Table 4. Yield and related properties - 2009 Main Cotton Variety Test across four Arkansas test sites.

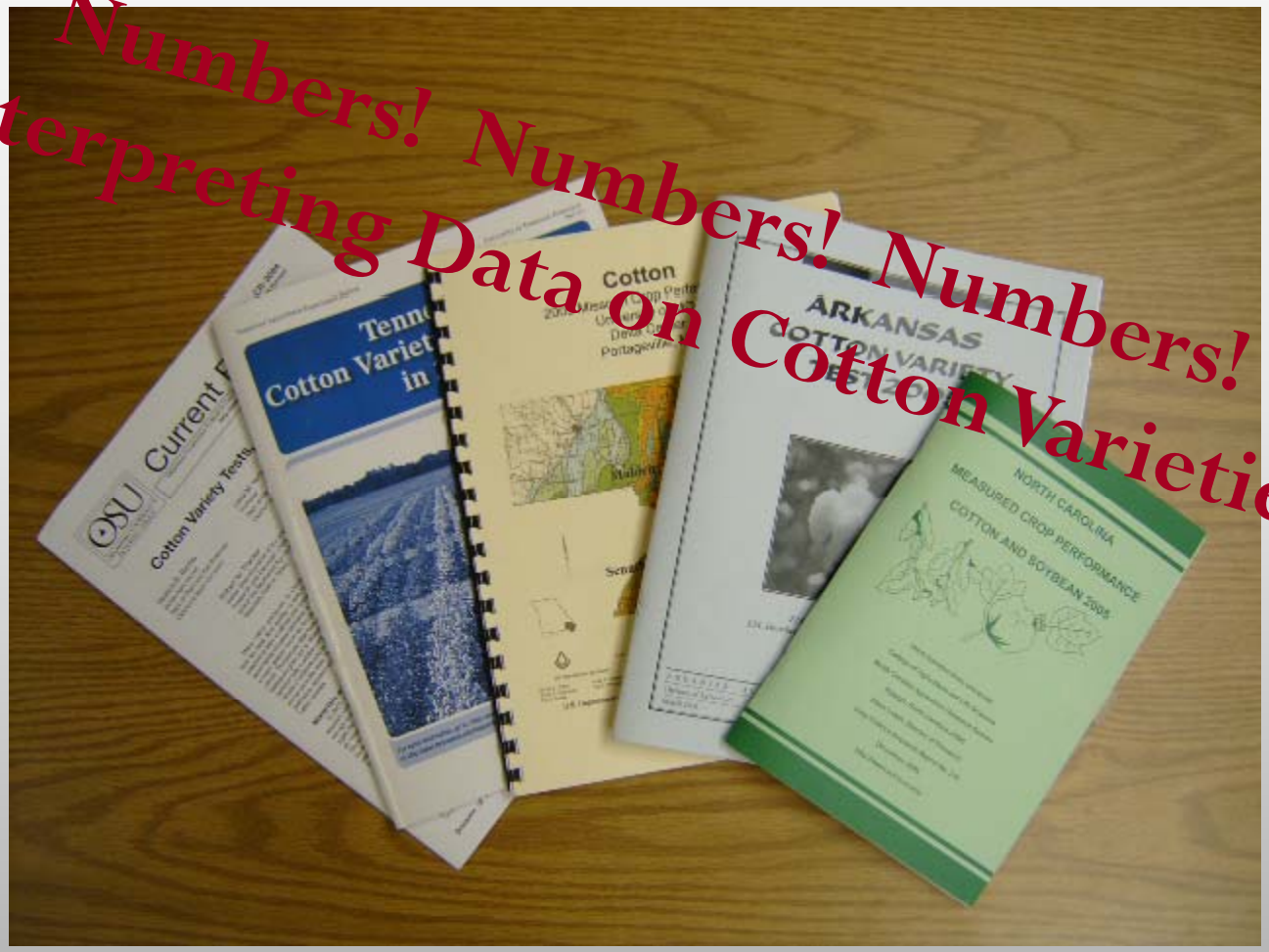
Variety	Lint yield	r	Lint frac.	r	Ht.	r	Open bolls	r	Seed index	r	Lint index	r	Seed/ acre	r	Fibers/ seed	r	Fiber density	r
	lb/a		%		cm		%		g		g		mil.		no.		no.	
DP 174 RF	1010	1	43.6	1	109	5	52	22	9.8	9	7.8	1	5.976	10	17704	2	301	3
ST 4288B2F	957	2	38.6	17	97	30	50	27	10.7	2	6.9	6	6.450	4	15500	16	241	28
ST 5288B2F	910	3	39.9	10	105	16	52	23	9.0	29	6.1	19	6.864	1	13647	29	255	22
PHY 370 WR	881	4	40.1	9	112	4	58	9	9.8	11	6.7	10	6.006	9	15766	14	270	15
DP 393 ck.	878	5	40.1	9	107	11	54	17	10.2	3	7.0	5	5.791	12	16307	11	268	16
DG 2570	868	6	41.6	2	108	10	59	10	9.6	15	7.0	4	5.731	14	16691	8	290	8
ST 5458 B2RF	856	7	38.7	15	106	14	49	29	10.0	6	6.5	13	6.025	8	15580	15	260	19
FM 1740 B2F	853	8	39.5	14	99	29	58	8	10.1	4	6.8	9	5.769	13	16947	6	282	10
PHY 375 WRF	848	9	41.0	6	109	8	55	15	9.9	10	6.8	7	5.660	16	17384	5	305	2
DP 0924 B2RF	836	10	39.6	12	108	9	56	14	9.3	25	6.2	18	6.157	6	15012	20	271	13
DP 0935 B2RF	833	11	40.1	9	109	7	50	27	9.7	12	6.8	8	5.723	15	15982	12	274	11
DP 141 B2RF	826	12	38.2	19	101	25	50	26	9.2	26	5.8	25	6.088	3	13737	27	250	26
PHY 485 WRF	818	13	38.6	18	107	12	53	13	9.3	24	6.0	22	6.289	2	14402	26	252	24
AM NG 3331 B2RF	807	14	38.2	20	107	12	53	10	9.9	7	6.2	17	5.958	11	14832	24	272	27
ST 4498 B2RF	804	15	37.8	24	103	18	51	24	9.5	17	6.1	21	6.070	7	14976	21	277	9
PHY 315 RF	799	16	41.6	3	106	15	59	6	9.8	10	7.1	3	5.122	28	17414	4	298	4
