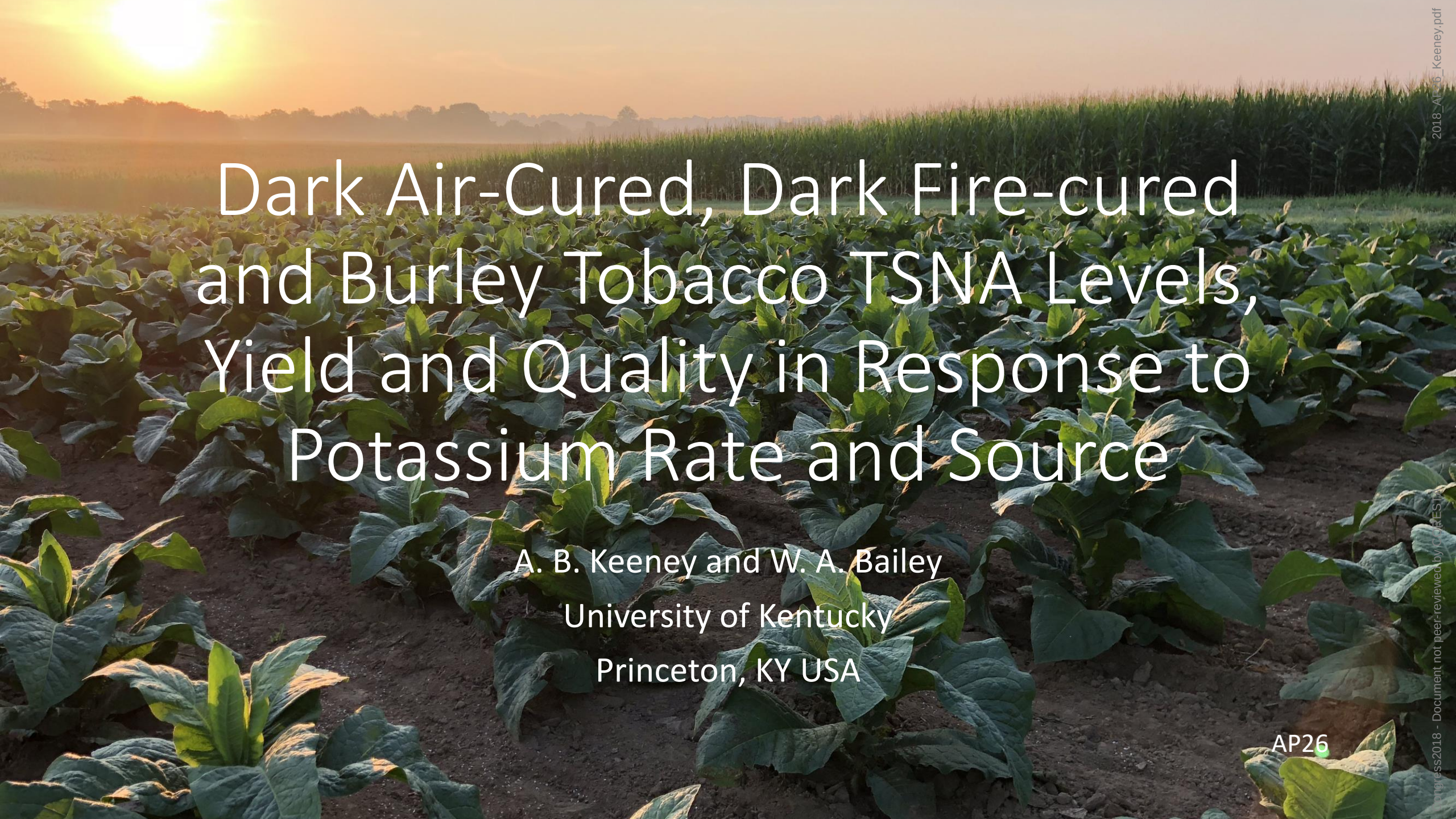

Dark Air-Cured, Dark Fire-cured and Burley Tobacco TSNA Levels, Yield and Quality in Response to Potassium Rate and Source

