VEGETATIVE PROPAGATION OF *PIPER BETLE* IN THE CENTRAL PROVINCES

By R. P. Asthana, M.Sc., Ph.D. (London), D.I.C., F.A.Sc.
AND
K. A. Mahmud, B.Sc.

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Readymade 'seeds' or cuttings of *Piper betle* (*Pan*) are not sold as such in markets. The customers have to purchase the full length of pan vines to make the 'seeds' themselves out of them. In the Central Provinces it is a common practice of the *baris* (pan growers) to use one or two top-most cuttings, each consisting of four to six internodes measuring from 12 to 18 inches in length. After taking the required number of cuttings from a vine the rest of it is discarded though the leaves from them are removed and sold. Before planting is carried out the leaves from the lower half of the first two top-most cuttings are also removed and marketed. The vines for 'seed' purposes are available at an average rate of 1,000 per sixteen rupees. Cuttings are generally planted in pairs and 1,40,000 pieces are required for an acre of land. Before the advent of foot-rot disease (*Phytopthhora parasitica* var. *piperina* Dast.) in an epidemic form the pan 'seeds' (cuttings) were in abundance and cheap. At present when hardly a few gardens are left undestroyed by foot-rot disease and when it has become extremely difficult to procure 'seeds' even at exhorbitant prices, the *baris* have adopted the practice of taking as many as six cuttings from each vine, very often with poor yield and little or no income.

It is a general saying that the cuttings which are taken from the upper parts of vines give a higher yield of pan leaves than those taken from the lower ones. But as the cuttings which are planted in a pan garden are always of a mixed nature, it has not been found possible to verify the statement and to come to a conclusion about the yield of the cuttings taken in a successive order from tip downwards of a vine nor it has been possible to recommend the number of desirable cuttings to be taken from each vine so that the maximum yield and income may be obtained. A systematic study of the problem was taken up and the data have yielded valuable results.

The seeds or cuttings of *kapuri* variety of pan were taken from two years old vines as they happen to be the best in their growth. Each vine was cut from tip to base into twelve pieces, each piece consisting of five internodes

and measuring from 12 to 15 inches in length. In the text these pieces will be referred to in order of succession from tip downwards as 1st, 2nd,....and 12th cuttings respectively. It is a common practice of *baris* to have generally three leaves with each cutting. Following the above practice 1st to 4th cuttings had three leaves each, 5th and 6th cuttings had two leaves each and 7th to 12th cuttings without any leaves as they had none on them.

A rectangular piece of land measuring 100 by 7 feet in dimensions was divided into four equal plots, each measuring 25 × 7 feet. Each plot was further divided into 12 rows, each seven feet long. One row in each plot was selected at random for each of the twelve types of cuttings. The experiment was replicated four times. All the four plots were manured with linseed oilcake once every month from February to September at the rate of 250 lb. per acre per application according to the existing practice of manuring of pan gardens.

The plantation was carried out on the 30th September 1942. Germination started in the 2nd week and continued till the 12th week. 1st, 2nd and 3rd cuttings took longer period for germination than the rest, the best germinations in the former being in the 7th and 8th weeks while in the latter in the 2nd and 3rd weeks. Later it was observed that majority of 5th to 12th cuttings did not survive longer than three months after germination due to poor development of root system (Table I). The mortality due to *Phytophthora parasitica* var. *piperina* Dast. causing foot-rot was also comparatively higher in 5th to 12th cuttings than the rest, the least susceptible being the 3rd cutting.

A record of the linear growth of the pan vines from all the cuttings was maintained and is given in Table II. It will be observed that the highest rate of growth has been found in the 1st cutting with progressively lesser rate of growth in the succeeding cuttings. The growth rate was very poor in the 9th, 10th, 11th and 12th cuttings.

The average yields of betel leaves per plant picked during the first year of the experiment are given in Table III. The leaves were picked and graded according to their size and market value under three heads: (1) *Bade pan* (large leaves), (2) *Khilli* (small leaves) and (3) *Chote khilli* (very small leaves). *Bade pan* are sold at an average rate of 3,000 per rupee, *Khilli* at the rate of 16,000 per rupee and *Chote khilli* have no market value and are thrown away. Yield of *Bade pan* was highest in the 1st, 2nd and 3rd cuttings, low in the 4th cuttings, lower in the 5th and 6th cuttings, least in the 7th cutting and nil in the 8th to 12th cuttings. 5th to 8th cuttings yielded more of *Khilli* while the last four cuttings, 9th to 12th, yielded only *Chote khilli.*

