PRESENTATION

Session:
GINNING NEWS

Title:
Reciprocating-knife and Rotary-knife Roller Ginning of Pima and Upland Cottons

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Reciprocating-knife and Rotary-knife Roller Ginning of Pima and Upland Cottons

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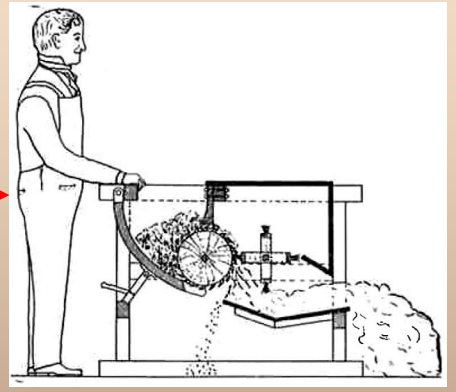
USDA Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

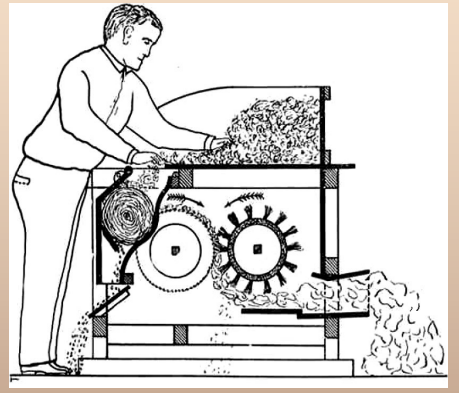
Cotton Incorporated

Ginning History

Churka Gin, 12th-14th century



Whitney, 1794



