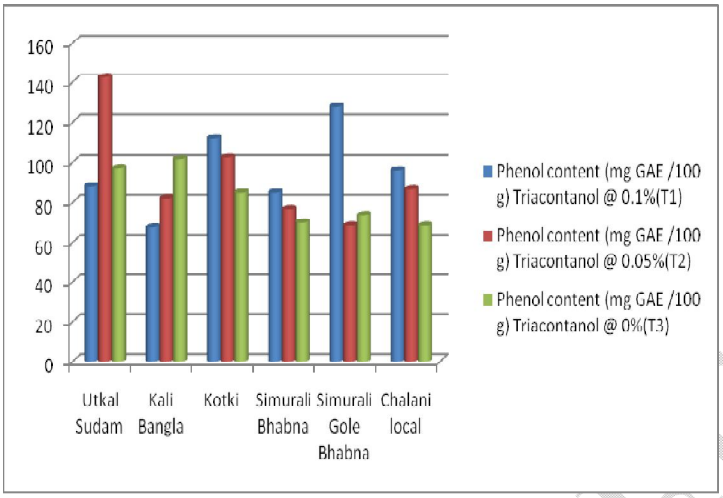
(b). Chlorophyll content (mg/g) in betelvine leaves of different cultivars under varying levels of Triacontanol.

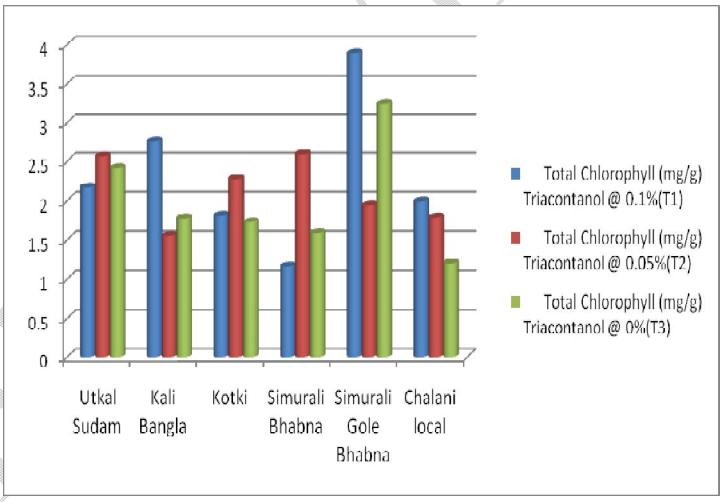
(c) Essential oil content (%) in betelvine leaves of different cultivars under varying levels of Triacontanol

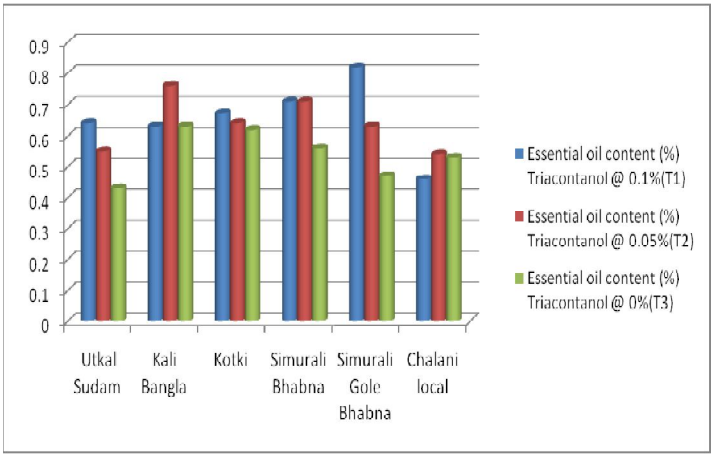
(d) Shelf life (days) of betelvine leaves of different cultivars under varying levels of Triacontanol

(a)