DP 161 B2RF	794	17	37.4	27	112	3	53	20	9.5	28	6.5	20	6.021	2	12644	30	235	29
AM 1550 B2RF	791	18	39.6	11	100	28	57	12	9.5	21	6.4	15	6.169	5	16820	7	296	5
DP 454 BG/RR ck.	786	19	41.5	4	119	1	52	23	9.0	30	6.5	12	5.642	21	17165	7	335	1
CG 3035RF	786	20	41.3	5	103	20	54	18	10.0	5	7.2	2	5.004	30	17530	3	293	6
FM 1845LLB2	766	21	36.3	29	101	25	53	20	11.3	1	6.6	11	5.303	25	14092	25	208	30
CG 4020 B2RF	727	22	37.9	23	101	26	60	4	9.6	14	6.1	20	5.632	21	14785	22	257	20
AM NG 4370 B2RF	727	23	38.1	21	107	13	54	18	9.5	20	6.0	23	5.548	20	14542	24	255	21
CG 3220 B2RF	723	24	39.5	13	101	24	59	6	9.7	13	6.5	14	5.157	27	15774	13	273	12
ST 4554 B2RF, ck.	717	25	38.6	16	103	19	56	15	9.8	8	6.4	16	5.166	26	15053	18	255	23
CG 3520 B2RF	702	26	37.7	25	102	21	63	1	9.5	22	5.9	24	5.464	22	15021	19	265	17
DG 2490	687	27	36.2	30	102	22	60	5	9.5	18	5.6	29	5.659	17	16580	9	291	7
DG 2520	684	28	37.4	26	103	17	62	2	9.4	23	5.8	26	5.434	24	15209	17	270	14
CG 3020 B2RF	680	29	36.8	28	102	23	61	3	9.5	17	5.7	28	5.441	23	16394	10	287	9
SSG HQ210CT	635	30	38.1	22	100	27	46	30	9.1	27	5.8	27	5.032	29	13680	28	252	25
Mean	801		39.1		106		55		9.7		6.4		5.763		15578		270	
Var. LSD 0.10	62		1.0		5		5		0.3		0.3		0.452		866		15	
Loc. LSD 0.10	22		0.4		2		2		0.1		0.1		0.158		243		5	
C.V.%	12.8		3.2		7.9		13.0		4.1		5.8		12.9		5.2		6.5	
R-sq x 100	69.0		85.8		83.0		81.8		85.3		89.4		71.5		89.7		86.8	
Prob (var x loc)	<.0001		0.120		0.035		0.144		<.0001		<.001		<.001		0.001		0.033	

