FBGA 2023 Annual Meeting, 11/21/2023

Bamboo Production Quantification Methods and Overview

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What Do You Get When You Cross Bambi With A Ghost?

Applying Forest Inventory Methodology to Bamboo

Yield Components

Yield = f(Genetics, Environment, Age)

Genetics = f(Genotype, Propagation)

Environment= f(Management, Site, Weather)

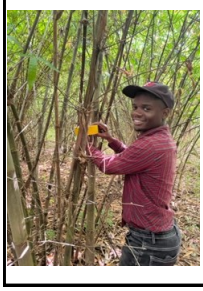
Management = f(Planting Density, Site Amendment, Weed Control)

Age = f(Rotation Length)

Predict Product Content

Bamboo Products: Food, Fiber, Carbon Sequestration, Etc.

Collaboration with Dr. Davie and Crew:
Kondwani, Noor, Aaron, Cyrus, William



Fatout 06/08/2023 4-Culm Sample: Culm Green Weight (GW, lbs.) Prediction

	Sample Data							
Culm	BD in	DBH in	TH ft	BD^2	BD^2TH	DBH^2	DBH^2TH	GW
1"	1.12	0.77	12.7	1.26	16.01	0.59	7.51	2.5
2"	1.95	1.87	25.8	3.81	98.22	3.50	90.38	15.7
3"	2.99	2.31	30.0	8.92	267.53	5.32	159.52	25.0
4"	3.80	2.85	34.0	14.46	491.67	8.12	276.01	37.5

	Predicted GWs for 4 Culms by Six Independent Variables GW = b0 + b1 x Variable					
GW	BD	DBH	BD^2	DBH^2	BD^2TH	DBH^2TH
2.5	3.35	0.72	5.66	2.45	6.30	3.88
15.7	13.72	18.89	11.97	16.06	11.93	14.60
25.0	26.68	26.04	24.64	24.53	23.53	23.55
37.5	36.90	35.00	38.39	37.62	38.89	38.62
b0	-10.71	-11.95	2.53	-0.31	5.21	2.91
b1	12.52	16.48	2.48	4.67	0.07	0.13
r^2	0.988	0.969	0.962	0.999	0.950	0.990
F	646.83	634.18	629.685	654.25	621.70	648.02

BD=Basal Diameter, DBH=Diameter at 4.5', TH=Culm Height, BD^2=BD squared, DBH^2=DBH squared, BD^2TH= BD squared * TH, DBH^2TH=DBH squared * TH

Fatout 06/08/2023 4-Culm Sample:
Culm Fiber Green Weight (GW, lbs) Prediction,
Moisture Content, and Field Drying

GW=2.479*BD^2+2.531

Predicted GWs for BDs 1-6"	
BD	GW
1	5.01
2	12.45
3	24.85
4	42.20
5	64.52
6	91.79

Moisture Content (%, DW)
At Felling – 255.8

Field Drying (%, GW)
1 month – 51.8
2 months – 44.4

Inventory Goals

Current

Current + Short-term Forecast

Current + Full Rotation

Rotation Length

Fieldwork Options

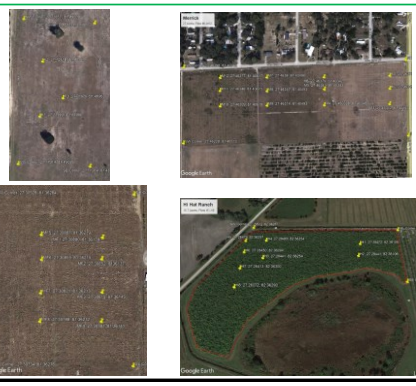
Plot Location: Random, Systematic

Plot Shape: Circular, Square, Rectangular

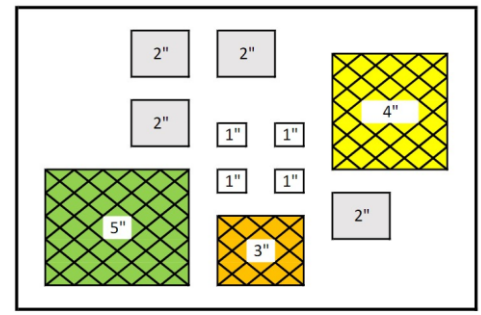
Plot Duration: Temporary, Permanent

Sampling Intensity: Fixed, Precision/Confidence

Permanent Plot Locations in Four Farms: Fatout, Merrick, MFA, Hi Hat



Representative Contributions of 11 Culms
(Four 1", Four 2", One 3", One 4", and One 5" Culms)
to Basal Area of One Clump (@1^2, 2^2, 3^2, 4^2, and 5^2)



Basal Area (sq.ft.) = .005454 x D(in)^2

Inventory Summaries for Four Farms:

Plot Shape, Size, Configuration, and Numbers of Plots, Clumps and Culms, Area, Coefficients of Variation (CV) for Clumps/Plots and Plots, Sampling Intensity, Achieved Precision, and Number of Plots for 10% Precision

	Fatout	Merrick	MFA	Hi Hat
Plot Shape	Square	Rectangular	Rectangular	Rectangular
Plot Size	30' x 30'	80' x 8'	80' x 8'	50' x 18'
Plot Configuration	3 rows x 3 clumps	6 rows x 1 clump	6 rows x 1 clump	3 rows x 2 clumps
No. of Plots	3	12	8	8
Total Clumps	27	72	48	48
Total Culms	430+	1,322+	941+	901+
Area (acres)	3	27	10	15.7
CV Clumps/Plots (%)	94-108	30-147	22-71	37-79
CV Plots (%)	16	23	13	18
Sampling Intensity (%)	2.1	0.7	1.2	1.1
Achieved Precision (±%)	38	38	11	15
Plots for 10% Precision	49	68	9	18

Across Farms Analysis of Variance (ANOVA) for Basal Area/Acre

	df	Mean Square	F
Farms	3	4.098	1.62
Plots(Farm)	27	2.523	1.25
Clumps(Plots(Farms))	154	2.018	
Culms(Clumps(Plots(Farms)))	2891		

Fatout ANOVA for Basal Area/Acre

Plots	2	5.985	2.91
Clumps(Plots)	18	2.053	3.75**
Culms(Clumps(Plots))	326	.547	

Merrick ANOVA for Basal Area/Acre

Plots	11	3.711	1.54
Clumps(Plots)	56	2.413	6.30**
Culms(Clumps(Plots))	955	.3829	

Similar ANOVAs for Basal Area/Acre at MFA and Hi Hat

Inventory Design Guidelines

Plot Location: Systematic

Plot Shape: Square, Rectangular

Clumps/Plot: 6-12

Plot Duration: Permanent

Sampling Intensity: Precision/Confidence; 1-3%