Diameter distribution model development of tropical hybrid Eucalyptus clonal plantations in Sumatera, Indonesia: A comparison of estimation methods

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A robust diameter distribution model is required to provide volume by classes & to manage forest plantation effectively. So, which method is the best to predict the parameters of the Weibull PDF that characterizing diameter distributions of *Eucalyptus hybrid* clone plantation?

- Study site: Teso East (APRIL plantation), Riau, Indonesia. The study used 2808 inventory plots of two *Eucalyptus hybrid* clones.
- 3-parm Weibull was used to characterize diameter distribution.

$$f(x) = \frac{c}{b}\left(\frac{x-a}{b}\right)^{c-1} exp\left[-\left(\frac{x-a}{b}\right)^{c}\right]$$

a= location = 1; *b*= scale; *c*=shape

- Three methods (moment MOM; percentile PCT; hybrid HYB) were compared to recover the future parameter(b and c).

Moment (D,DQ)

$$b = \frac{\left(\widehat{\bar{D}} - a\right)}{\Gamma_1}$$

$$\widehat{DQ}^2 - a^2 2a\widehat{\bar{D}} - b^2\Gamma_2 = 0$$

Hybrid (DQ,P_{25},P_{99})

$$b = -a\frac{\Gamma_1}{\Gamma_2} + \left[\left(\frac{a}{\Gamma_2}\right)^2\left(\Gamma_1{}^2 - \Gamma_2\right) + \frac{\widehat{DQ}^2}{\Gamma_2}\right]^{0.5}$$

$$c = \frac{ln\left(\frac{ln(1-.99)}{ln(1-.25)}\right)}{ln\left(\widehat{D}_{99} - a\right) - ln\left(\widehat{D}_{25} - a\right)}$$

Percentile (D_{25},D_{99})

$$b = \frac{\widehat{D}_{99} - a}{[-ln(1-.99)]^{\frac{1}{c}}}$$

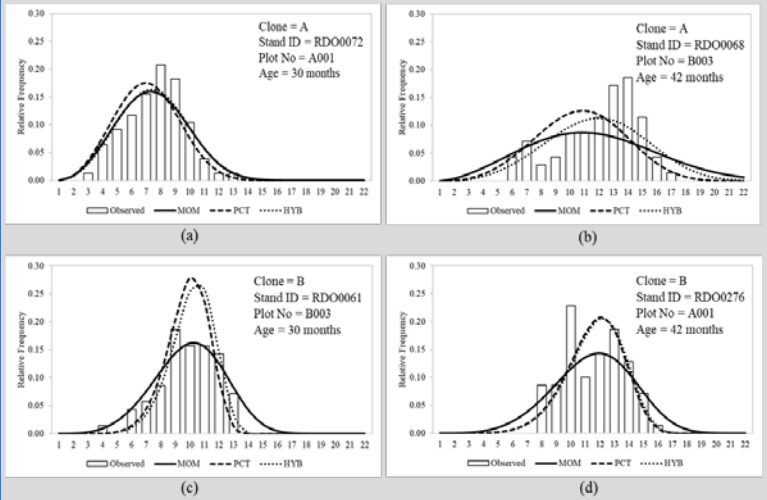
$$c = \frac{ln\left(\frac{ln(1-.99)}{ln(1-.25)}\right)}{ln\left(\widehat{D}_{99} - a\right) - ln\left(\widehat{D}_{25} - a\right)}$$

- DQ was predicted from the stand growth model; D, D_{25}, D_{99} were predicted using regression equations of stand attributes.
- The method producing the lowest Kolmogorov-Smirnov (KS) statistics and Error-Index (EI) was the best.

Result

Method	KS		EI	
	Mean	Std	Mean	Std
MOM	0.176	0.072	26.52	6.71
PCT	0.213	0.076	31.47	9.80
HYB	0.199	0.083	27.73	8.20

The MOM has the lowest KS and EI, followed by HYB and PCT methods. The MOM tends to be more robust with tails of the distribution and exhibited greater flexibility.



Overall, the Weibull with MOM appeared relatively robust in determining diameter distributions of *Eucalyptus hybrid* clone, yet some refinements may be necessary to characterize more complex distributions.

Several variants of Weibull distribution and other PDF distributions are potentially worth examining for future evaluation.

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