The yield of pan leaves from each type of cutting and the income from their sale proceeds per acre for the first year and for the duration of five years of a pan garden are given in Table IV. It has already been mentioned that the pan "seeds" or cuttings are not sold as such in market but the customers have to purchase the full length of the vines and make seeds out of them. If only one 'seed' is taken from each vine the cost of 'seeds' will amount to Rs. 1,714, the cost of construction will amount to Rs. 800 and the cost

TABLE I

Mortality in pan vines due to foot-rot disease and poor root system

Cutting No.	No. of cuttings germinated out of 100 planted	No. of cuttings died within three months due to poor root system	No. of vines infected with foot-rot							Total No. of vines dead on 30-9-43	Percentage of mortality due to foot-rot and poor development of root-system
			31-3-43	30-4-43	31-5-43	30-6-43	31-7-43	31-8-43	30-9-43		
1st	83	..	4	..	..	..	1	3	14	22	26·5
2nd	94	..	1	3	..	..	..	7	9	20	21·2
3rd	97	..	3	1	..	..	9	2	1	16	16·4
4th	98	..	2	..	..	..	3	17	6	28	28·5
5th	97	17	5	..	..	..	13	27	7	69	71·1
6th	100	12	1	2	..	..	4	12	19	50	50·0
7th	98	49	..	1	..	..	23	5	7	85	86·7
8th	100	53	7	1	..	..	11	1	7	80	80·0
9th	93	47	4	..	..	..	9	4	2	66	70·9
10th	100	58	..	2	..	..	17	19	3	99	99·0
11th	97	43	2	4	..	..	8	22	9	88	90·7
12th	99	62	2	..	..	..	13	9	6	92	92·2

TABLE II

Average linear growth of the vines

Cutting No.	Dates of measurement										
	30-11-42	31-12-42	31-1-43	28-2-43	31-3-43	30-4-43	31-5-43	30-6-43	31-7-43	31-8-43	30-9-43
1st	0′ 6″	0′ 6″	1′ 11″	2′ 4″	2′ 4″	4′ 4″	5′ 6″	6′ 5″	7′ 10″	9′ 3″	10′ 10″
2nd	0′ 6″	0′ 6″	1′ 8″	2′ 0″	2′ 10″	3′ 9″	4′ 8″	5′ 4″	6′ 3″	8′ 0″	9′ 11″
3rd	0′ 6″	0′ 6″	1′ 3″	1′ 3″	2′ 4″	3′ 4″	4′ 6″	5′ 3″	6′ 1″	8′ 0″	9′ 9″
4th	0′ 5″	0′ 6″	0′ 6″	0′ 7″	1′ 2″	1′ 7″	2′ 6″	3′ 3″	4′ 5″	6′ 8″	8′ 8″
5th	0′ 6″	0′ 6″	0′ 6″	0′ 7″	1′ 1″	1′ 2″	2′ 1″	2′ 7″	3′ 10″	5′ 7″	7′ 2″
6th	0′ 6″	0′ 6″	0′ 6″	0′ 7″	0′ 11″	1′ 2″	1′ 11″	2′ 5″	3′ 4″	4′ 11″	6′ 4″
7th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 9″	0′ 9″	1′ 9″	2′ 10″	4′ 1″
8th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 8″	0′ 9″	1′ 8″	2′ 10″	4′. 0″
9th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 8″	0′ 8″	0′ 11″	1′ 3″	1′ 10″
10th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 8″	0′ 8″	0′ 11″	1′ 3″	1′ 9″
11th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 8″	0′ 8″	0′ 11″	1′ 3″	1′ 9″
12th	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 6″	0′ 8″	0′ 8″	0′ 11″	1′ 3″	1′ 9″

TABLE III

Average yield of betel leaves per plant per annum

Cutting No.	1st picking March		2nd picking May		3rd picking July		4th picking September			Total yield per plant per annum					
										Bade pan		*Khilli*		*Chote khilli*	
	Bade pan	*Khilli*	*Bade pan*	*Khilli*	*Bade pan*	*Khilli*	*Bade pan*	*Khilli*	*Chote khilli*	Total No.	Per-centage	Total No.	Per-centage	Total No.	Per-centage
1st	6	2	19	8	21	7	32	13	..	78	72·2	30	27·8	..	..
2nd	5	3	16	8	20	11	22	9	..	63	67·1	31	32·9	..	..
3rd	5	3	14	7	20	10	25	12	..	64	67·3	31	32·6	..	..
4th	3	..	4	3	9	7	15	10	..	31	60·8	20	39·2	..	..
5th	..	..	2	5	7	9	9	12	..	18	40·0	27	60·0	..	..
6th	..	..	3	6	5	9	10	14	..	18	38·2	29	61·7	..	..
7th	..	..	..	..	..	9	2	14	..	8	8·0	23	92·0	..	..
8th	..	..	..	..	..	9	..	18	..	..	..	27	10·0	..	..
9th	..	..	..	..	..	..	..	..	21	..	..	..	..	21	100
10th	..	..	..	..	..	..	..	..	18	..	..	..	..	18	100
11th	..	..	..	..	..	..	..	..	13	..	..	..	..	13	100
12th	..	..	..	..	..	..	..	..	13	..	..	..	..	13	100