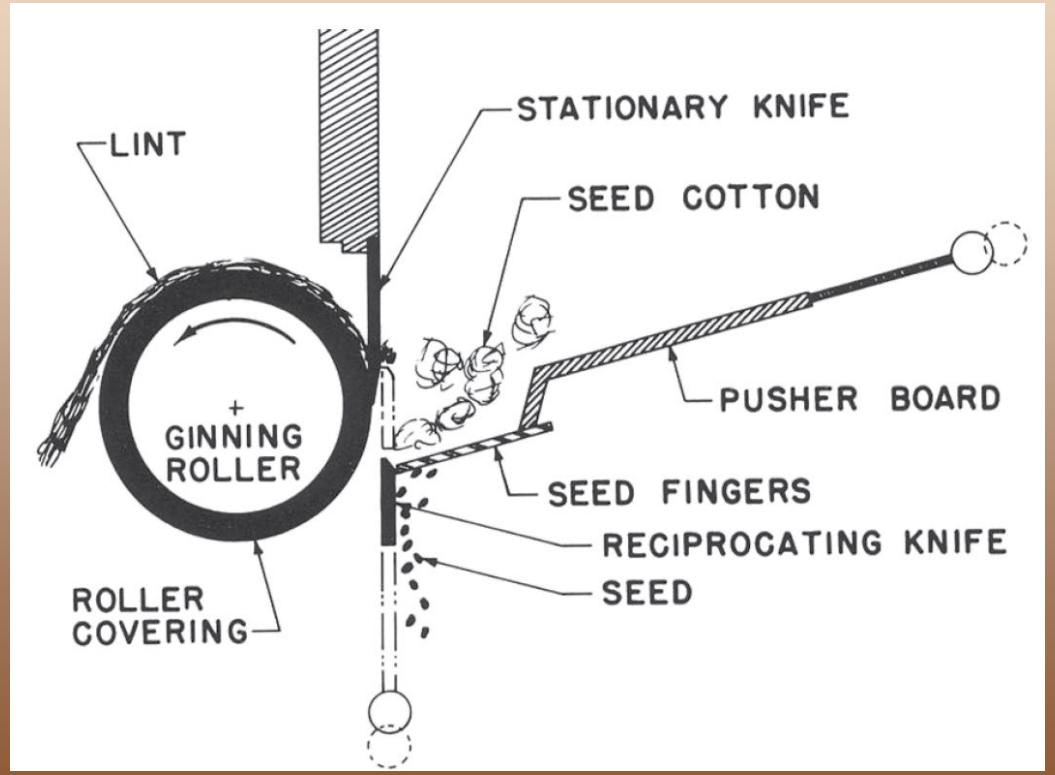
Holmes, 1796

McCarthy, 1840

USDA Gin Lab, NM~1960

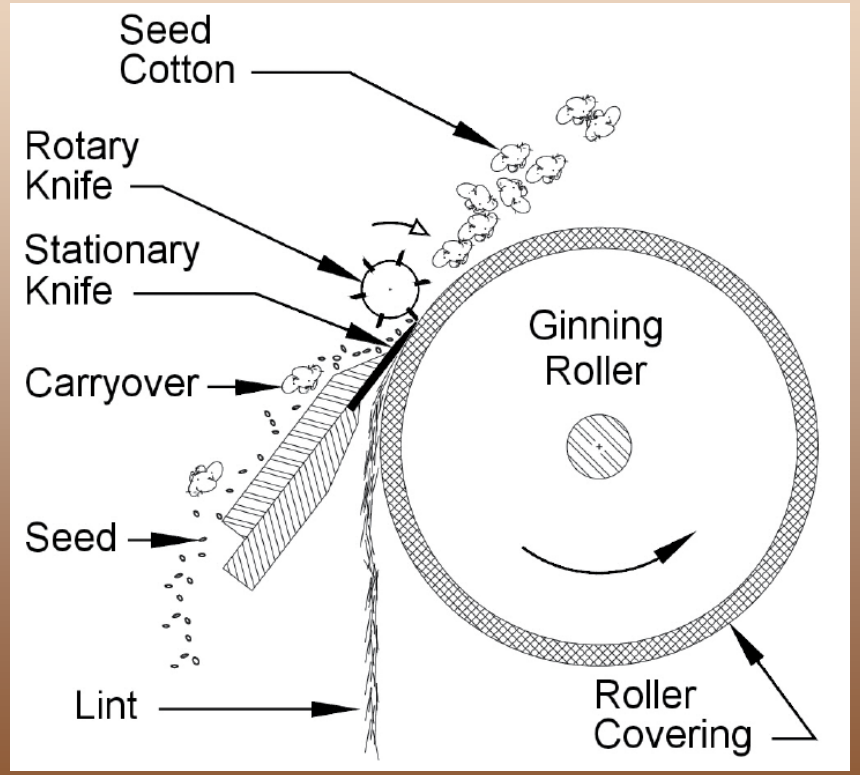
USDA Gin Lab, NM~2007

Reciprocating-knife Roller Gin Stand

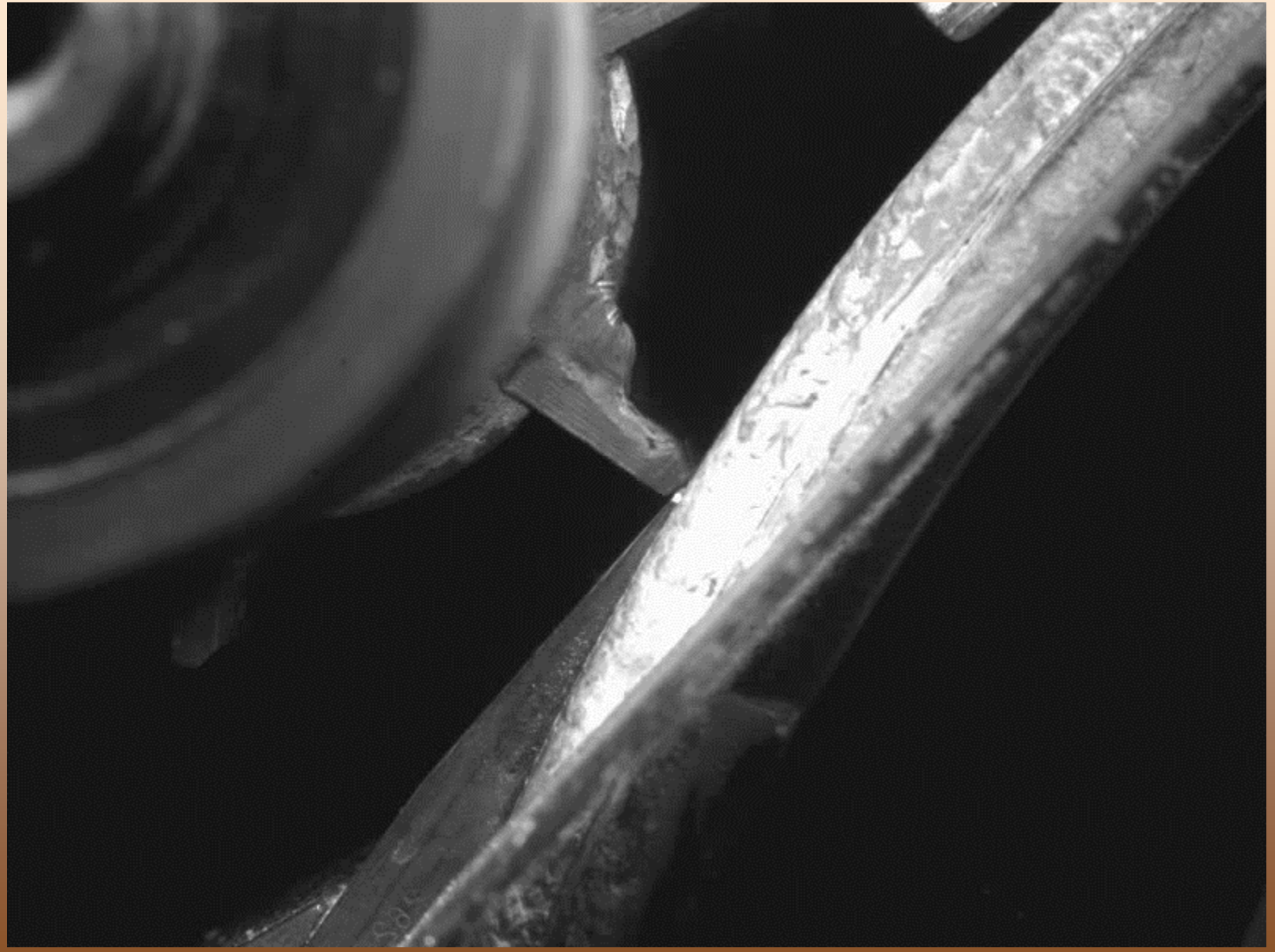


- Invented 1840 by Fones McCarthy
- 1-m (40-in.) wide
- 18 kg (40 lb) per hr
- Leather roll covering, later laminated canvas and rubber

Rotary-knife Roller Gin Stand



- Developed ~1960 at USDA-ARS Southwestern Cotton Ginning Research Laboratory
- 1-m (40 &46-in.) wide
- 218 kg (480 lb) per hr
- Laminated canvas and rubber



Reciprocating-knife vs. Rotary-knife

- 1989 – USDA-ARS Gin Lab, NM: no difference in fiber quality
  - Never published
- 2008 – Cotton Research Inst., Egypt: Rotary the same or better HVI results
  - Egyptian Journal of Agricultural Research - DOI: 10.21608/EJAR.2008.209184
- 2021 – Cotton Research Inst., Egypt: Recip had better HVI results
  - Middle East Journal of Agriculture Research - DOI: 10.36632/mejar/2021.10.3.64

Objective – Compare and document the fiber properties from reciprocating-knife and rotary-knife roller gin stands.

