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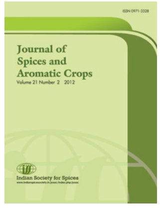

Standardization of stem thickness and length for harvesting cinnamon (*Cinnamomum verum* J. Pres.) bark

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Abstract

An experiment was conducted during 2008–09, 2009–10 & 2010–11 at Dapoli (Maharashtra) to study the effect of stem thickness and stem length for harvesting cinnamon bark. Twelve treatment combinations *viz.*, two genotypes; Konkan Tej (G_1), ACC-11 (G_2), two lengths of stem; 50 cm (L_1), 100 cm (L_2) and three thicknesses of stem; 1–2 cm (T_1), 2–3 cm (T_2), 5–6 cm (T_3) were used for experimentation. There were no significant differences in bark thickness before and after drying, fresh and dry weights of quill in the genotypes studied and length of cinnamon stem selected for bark extraction. Significantly highest bark thicknesses before (1.14 mm) and after (0.82 mm) drying and fresh (111.21 g) and dry (56.64 g) weights of quill were recorded in T_3 (5–6 cm thick stem) treatment. Interaction effect of genotype, length and thickness of stem selected for coppicing indicate significant differences in bark thickness before and after drying and fresh and dry weights of quill. Significantly maximum bark thickness before drying (1.74 mm) was recorded in treatment combination $G_2L_1T_3$, which was at par with $G_1L_2T_3$ (1.72 mm), $G_2L_2T_3$ (1.71 mm) and $G_1L_1T_3$ (1.67 mm). The treatment combination $G_1L_2T_3$ produced significantly highest bark thickness after drying (1.33 mm) fresh (223.31 g) and dry (117.28 g) weights of quill respectively. Significantly low bark thickness before drying (1.00 mm) fresh (49.13 g) and dry (22.92 g) weights of quill were recorded in treatment combination $G_1L_1T_1$, which were at par with treatment combination $G_2L_1T_1$. Higher oil percentage was observed in 5–6 cm thick stem i.e. Konkan Tej (3%) and ACC-11 (2.50%) respectively. Thus for coppicing of cinnamon for extraction of bark, harvesting of 5-6 cm thick stem is recommended.

Keywords: cinnamon bark, cinnamon, harvest, stem thickness

Cinnamon (*Cinnamon verum* J. Pres), belonging to family Lauraceae is the oldest and most important tree spice grown for dried bark in India. Its leaves are also used as spice in many Indian dishes. Bark having purple colour with young flushes yield more oil than green flushes. Oil content in dry bark varies from 2.0–3.5%. Oil has pungent odour and hot taste and contains 70.0–80.0% eugenol with traces of cinnamaldehyde. Cinnamon in its natural habitat grows to a height of about 10 m and has to be coppiced periodically for extraction of bark which is a commercial product (Kumar *et al.* 2006). Cinnamon when intercropped in coconut and arecanut gardens are coppiced annually to harvest bark from 4th–5th year after planting. Cinnamon trees in these plantations assume a bush shape with many shoots of varying sizes useful for peeling and extraction of bark. (Jaisankar *et al.* 2010) The time of peeling and extraction of bark vary under different agroclimatic conditions. But many a times, low bark productivity is due to incorrect selection and choosing season of bark extraction, lack of knowledge about thickness of stem and its bark length. Cinnamon bark yield varies from variety to variety depending upon agro climatic conditions. The yield also varies according to size of shoot selected for coppicing. The present experiment was conducted to know the genotype suitability and to find out the effect of length and thickness of stem on bark yield in cinnamon.

The experiment was laid out at College of Agriculture, Dapoli, Maharashtra in factorial randomised block design with twelve treatment combinations (Panse & Sukhatme 1995) in three consecutive seasons 2008–09, 2009–10 and 2010–11. Two genotypes viz. Konkan Tej (G_1) and ACC-11 (G_2), two lengths of stem *viz.* 50 cm (L_1) and 100 cm (L_2) and three thicknesses of stem; 1–2 cm (T_1), 2–3 cm (T_2), 5–6 cm (T_3) formed the treatment combination. The bark thickness before and after drying and quill weight before and after drying were recorded in all treatment combinations. The oil percentage in different thickness of bark was also estimated in both the genotypes. Economics for production of 10 kg dry cinnamon bark in different thickness of stem was estimated using present market rates and conditions.

The data pertaining to bark thickness before drying, bark thickness after drying, quill fresh weight, quill dry weight as affected by genotype, length of stem, thickness of stem and their interactions is presented in Tables 1 to 3. The oil percentage as affected by thickess of stem in cinnamon and cost of production in cinnamon is presented in Tables 4 and 5 respectively.

There were no significant differences among genotypes with respect to bark thickness before and after drying, quill fresh and dry weight (Table 1). Though 100 cm long stem recorded higher quill dry weight (63.93 g), it did not differ statistically with dry weight of 50 cm long stem.