TABLE IV

Yield and income from each type of cutting

Cutting No.	Yield of *Bade pan* per acre per annum	Income from *Bade pan* per acre per annum (in rupees)	Yield of *Khilli* per acre per annum	Income from *Khilli* per acre per annum (in rupees)	*Yield of *Chote khilli* per acre per annum	Total income per acre per annum (in rupees)	Income over expenditure during first year (in rupees)	Total net profit during five years (in rupees)
1st	1,09,20,000	3,640	42,00,000	262	..	3,902	+ 188	+10,996
2nd	88,20,000	2,940	43,40,400	271	..	3,211	— 503	+ 8,341
3rd	89,69,000	2,986	43,40,400	271	..	3,257	— 457	+ 7,771
4th	43,40,000	1,446	28,00,000	175	..	1,621	—2,093	— 409
5th	25,20,000	840	37,80,000	236	..	1,076	—2,638	— 2,142
6th	25,20,000	840	40,60,000	253	..	1,093	—2,621	— 3,0 9
7th	2,80,000	93	32,20,000	201	..	294	—3,420	— 7,044
8th	..	..	37,80,000	236	..	236	—3,478	— 7,334
9th	..	..	..	..	29,40,000	nil	—3,714	— 8,514
10th	..	..	..	..	25,20,000	,,	—3,714	— 8,514
11th	..	..	..	..	18,20,000	,,	—3,714	— 8,514
12th	..	..	..	..	18,20,000	,,	—3,714	— 8,514

* No income is derived by the yield of *Chote khilli*

of cultivation per year will come to Rs. 1,200. Thus during the first year each garden will cost Rs. 3,714 and on subsequent years only Rs. 1,200. To avoid foot-rot, leaf-rot and other diseases a pan garden should always be dismantled after five years of plantation and this has of late been generally practised in this province. Therefore the recurring and non-recurring

expenditure of the garden for five years will amount to Rs. 8,514, yielding a net income of Rs. 10,996 from the first cutting, Rs. 8,341 from the 2nd and Rs. 7,771 from the 3rd cutting. If other than first three cuttings are planted there will be a definite loss to the growers. During the first year only the 1st cuttings will show the profit.

The above, however, is not the general practice. These days the growers always plant several cuttings from each vine. It will be seen from Table V

TABLE V

Yield and income from mixed cuttings

Cost of construction of a pan garden per acre—Rs. 800.
Cost of cultivation per acre per annum—Rs. 1,200.
Total expenditure during 2nd to 5th years—Rs. 1,200.

Cutting No.	Cost of cuttings per acre (in rupees)	Total expenditure per acre for the first year (in rupees)	Total income per acre for the first yrar (in rupees)	Income over expenditure for the first year (in rupees)	Income over expenditure for five years.
1st	1,714	3,714	3,902	+188	+10.996
1st and 2nd	908	2,908	3,556	+648	+10,072
1st, 2nd and 3rd	628	2,628	2,456	+828	+ 9,752
1st to 4th	496	2,496	2,997	+501	+ 7,689
1st to 5th	398	2,398	2,613	+215	+ 5,867
1st to 6th	330	2,330	2,360	+ 30	+ 4,670
1st to 7th	286	2,286	2,064	−222	+ 3,234
1st to 8th	250	2,250	1,836	−414	+ 2,130
1st to 9th	220	2,220	1,632	−588	+ 1,130
1st to 10th	198	2,198	1,469	−729	+ 347
1st to 11th	180	2,180	1,335	−845	− 305
1st to 12th	164	2,164	1,224	−940	− 844

that the highest income during the life time (5 years) of a pan garden is obtained when the 1st cutting is taken, closely followed by 1st and 2nd, and 1st, 2nd and 3rd cuttings. If 1st and 2nd cuttings are taken the initial expenditure which is rather of importance from the cultivators' point of view is lessened by Rs. 806 but if 1st, 2nd and 3rd cuttings are taken from each vine then the initial expenditure is further lessened by Rs. 1,086 without any significant loss to the cultivators.

The above experiments have conclusively shown that only first three cuttings should be taken from each vine. This procedure will minimise the incidence of diseases, specially foot-rot and will pay handsomely the cultivators with only an initial expenditure of Rs. 2,628 per acre.