Gin Stands

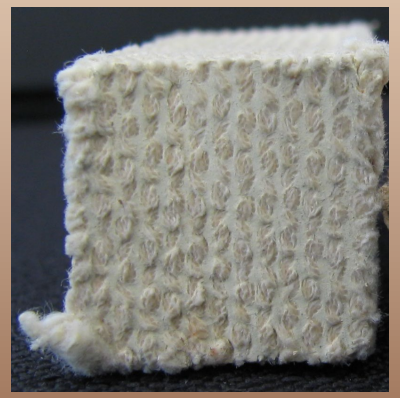
Reciprocating-knife

Rotary-knife

Saw

Roll Covering

Reciprocating-knife



- Woven Cotton
- Laminated
- Bonded with rubber compound

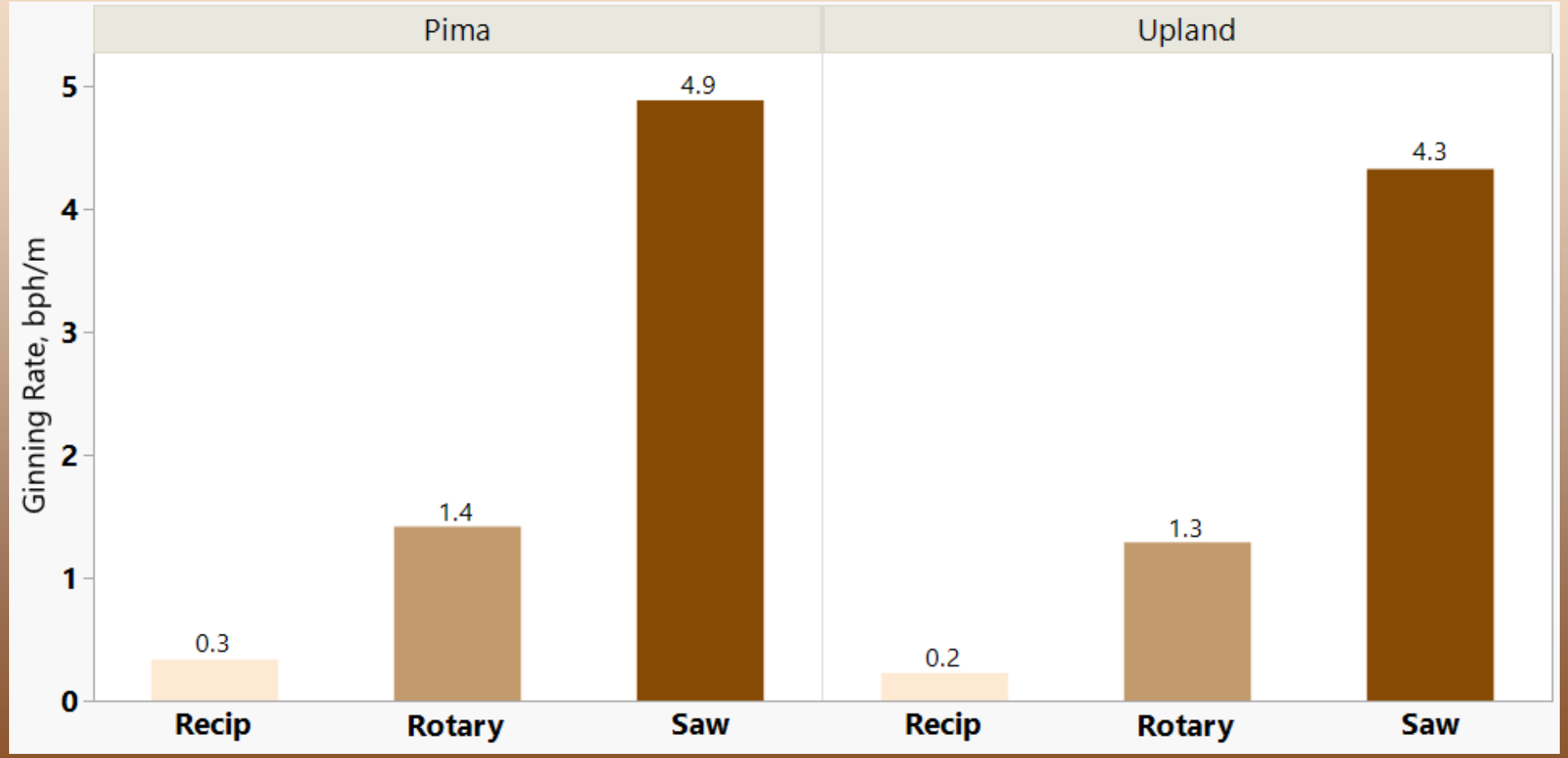
Rotary-knife

Lint Cleaning

Roller-gin Mill-type

Saw-gin Controlled-batt

Ginning Rate



HVI Results - Pima

	Reciprocating-knife	Rotary-knife	Saw
Color grade	1	1	1
Reflectance, Rd	71.4	71.0	71.8
Yellowness, +b	12.5	12.4	12.6
Leaf grade	1	1.3	1
Trash area, %	0.11	0.23	0.13
Staple length	47.4	48	46.6
UHM length, mm	35.1	35.3	35.4
Micronaire	3.9	3.9	3.9
Strength, g/tex	42.2	41.5	42.3
Uniformity index, %	85.9	86.8	85.1
Loan value, $/kg	2.11	2.11	2.09