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Princeton, KY USA

AP26

Outline

Potassium Fertilizer

Objectives

Results

Conclusion

Potassium Fertilization

Two major potassium sources available in Kentucky:

- Potassium Sulfate 0-0-50 (K_2SO_4)
- Potassium Chloride 0-0-60 (KCl)

Potassium Chloride has been shown to detrimentally impact leaf quality when used in the Spring

<u>Chloride (Cl) >1% in cured leaf:</u>

- Higher moisture content
- Aroma
- Burning

Potassium Chloride

KY regulates farmers from applying KCl after January 1st

- <56 kg Cl/ha or 123 kg KCl/ha

Many farmers apply KCl in the Fall due to

- Lower price (30-50% cheaper than K_2SO_4)

REGULATIONS UNDER THE KENTUCKY FERTILIZER LAW UNIVERSITY OF KENTUCKY College of Agriculture Division of Regulatory Services

Objectives

- Determine if potassium source and application rate has an effect on yield and leaf quality in dark and burley tobacco

- Evaluate the effect of potassium source and application rate on chloride and total Tobacco Specific Nitrosamines (TSNA) in cured leaf

Materials and Methods

Trials conducted in:

- 2016
- 2017
- 2018

Potassium Sources:

- KCl
- K_2SO_4

Application rates:

- 0, 112, 224, 336 kg ha^{-1}

Plot Design:

- Randomized Complete Block Design, 4 replications
  - Dark: 4 rows, 4 m wide x 12.2 m long
  - Burley: 4 rows, 4.1 m wide x 10.6 m long

For all years and locations Phosphorus and Nitrogen were applied according to soil test recommendations and current University of Kentucky Extension recommendations were followed for field management.

2016 Materials and Methods

<u>One location:</u>

- Princeton, Kentucky USA

<u>Two trials:</u>

- Dark Air-Cured (DAC)
- Dark Fire-Cured (DFC)

<u>Variety:</u>

- KTD14LC

2017-2018 Materials and Methods

Three Locations:

- Princeton, Kentucky USA
- Murray, Kentucky USA
- Lexington, KY USA

Trials:

- DAC
- DFC
- Burley

Varieties:

- DAC/DFC: KTD14LC and NLMadoleHC
- Burley: TN90LC and TN90HC

Transplanting and Harvest Dates

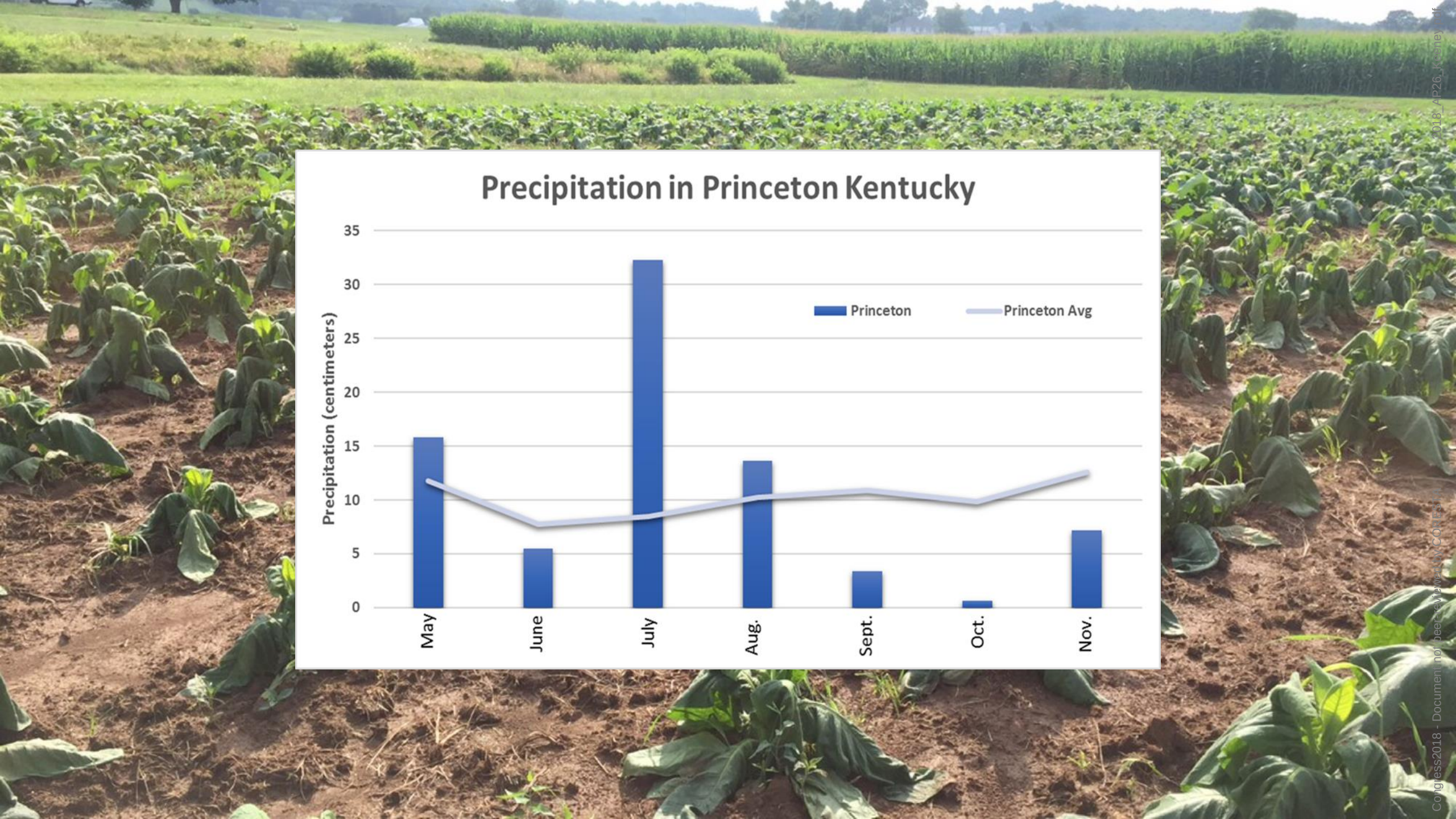
2016
Transplanted: May 25th
Harvested: August 23rd

- 6 stalks placed evenly on stick; 5 sticks per plot
- Placed either in an air-cured or fire-cured barn

2017
Princeton
Transplanted: May 26th
Harvested: September 21st
Murray
Transplanted: June 21st
Harvested: October 12th
Lexington
Transplanted: June 13th
Harvested: September 8th

2018
Princeton
Transplanted: May 24th
Harvested: September 12th
Murray
Transplanted: June 20th
Harvested: October 19th
Lexington
Transplanted: June 19th
Harvested: September 21st

2016 Results


Precipitation in Princeton Kentucky
Precipitation (centimeters)
35
30
25
20
15
10
5
0
Princeton
Princeton Avg
May
June
July
Aug.
Sept.
Oct.
Nov.

2016 Total Yield and Moisture DAC

Source	Yield	Moisture
	---kg ha^{-1}---	---%---
KCl	2098 A	11.60 A
K_2SO_4	1864 B	11.03 B
Untreated (no K, UTC)	1615 C	10.55 C
P-value	*0.0299*	*0.0311*

2016 Chloride Content in Cured DAC

Source	Rate	Chloride Content
	---kg K_2O ha^{-1}---	---%---
KCl	112	0.66 B
	224	1.20 A
	336	1.15 A
K_2SO_4	112	0.12 C
	224	0.12 C
	336	0.11 C
	P-value	*0.0004*