Quality		Fiber properties									
score	r	Micronaire	r	Length	r	Unif. index	r	Strength	r	Elongation	r
				in.		%		g/tex		%	
80	2	4.3	13	1.21	4	85.1	2	29.2	19	11.0	16
66	8	4.5	3	1.19	5	83.9	17	30.0	12	10.6	18
61	17	4.6	1	1.18	9	83.7	23	29.1	20	10.4	23
53	26	4.5	2	1.14	26	84.0	14	30.3	8	10.8	17
69	5	4.3	12	1.18	8	84.7	5	30.8	7	11.1	13
64	10	4.3	14	1.17	14	84.6	6	30.3	9	11.4	8
65	9	4.3	15	1.19	6	83.8	20	29.4	17	9.7	29
61	16	4.1	23	1.17	13	84.3	8	29.4	18	10.3	24
62	12	4.0	26	1.16	16	83.9	18	29.0	22	10.5	20
52	27	4.4	6	1.14	27	83.3	28	29.0	21	11.3	10
62	13	4.3	9	1.17	12	84.2	10	30.2	10	10.5	21
77	4	4.2	20	1.21	3	84.2	9	31.3	4	10.1	27
68	6	4.3	9	1.17	11	84.7	3	31.6	2	11.8	5
55	25	4.5	3	1.14	25	83.7	22	30.0	13	10.5	19
60	18	4.2	21	1.15	22	84.0	13	31.5	3	12.2	3
63	11	4.2	19	1.16	15	83.9	16	28.7	23	10.3	25
79	3	4.3	17	1.22	2	84.3	7	30.2	11	9.8	28
50	28	4.1	25	1.13	28	83.4	27	27.9	26	11.2	12
59	20	3.7	28	1.16	16	84.7	4	29.6	15	10.2	26
57	24	4.3	11	1.14	24	83.7	25	29.5	16	11.7	6
81	1	4.5	5	1.24	1	84.1	11	31.7	1	9.3	30
68	7	4.2	22	1.18	7	84.0	15	27.7	29	11.1	15
59	22	4.3	15	1.15	23	84.1	11	29.7	14	11.1	13
59	20	4.1	24	1.16	19	83.7	24	28.7	24	11.3	11
62	14	4.4	7	1.19	21	83.8	19	31	6	12.6	1
59	19	4.1	24	1.16	19	83.8	21	27.8	27	11.5	7
41	30	3.7	30	1.12	30	83.8	30	27.7	28	12.3	2
61	15	3.9	27	1.18	10	83.7	26	28.0	25	11.4	9
44	29	3.7	29	1.12	29	83.3	29	27.3	30	12.0	4
58	23	4.4	7	1.16	16	84.1	12	30.2	5	10.4	22
62		4.2		1.17		84.1		29.6		10.9	
8		0.2		0.02		0.7		0.9		0.4	
ns		0.1		0.01		ns		0.3		0.1	
16.5		5.3		2.0		1.1		3.5		4.1	
74.2		90.8		84.2		63.8		82.3		88.9	
0.083		0.005		0.001		0.649		0.811		0.008	

Numbers! Numbers! Numbers!
Interpreting Data on Cotton Varieties

Fred Bourland, University of Arkansas
Division of Agriculture

Variety Test Publications



Numbers! Numbers! Numbers!
Interpreting Data on Cotton Varieties

State	2009 No. of locations	2009 No. of entries	Means per parameter (w/o across loc means)
Missouri	3	Main = 36 or 44	124
Tennessee	6	Main = 45	270
Arkansas	4 4	Main = 31 New = 19	124 76
Mississippi – Delta	5 2	Main = 31 New = 18	155 36
Mississippi - Hill	4 2	Main = 31 New = 18	124 36
Louisiana	6 6	Early = 21 or 25 Mid = 16 or 20	142 112
Total	**32 diff. loc.**		**1199**

Numbers! Numbers! Numbers!
Interpreting Data on Cotton Varieties

Number of Parameters: Arkansas Cotton Variety Test

Loc	Rep	Parameter	Observations per entry	Means per entry
4	4	4 (**LY**, HT, OB, SPA)	64	16 +1
4	2	5 (**L%**, SI, LI, FPS, Fden)	40	20 +1
4	2	6 (QS, **Mic, Len, UI, Str**, Elo)	48	24 + 1
1	4	3 (Lpub, Spub, Btri)	12	3
1	12	1 (TPB)	12	1
	Total	**19**	**176**	**67**