HVI Results - Upland

	Reciprocating-knife	Rotary-knife	Saw
Color grade	12	22	11
Reflectance, Rd	78.8	78.3	79.5
Yellowness, +b	10.3	10.0	10.2
Leaf grade	1.7	2.5	1.7
Trash area, %	0.11	0.25	0.15
Staple length	36.2	36.8	34.6
UHM length, mm	28.7	29.0	27.4
Micronaire	4.1	4.1	4.1
Strength, g/tex	30.4	29.2	29.7
Uniformity index, %	82.2	82.4	80.0
Loan value, $/kg	1.22	1.23	1.22

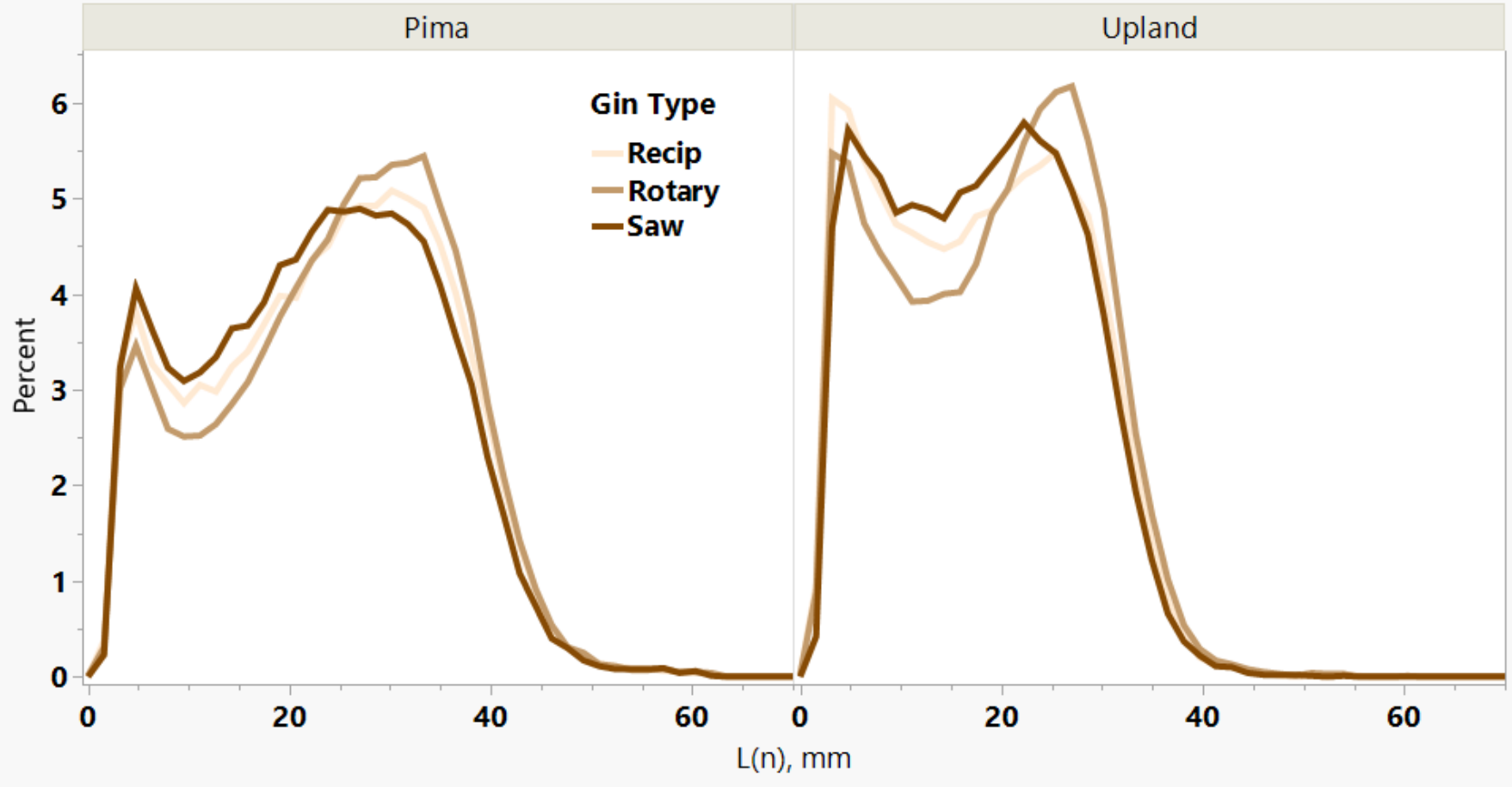
AFIS Raw Fiber Results - Pima

	Reciprocating-knife	Rotary-knife	Saw
Length (n), mm	24.6	25.4	23.9
Length (n) CV, %	46.9	44.7	47.5
5% Length (n), mm	41.9	41.9	41.1
Short fiber content (n), %	19.7	17.4	20.7
Total trash count	271	490	267
Vis. foreign matter	0.51	1.07	0.72
Nep count	194	181	300
Seed coat nep count	8.6	5.7	5.9
Fineness, mTex	140.1	139.9	137.2
Immature fiber content, %	6.62	6.79	6.94