Stem thickness influenced the bark thickness and quill weight. The highest bark thickness before (1.14 mm) and after drying (0.82 mm) and quill fresh weight (111.21 g) and dry weight (56.64 g) were recorded in T_3 treatment (5–6 cm thickness). This might be due to the fact that maturity of stem is related to higher thickness and more weight of bark in cinnamon.

The interaction effect of genotype and length of stem indicated no significant differences for bark thickness before and after drying, but it influenced quill fresh and dry weight (Table 2). The G_1L_2 (Konkan Tej with 100 cm length of stem) recorded higher values of 126.33 g and 65.93 g quill fresh and dry weight respectively which was at par with G_2 L_2 which recorded 124.05 g quill fresh weight and 61.92 g quill dry weight. This might be due to interaction effect of higher length of stem (100 cm) with genotypes (G_1 and G_2).

It was observed that interaction effect of genotype and thickness of stem produced significant difference in bark thickness before and after drying and fresh and dry weight of quill (Table 2). Maximum bark thickness before drying was recorded in the treatment combination G_2 T_3 *i.e.* 1.72 mm which was at par with 1.70 mm (treatment combination G_1 T_3). Maximum bark thickness after drying (1.28 cm), quill fresh weight (172.49 g) and quill dry weight (89.26 g) were recorded in treatment combination G_1T_3 which were followed by G_2T_3 treatment combination *i.e.* 1.17 mm bark thickness after drying, 161.15 g quill fresh weight and 80.67 quill dry weight. Low bark thickness before drying (1.00 mm) and after (0.69 mm) drying and quill fresh (58.12 g) dry (26.72 g) weight were recorded in G_1T_1 treatment which were also at par with G_2T_1 treatment. The higher values of bark thickness and quill weight in T_3 treatment indicated the

Table 1. Effect of genotype, length (cm) and thickness (cm) of stem on bark thickness before drying, bark thickness after drying and fresh & dry weights of quill of cinnamon (Pooled data of 2008–09, 2009–10, 2010–11)

Treatments	Bark thickness before drying (mm)	Bark thickness after drying (mm)	Quill fresh weight (g)	Quill dry weight (g)
Genotype (G)				
G_1	1.29	0.92	104.20	53.35
G_2	1.31	0.89	102.68	51.80
S.Em.±	0.016	0.037	5.374	3.70
CD (P<0.05)	N.S.	N.S.	N.S.	N.S.
Length of stem (L)				
L_1	1.31	0.91	81.69	41.22
L_2	1.29	0.90	125.19	63.93
S.Em.±	0.0034	0.029	5.473	3.435
CD (P<0.05)	N.S.	N.S.	N.S.	N.S.
Thickness of stem (T)				
T_1	0.67	0.47	39.74	18.82
T_2	0.79	0.53	55.93	29.69
T_3	1.14	0.82	111.21	56.64
S.Em.±	0.018	0.019	2.255	1.643
CD (P<0.05)	0.110	0.115	13.718	9.995

G_1=Konkan Tej;G_2=Acc-11; L_1=50 cm length of stem; L_2=100 cm length of stem; T_1=1-2 cm thickness of stem; T_2=2-3 cm thickness of stem; T_3=5-6 cm thickness of stem

dominant and profound effect of genotypes on thickness of stem.

There were differences in bark thickness before and after drying and quill fresh and dry weight due to interaction effect of genotype, length and thickness of stem (Table 3). Significantly maximum bark thickness before drying (1.74 mm) was recorded in the treatment combination $G_2L_1T_3$, which was on par with $G_1L_2T_3$ (1.72 mm), $G_2L_2T_3$ (1.71 mm) and $G_1L_1T_3$ (1.67 mm). The treatment combination $G_1L_2T_3$ produced significantly highest bark thickness after drying (1.33 mm), quill fresh (223.31 g) and dry weight (117.28 g). Significantly low bark thickness before drying (1.00 mm), quill fresh weight (49.13 g) and quill dry weight (22.92 g) were recorded in the treatment combination $G_1L_1T_1$, which was at par with the treatment combination $G_2L_1T_1$. Significantly low bark thickness after drying (0.65 mm) was recorded in the treatment combination $G_1L_2T_1$ which was at par with $G_2L_2T_1$ treatment combination (0.70 mm).

The thickness of stem selected for coppicing is very important for quill thickness and weight in cinnamon. Increased fresh and dry bark thickness and fresh and dry quill weight resulted from interactive effect of thick stem (T) with genotypes (G) and lengths (L). Thick stem (5–6 cm thick) used for coppicing might have accumulated more food material and therefore, higher yield (Hartmann *et al.* 2002).