2016 Total TSNA for Curing Method

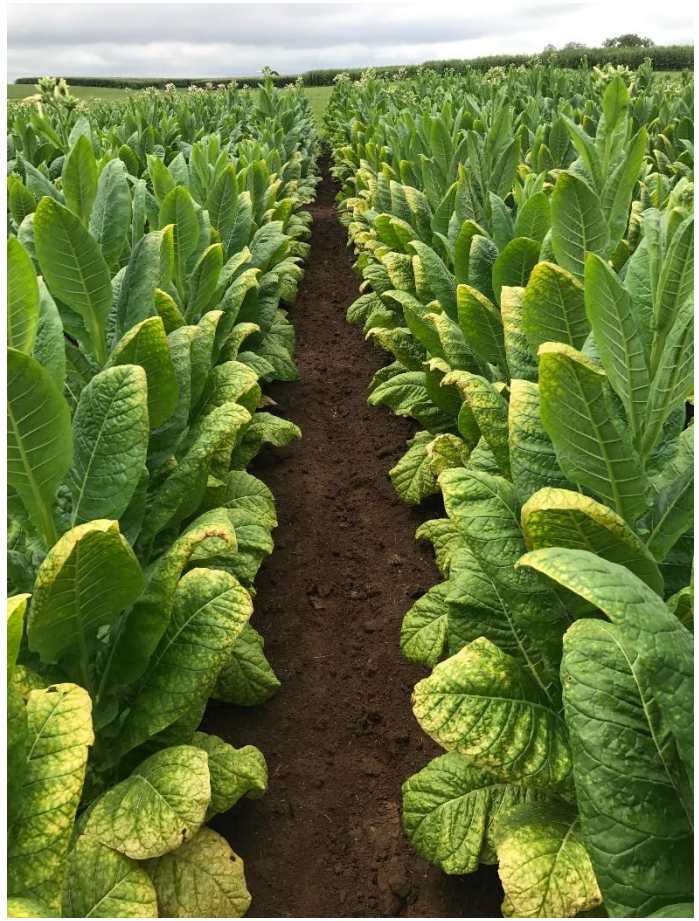
Curing Method	Total TSNA Level
	---ng g^{-1}---
DFC	2187 A
DAC	197 B
P-value	*<0.0001*

2016 Total TSNA for Source

Source	Total TSNA Level
	---ng g^{-1}---
K_2SO_4	1290 A
KCl	1004 B
UTC	1282 AB
P-value	*0.0756*

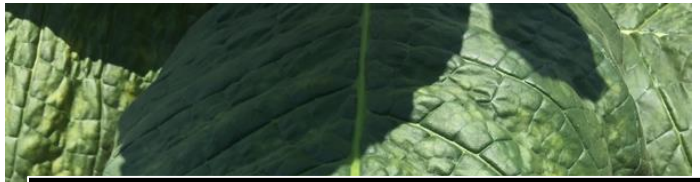
Potassium Deficiency symptoms

Dark



Burley

Potassium Deficiency symptoms



HC selection showed more potassium deficiency symptoms than the LC selection in 2017 and 2018.

Dark

Burley

2017 DFC and DAC Yield

Location	Curing	Yield
		---kg ha^{-1} ---
Murray	DFC	2377 BC
	DAC	2299 C
Princeton	DFC	2865 A
	DAC	2460 B
	P-value	*0.0002*

2017 DFC and DAC Yield

Source	Yield
	--- kg ha^{-1} ---
KCl	2626 A
K_2SO_4	2579 A
UTC	2295 B
P-value	*< 0.0001*
Selection	
LC	2542 A
HC	2457 B
P-value	*0.0286*

2017 Princeton DAC HC

Source	Moisture
	------%------
K_2SO_4	6.3 B
KCl	6.4 A
P-value	*0.0497*

2017 DFC Quality

Location	Selection	Grade Index
		--- 1-100---
Murray	LC	72 A
	HC	64 B
	P-value	*0.0015*
Princeton	LC	72 A
	HC	69 B
	P-value	*0.0094*