Numbers! Numbers! Numbers!
Interpreting Data on Cotton Varieties

3 zones (Eastern, Central, Western)
~ 30 locations per zone
~ 40 entries per location
= ~3,600 means for each parameter

6 parameters * 3,600 = 21,600 means!
Plus: Means across locations
Additional parameters
Usually 4 replications

Yield and Yield Component Parameters

Arkansas Cotton Variety Test, 2003-2009

Parameter	No. of tests	Sign. (0.10) Variety effect	Sign. (0.10) Loc. effect	Sign. (0.10) Var. x Loc.
Lint yield	16	100%	100%	**100%**
Seed per acre	16	100%	100%	**100%**
Lint %	16	100%	100%	**63%**
Seed index	16	100%	94%	**56%**
Lint index	16	100%	94%	**50%**
Fibers per seed	16	100%	94%	**56%**
Fiber density	6	100%	83%	**50%**

Maturity and Fiber Parameters

Arkansas Cotton Variety Test, 2003-2009

Parameter	No. of tests	Sign. (0.10) Variety effect	Sign. (0.10) Loc. effect	Sign. (0.10) Var. x Loc.
Open bolls %	16	100%	94%	**82%**
Plant height	16	100%	100%	**44%**
Q-score	6	100%	33%	**50%**
Micronaire	16	100%	94%	**56%**
Length	16	100%	94%	**38%**
Unif. Index	16	100%	81%	**6%**
Strength	16	100%	81%	**19%**
Elongation	16	100%	81%	**38%**

Variety x Location Interactions

1. Soil type
   - ✓ Texture
   - • Surface/internal drainage; fertility
2. Diseases
   - ✓ Verticillium wilt
   - ✓ Root-knot nematode
   - • Reniform nematodes and other diseases
3. Insects
   - • Different technologies (various Bt's & non-Bt)
   - • Insect infestations
   - • Varietal responses to insect pests
4. Maturity
   - ✓ Latitude of test site
   - • Variety differences in fruiting
   - • Stand/emergence consistency (different seed sources)
5. Management of test
   - ✓ Irrigated or non-irrigated
   - • Timing of planting, irrigation, other inputs, defoliation
   - • Control of maturity (plant growth regulators)

Evaluation of Lint Yields

Specific location adaptation:

Examine test sites with similar soil texture, disease incidence, latitude, and irrigation status.

- Use multiple years (often limited).
- May have few "similar" sites.

General (or wide) adaptation:

Examine as many sites and years within broad area that are available.

- Year-to-year variation $\geq$ site-to-site variation.
- May include non-similar sites and years, but "cream-to-the-top".

Older Varieties Data Set - 3 years, 2007-09

(2 & 3 year data usually reported, these evaluated > 2 years, rank out of 20)

Variety	Lint yield, lb/a	Keiser	Judd Hill	Marianna	Rohwer
DP 174 RF	1175	4	9	2	1
PHY 370 WR	1163	6	2	1	2
DG 2570	1126	5	4	4	9
PHY 315 RF	1124	8	1	10	4
PHY 375 WRF	1116	7	3	6	8
AM 1550 B2RF	1107	9	7	7	7
DP 454 BG/RR, ck.	1094	10	5	13	5
DP 393, ck.	1089	2	15	8	11
PHY 485 WRF	1076	14	6	16	6
ST 5458 B2RF	1069	11	16	15	3
CG 3035 RF	1061	1	13	9	19
CG 3220 B2RF	1061	12	10	5	16

Components of Yield

Definitions
• Seed per acre = (Seedcotton yield * % seed)/seed index • Seed index = seed size, weight of 100 seed. • Lint index = weight of lint from 100 seed. • Lint percentage = portion of lint in seedcotton. • Fiber per seed = lint index / avg. weight of a fiber • Fiber density = fibers per seed / seed size
Seed per acre most closely related to lint yield. All other components are less affected by environment.

Using Components of Yield

Most basic model:
Yield = number of seed per acre * lint index

Advantages of "lint index" over "number of seed per acre":

- **Gravimetric: ~1.6 lb of seed to produce 1 lb of lint.**
- **Energetic: 2.25x as much energy to produce oil (seed) than cellulose (fiber).**

Increased reliance on "lint index" should enhance yield and yield stability.

Therefore, among group of varieties with highest yield - choose ones with relative higher lint index.