AFIS Raw Results - Upland

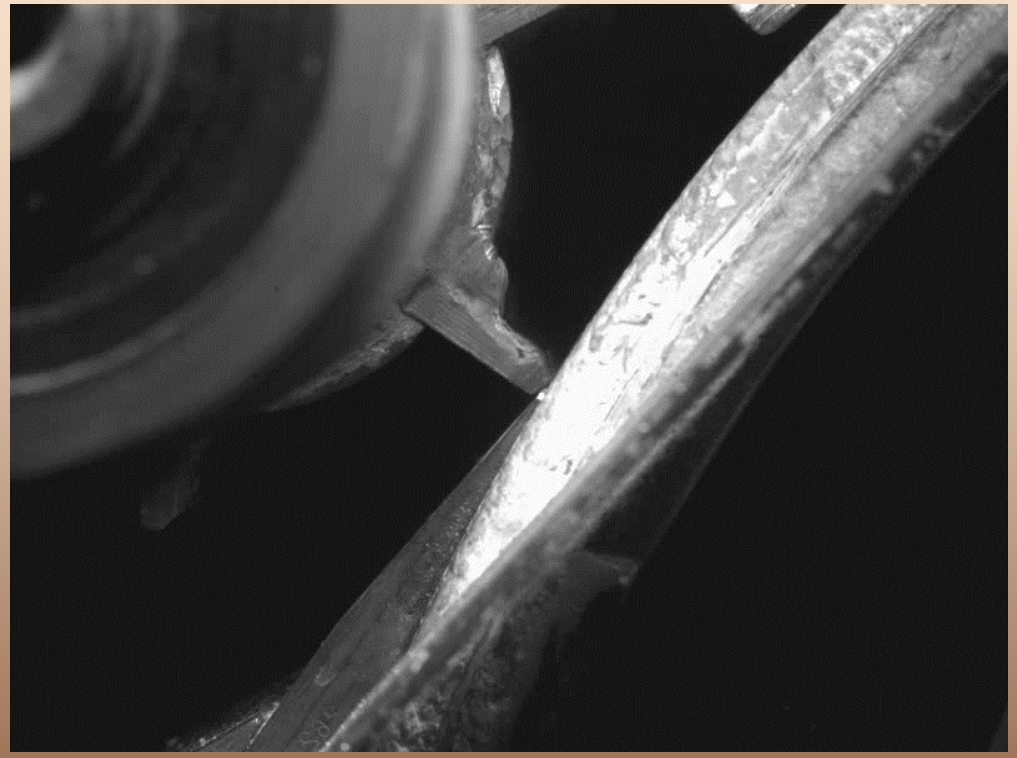
	Reciprocating-knife	Rotary-knife	Saw
Length (n), mm	18.5	19.8	18.5
Length (n) CV, %	51.9	49.7	49.5
5% Length (n), mm	33.8	34.3	33.3
Short fiber content (n), %	32.8	29.0	31.3
Total trash count	535	706	343
Vis. foreign matter	0.85	1.8	1.09
Nep count	174	152	242
Seed coat nep count	24.2	25.3	17.7
Fineness, mtex	168	167.6	166.3
Immature fiber content, %	6.68	6.88	7.13

L(n) Distribution



Summary

- Rotary 4-5 times greater ginning rate than Recip
- Very few or insignificant differences in raw fiber properties and loan value
- Rotary…as long or longer fiber then Recip and more uniform length
- Rotary…fewer neps than Recip
- Rotary…more trash than Recip



Results indicate that a Rotary-knife roller gin stand produces fiber of the same quality as a Reciprocating-knife roller gin stand…but at 4-5 times the capacity.

Future work

- Spinning Results
- Publication