2017 DFC Quality

Location	Curing	Rate	Grade Index
		--- kg K_2O ha^{-1}---	--- 1-100---
Princeton	DFC	0	68 B
		112	69 B
		224	72 AB
		336	73 A
		P-value	*0.0596*

NS in the Princeton DAC trial or Murray DFC and DAC trials

2017 DAC Quality

Location	Selection	Grade Index
		--- 1-100---
Murray	LC	22 B
	HC	34 A
	P-value	*<0.0001*
Princeton	LC	47 A
	HC	49 A
	P-value	*NS*

2017 DAC and DFC Grade Index

Location	Curing	Source	Grade Index
			---1-100---
Murray	DFC	KCl	73 A
		K_2SO_4	66 B
		UTC	61 B
		P-value	*.0115*
	DAC	KCl	30 A
		K_2SO_4	25 B
		UTC	29 AB
		P-value	*.0381*
Princeton	DFC	KCl	73 A
		K_2SO_4	70 B
		UTC	68 B
		P-value	*.0274*
	DAC	KCl	49
		K_2SO_4	47
		UTC	48
		P-value	*NS*

Burley Yield

Location	Type	Source	Rate	Yield
			------ kg ha^{-1} ------	
Lexington	Burley	KCl	112	2447 B
			224	2757 A
			336	2722 A
		KSO	112	2764 A
			224	2776 A
			336	2696 A
		UTC	0	2307 B
			P-value	*.0751*

2017 Burley Yield

Location	Type	Selection	Yield
			---kg ha^{-1} ---
Lexington	Burley	LC	2623 A
		HC	2505 B
		P-value	*.0660*

2017 TSNA LC Selection

Location	Type	Source	Total TSNA
			--- ng g $^{-1}$---
Princeton	DAC	K_2SO_4	440 A
		KCl	227 B
		P-value	<0.0001
	DFC	K_2SO_4	5832 A
		KCl	3762 B
		P-value	0.0252
Murray	DAC	K_2SO_4	437 A
		KCl	320 B
		P-value	0.0083
	DFC	K_2SO_4	7009
		KCl	5919
		P-value	*NS*
Lexington	Burley	K_2SO_4	930 A
		KCl	617 B
		P-value	0.0034

2017 TSNA HC Selection

Location	Type	Source	Total TSNA
			--- ng g $^{-1}$---
Princeton	DAC	K_2SO_4	2245 A
		KCl	1327 B
		P-value	*0.0005*
	DFC	K_2SO_4	31158 A
		KCl	22177 B
		P-value	*0.0003*
Murray	DAC	K_2SO_4	1778
		KCl	1743
		P-value	*NS*
	DFC	K_2SO_4	31400
		KCl	25786
		P-value	*NS*
Lexington	Burley	K_2SO_4	3596 A
		KCl	2448 B
		P-value	*0.0423*

2017 DAC Princeton HC TSNA

Source	Rate	Total TSNA
	---kg K_2O ha^{-1} ---	---ng g^{-1} ---
K_2SO_4	112	1843 CB
	224	2120 B
	336	2771 A
KCl	112	1398 CD
	224	1421 CD
	336	1161 D
	P-value	*0.0826*

2017 DAC Princeton LC TSNA

Source	Rate	Total TSNA
	--- kg K_2O ha $^{-1}$---	--- ng g $^{-1}$ ---
K_2SO_4	112	370 B
	224	390 B
	336	561 A
KCl	112	244 C
	224	251 C
	336	186 C
	P-value	*0.0107*

Conclusion

- <u>2016</u>
  - KCl treatments yielded higher than K_2SO_4 treatments→ higher moisture content in KCl
  - KCl treatments had higher Cl% in cured leaf
  - K_2SO_4 treatments had higher total TSNA than KCl treatments

- <u>2017</u>
  - KCl treatments yielded higher than K_2SO_4 treatments in dark trials
  - In dark trials there were no differences in sources for yield
  - In burley trials there was no difference in yield except for the lowest rate of KCl and the UTC
  - 7/10 trials K_2SO_4 treatments had higher total TSNA levels →main effect of source

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