Older Varieties Data Set: 1-year (2009)

(Ranks out of 30)

Variety	Lint yield	Open bolls	Lint %	Lint index	Seed per acre	Fibers per seed	Fiber density
DP 174 RF	1	22	1	9	10	2	3
PHY 370 WR	4	9	8	10	9	14	15
DG 2570	6	10	2	4	14	8	8
PHY 315 RF	16	16	3	3	28	4	4
PHY 375 WRF	9	16	6	7	16	5	2
AM 1550 B2RF	18	12	11	15	18	7	5
DP 454 BG/RR, ck	19	23	4	12	19	1	1
DP 393, ck.	5	17	9	5	12	11	16
PHY 485 WRF	13	13	18	22	5	26	24
ST 5458 B2RF	7	29	15	13	8	15	19
CG 3035 RF	20	18	5	2	30	3	6
CG 3220 B2RF	24	6	13	14	27	13	12

Fiber Quality Traits

Q-Score
Q-score – a fiber quality index of up to six HVI fiber quality parameters. Ranges from 0 to 100.
Current weights used: Fiber length = 50 Micronaire = 25 Length uniformity = 15 Strength = 10
Research now underway to determine optimum weightings in relation to yarn quality

Fiber quality – less trash

Less leaf pubescence on smooth-leaf & semi-smooth varieties

Density of marginal bract trichomes varies among hairy and smooth leaf varieties.

Older Varieties Data Set: 1-year (2009)

Variety	Lint yield, rank/30	Q-score, index	Leaf pub, rating	Bract tri. rank/30
DP 174 RF	1	80	3.4	32
PHY 370 WR	4	53	3.1	33
DG 2570	6	64	2.8	27
PHY 315 RF	16	63	3.1	33
PHY 375 WRF	9	62	3.2	31
AM 1550 B2RF	18	50	1.2	24
DP 454 BG/RR, ck	19	59	5.2	38
DP 393 ck.	5	69	2.1	33
PHY 485 WRF	13	68	4.1	43
ST 5458 B2RF	7	65	4.1	29
CG 3035 RF	20	57	1.1	24
CG 3220 B2RF	24	59	1.5	27

Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois)

Nectaried and nectariless leaves

Damaged plants

Damaged “dirty” flower

Use of Statistics

Lint yield across locations, Ark. Cotton Variety Test, 2009

Significance level	LSD
0.001	120
0.01	94
0.05	71
0.10	60
0.20	46
0.40	31
0.50	24

Two types of errors:

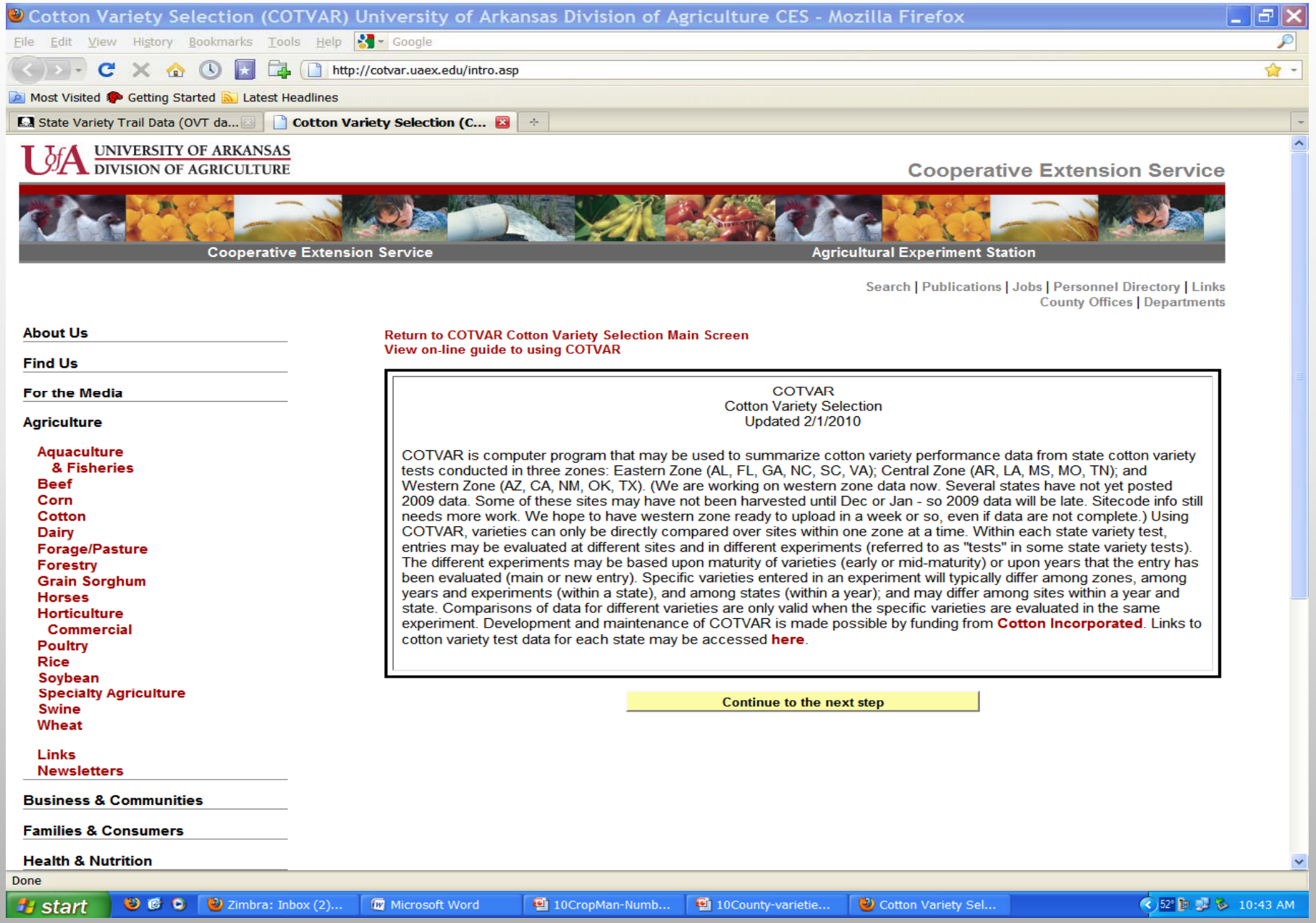
1. Rejecting a true H_0 -Say that two means differ when they are actually equal.
2. Accepting a false H_0 -Say that two means are equal when they actually differ.