The data regarding oil percentage of different thickness of stem in Konkan Tej and ACC–11 genotypes are presented in Table 4. It was observed that oil percentage was higher in thicker stem in both the genotypes. Higher oil percentage was observed in 5–6 cm. thick stem of cinnamon varieties *i.e.* Konkan Tej (3.0%) and ACC-11 (2.50%). The data regarding economics of bark extraction in cinnamon are presented in Table 5. It was observed from the table that treatment T_3 (5–6 cm thickness stem of cinnamon) resulted in highest net profit (Rs. 670/10 kg bark). Hence, it is recommended that

Table 2. Effect of G × L, G × T and L × T on fresh bark thickness before drying, bark thickness after drying, quill fresh weight and quill dry weight of cinnamon (Pooled data of 2008–09, 2009–10, 2010–11)

Treatment combinations	Bark thickness before drying (mm)	Bark thickness after drying (mm)	Quill fresh weight (g)	Quill dry weight (g)
G × L				
G_1L_1	1.28	0.93	82.07	40.76
G_1L_2	1.30	0.92	126.33	65.93
G_2L_1	1.33	0.90	81.32	41.68
G_2L_2	1.28	0.87	124.05	61.92
S.Em.±	0.035	0.028	3.427	1.724
CD (P<0.05)	N.S.	N.S.	14.20	5.966
G × T				
G_1T_1	1.00	0.69	58.12	26.72
G_1T_2	1.17	0.80	81.99	44.06
G_1T_3	1.70	1.28	172.49	89.26
G_2T_1	1.00	0.71	61.10	29.73
G_2T_2	1.19	0.78	85.79	45.01
G_2T_3	1.72	1.17	161.15	80.67
S.Em.±	0.026	0.037	3.871	2.553
CD (P<0.05)	0.088	0.130	13.395	8.833
L × T				
$L_1 T_1$	1.00	0.72	50.62	23.40
L_1T_2	1.22	0.82	75.04	39.37
L_1T_3	1.70	1.20	119.42	60.90
L_2T_1	1.00	0.68	68.60	33.05
L_2T_2	1.15	0.76	92.75	49.71
L_2T_3	1.72	1.24	214.22	109.03
S.Em.±	0.034	0.02	3.52	2.18
CD (P<0.05)	0.118	0.07	12.19	7.53

G_1=Konkan Tej; G_2=Acc-11; L_1=50 cm length of stem; L_2=100 cm length of stem; T_1=1-2 cm thickness of stem; T_2=2-3 cm thickness of stem; T_3=5-6 cm thickness of stem

Table 3. Effect of interaction on bark thickness before drying, bark thickness after drying, quill fresh weight, quill dry weight of cinnamon (Pooled data of 2008–09, 2009–10, 2010–11)

Treatments combinations	Bark thickness before drying (mm)	Bark thickness after drying (mm)	Quill fresh weight (g)	Quill dry weight (g)
$G_1L_1T_1$	1.00	0.73	49.13	22.92
$G_1L_1T_2$	1.18	0.83	75.41	38.13
$G_1L_1T_3$	1.67	1.24	121.67	61.23
$G_1L_2T_1$	1.00	0.65	67.10	30.91
$G_1L_2T_2$	1.17	0.77	88.57	50.00
$G_1L_2T_3$	1.72	1.33	223.31	117.28
$G_2L_1T_1$	1.01	0.72	52.10	23.87
$G_2L_1T_2$	1.26	0.81	74.67	40.62
$G_2L_1T_3$	1.74	1.17	117.18	60.56
$G_2L_2T_1$	1.01	0.70	70.10	35.59
$G_2L_2T_2$	1.13	0.76	96.92	49.41
$G_2L_2T_3$	1.71	1.16	205.13	100.77
S.Em.±	0.047	0.040	5.6196	3.3097
C.D. 5%	0.138	0.118	16.479	9.705

G_1=Konkan Tej; G_2=Acc-11; L_1=50 cm length of stem; L_2=100 cm length of stem; T_1=1-2 cm thickness of stem; T_2=2 - 3 cm thickness of stem; T_3=5-6 cm thickness of stem

Table 4. Oil percentage as influenced by thickness of stem in cinnamon

Sr. No.	Genotype	Oil percentage		
	Stem thickness	1-2 cm	2-3 cm	5-6 cm
1	Konkan Tej	2.78	2.80	3.00
2	ACC–11	2.35	2.40	2.50

Table 5. Economics of 10 kg cinnamon bark extraction

Sr. No.	Particulars	1-2 cm stem thickness	2-3 cm stem thickness	5-6 cm stem thickness
1	Material cost (Rs.)	1460	1430	1285
2	Labour cost (Rs.)	550	515	425
3	Other cost (Rs.)	310	135	120
4	Total cost (Rs.)	2320	2080	1830
5	Net return by selling of produce (Rs.)	2500	2500	2500
6	C : B ratio (Rs.)	1.08	1.20	1.36
7	Net profit per 10 kg bark (Rs.)	180	420	670

for getting highest cinnamon bark yield, 5–6 cm thick stem bark should be used for coppicing.

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