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Development of Volumetric Equation for Quick Assessment of Standing Trees of *Casuarina* sp.

R.P. Gunaga*, L.K. Behera, S.K. Sinha, A.A. Mehta, N.S. Thakur, Y.A. Garde, J.B. Bhusara and R.L. Sondarva

College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India

*Email: rpgunaga@nau.in

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1. Introduction

Casuarina sp. (Family: Casuarinaceae) are commercial multipurpose tree species and well suited for agroforestry systems as wind break/shelter belt, soil conservation and nitrogen fixing trees. Presently, fast growing genotypes, clones and hybrids of *Casuarina* are planted across the country. Farmers are much benefitted for higher yield, economic returns and environmental security. Due to its fast-growing nature and local demand for pole and pulpwood, Gujarat farmers are growing this plant in their farmlands. Further, local industries *viz.*, paper industries (for pulp wood) and construction industries (for pole) are procuring raw materials from farms and plantations. The present study focused towards development of volumetric equation for this species.

2. Material and methods

The present study was carried out in different parts of south Gujarat Heavy rainfall zone AES-III, India. In order to develop volumetric equation, Casuarina trees belonged to 12 different diameter classes from 10-15 cm (D_1) to 65-70 cm (D_{12}) were considered (Table 1) and various biometric parameters such as tree height (H), dimeter at breast height (DBH, D), Mid- diameter, Form Quotient [FQ=DBH/MD] and Volume [$V=\pi D^2/4$ x H x FQ] were recorded/estimated (Gunaga et al 2021). Trees located in the conventional plantations, coastal belt, avenue/road-side plantations, agroforestry landscapes were used. Using these data volumetric equation was developed using regression equation.

3. Results and discussion

In the present study, about 1300 trees belonged to different diameter classes *viz.*, D1: 10-15 cm, D2: 15-20 cm, D3: 20-25 cm, D4: 25-30 cm, D5: 30-35 cm, D6: 35-40 cm, D7: 40-45 cm, D8: 45-50 cm, D9: 50-55 cm, D10: 55-60 cm, D11: 60-65 cm and D12: 65-70 cm, were selected in different parts of south Gujarat. Among them, after deleting out-layers, 1108 trees were used for assessment. Data pertaining height, diameter and mid-diameter, form quotient and volume are given in Table 1. Result showed that there was a huge difference in terms of diameter, height and volume calculated from lower diameter to higher diameter classes; therefore, data were grouped into two sets, the first set includes D1 to D7 diameter classes and the second set includes D8 to D12 diameter classes. Regression equations developed using first data set was Volume (V_1) = 0.00005 x HD^2+ 0.0196 (R^2 = 0.919), while volume for second data set was V_2 = 0.00003 x HD^2 + 0.6874 (R^2 = 0.712). Here, 0.0196 and 0.6874 are constant values used in the equation. Therefore, farmers, foresters, wood merchants and wood industrial persons can use these volumetric equations for quick estimation of standing volume of *Casuarina* trees.

Reference

Gunaga RP, LK Behera, SK Sinha, AA Mehta, NS Thakur 2021. Development of local volume table for Saru (*Casuarina equisetifolia* L.). *In:* Report of Forestry sub-committee of NAU presented in 17th Combined Joint AGRESCO at SDAU, SK Nagar, Gujarat. Pp. 33-44.

Table 1: Biometric parameters of standing *Casuarina* trees across different diameter classes

Diameter classes		Sample size (N)	DBH (cm)	Mid-dia. (cm)	Height (m)	FQ	Volume (m^3)
D1: 10 to 15 cm	Min	173	10.25	5.40	8.40	0.09	0.01
	Max		15.00	14.90	27.30	1.05	0.39
	Mean		12.68	9.13	16.54	0.71	0.16
D2: 15 to 20 cm	Min	132	15.10	8.20	10.50	0.51	0.14
	Max		20.00	17.30	29.20	0.94	0.63
	Mean		17.69	12.25	20.39	0.69	0.35
D3: 20 to 25 cm	Min	169	20.05	10.30	13.70	0.47	0.28
	Max		25.00	20.80	30.80	0.95	1.18
	Mean		22.75	14.29	21.81	0.63	0.56
D4: 25 to 30 cm	Min	180	25.05	12.60	15.20	0.46	0.41
	Max		29.95	22.10	33.10	0.82	1.50
	Mean		27.44	16.21	23.74	0.59	0.84
D5: 30 to 35 cm	Min		30.10	13.10	17.20	0.42	0.64
	Max	144	34.95	28.50	40.50	0.88	2.93
	Mean		32.48	18.72	26.54	0.58	1.29
D6: 35 to 40 cm	Min		35.05	14.80	19.70	0.40	0.94
	Max	129	40.00	37.50	41.50	1.00	4.56
	Mean		37.53	22.03	29.49	0.59	1.95
D7: 40 to 45 cm	Min		40.10	15.80	18.30	0.37	0.97
	Max	73	45.00	36.60	41.30	0.85	4.10
	Mean		42.49	23.52	30.42	0.55	2.42
D8: 45 to 50 cm	Min		45.05	19.50	26.20	0.40	2.16
	Max	40	49.85	33.40	45.50	0.74	5.54
	Mean		47.35	25.31	33.71	0.53	3.20
D9: 50 to 55 cm	Min		50.60	20.60	26.30	0.39	2.23
	Max	27	54.95	36.70	43.30	0.67	6.80
	Mean		52.98	27.54	32.56	0.52	3.76
D10: 55 to 60 cm	Min		55.40	20.50	27.10	0.35	2.80
	Max	21	59.95	38.10	45.10	0.66	7.11
	Mean		57.63	28.40	34.33	0.49	4.45
D11: 60 to 65 cm	Min		60.30	20.70	27.40	0.34	2.88
	Max	11	64.75	35.40	43.30	0.56	7.65
	Mean		62.23	27.17	33.93	0.44	4.58
D12: 65 to 70 cm	Min	9	65.95	23.70	31.10	0.36	4.30
	Max		69.50	31.30	41.70	0.45	7.11
	Mean		67.79	27.97	36.66	0.41	5.48
		1108					

DBH=Diameter at breast height; FQ= Form Quotient = Form Quotient