Two types of mistakes:

1. Too slack – ignore LSD & statistics
2. Too strict – ignore trends.

Cotton Variety Test Results

- State Variety Tests:
  - http://www.cottoninc.com/AgriculturalResearch/StateVarietyTrialData/
- COTVAR:
  - On-line: http://cotvar.uaex.edu/intro.asp
  - Summarizes data from all State Cotton Variety Tests
    - 3 zones (Eastern, Central, Western)
    - ~30 test locations in each zone per year
- Other variety test summary programs from companies.
  - Across company comparisons w/in company tests?
  - Accuracy of state variety test data sets?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Cotton Variety Selection
Updated 2/1/2010
COTVAR is computer program that may be used to summarize cotton variety performance data from state cotton variety tests conducted in three zones: Eastern Zone (AL, FL, GA, NC, SC, VA); Central Zone (AR, LA, MS, MO, TN); and Western Zone (AZ, CA, NM, OK, TX). (We are working on western zone data now. Several states have not yet posted 2009 data. Some of these sites may have not been harvested until Dec or Jan - so 2009 data will be late. Sitecode info still needs more work. We hope to have western zone ready to upload in a week or so, even if data are not complete.) Using COTVAR, varieties can only be directly compared over sites within one zone at a time. Within each state variety test, entries may be evaluated at different sites and in different experiments (referred to as "tests" in some state variety tests). The different experiments may be based upon maturity of varieties (early or mid-maturity) or upon years that the entry has been evaluated (main or new entry). Specific varieties entered in an experiment will typically differ among zones, among years and experiments (within a state), and among states (within a year); and may differ among sites within a year and state. Comparisons of data for different varieties are only valid when the specific varieties are evaluated in the same experiment. Development and maintenance of COTVAR is made possible by funding from Cotton Incorporated. Links to cotton variety test data for each state may be accessed here.
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State Variety Trial Data
These web links provide access to the 17 states that conduct cotton variety trials across the US Cotton Belt. Performance data includes lint yield, fiber quality traits, and other important agronomic traits.
COTVAR: Variety Comparison Tool is web-based program that may be used to summarize cotton variety performance data from state cotton variety tests conducted in five Mid-South states. Development plans are in progress to add states in the future.
Alabama
Arizona
Arkansas
California
Florida
Georgia
Kansas
Louisiana
Missouri
Mississippi
New Mexico
North Carolina
Oklahoma
South Carolina
Tennessee
Texas
Virginia
National Cotton Variety Test
COTVAR: Variety Comparison Tool
The Cotton Diversity Database
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