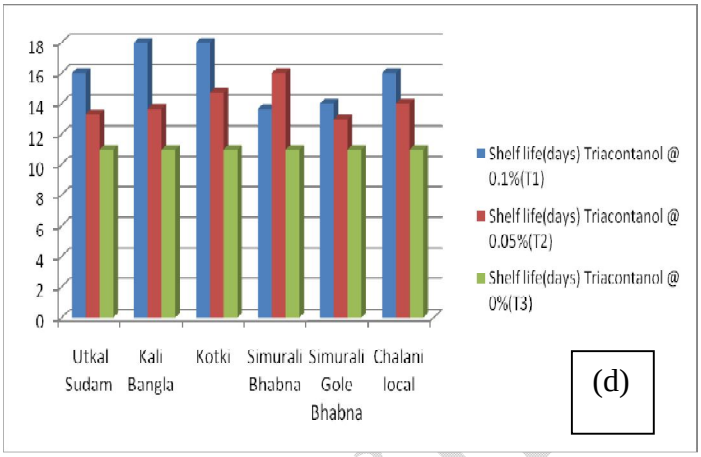
(b)







(c)



(d)

3.6 Economic return of betel vine:

From the present studies (Table 4), it was found that the benefit cost ratio among all the cultivars showing significant variation in respective of leaf yield. The cultivar Kali Bangla has recorded the highest B:C ratio i.e., 3.03, 2.94 and 2.83 respectively under the influence of all the treatments T_1, T_2 and T_3 with respect to the highest selling prices/1000 leaves followed by Utkal Sudam (2.39). The lowest B:C ratio was recorded in Chalani local (1.75).

Table 4. Economic analysis of the experiment

Name of cultivars	Fixed cost (Rs.)	Leaf yield (Lakh ha^{-1})	Selling prices/1000 leaves	Gross return (Rs.)	Net return (Rs.)	B:C ratio
Utkal Sudam × T_1	33992	5.75	150	86250	49789	2.37
Kali Bangla × T_1	33992	6.13	180	110340	73879	3.03
Kotki × T_1	33992	6.14	120	73680	37219	2.02
Simurali Bhabna × T_1	33992	5.86	120	70320	33859	1.93
Simurali Gole Bhabna × T_1	33992	5.97	120	71640	35179	1.96
Chalani local × T_1	33992	5.54	120	66480	30019	1.82
Utkal Sudam × T_2	33992	5.59	150	83850	48623	2.39
Kali Bangla × T_2	33992	5.75	180	103500	68273	2.94
Kotki × T_2	33992	5.43	120	65160	29933	1.85
Simurali Bhabna × T_2	33992	5.45	120	65400	30173	1.86
Simurali Gole Bhabna × T_2	33992	5.62	120	67440	32213	1.91

Chalani local × T_2	33992	5.35	120	64200	28973	1.83
Utkal Sudam× T_3	33992	5.05	150	75750	41758	2.23
Kali Bangla× T_3	33992	5.34	180	96120	62128	2.83
Kotki × T_3	33992	5.12	120	61440	27448	1.81
Simurali Bhabna× T_3	33992	5.37	120	64440	30448	1.90
Simurali Gole Bhabna × T_3	33992	5.01	120	60120	26128	1.77
Chalani local × T_3	33992	4.95	120	59400	25408	1.75

4. CONCLUSION:

The present experiment was done to evaluate the performance of six betelvine cultivars under varying levels of Triacontanol i.e. T_1 (Triacontanol 0.1%), T_2 (Triacontanol 0.05%) and T_3 (No application of Triacontano i.e. Control). It was found that the application of Triacontanol @ 0.1% (T_1) on the cv. Kotki recorded the highest leaf yield (6.14 lakh) which was statistically *at par* with Kali Bangla (6.13 lakh) with same treatment doses. But from the economic point of view, the cultivar Kali Bangla recorded the highest B:C ratio i.e., 3.03 under (T_1) and being more economical among the other treatments. Hence, the cultivar Kali Banglaand Triacontanol @ 0.1% may be adopted for cultivation under *Terai* region of West Bengal.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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