Potato, Tobacco, and Turf Trial Findings

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Potatoes

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Potato Trials

- Tindall and Westerman (1991--Idaho) 3 year study
  - **Greater yields vs. MOP**
  - **A Chloride--nitrate antagonism**

- McDole (1978)
  - **SOP resulted in higher specific gravities**
  - **Trend similar for four varieties**

"The chloride form of potassium can actually reduce tuber growth and specific gravity. The sulfate form may be a better choice while at the same time decreasing blackspot bruise."

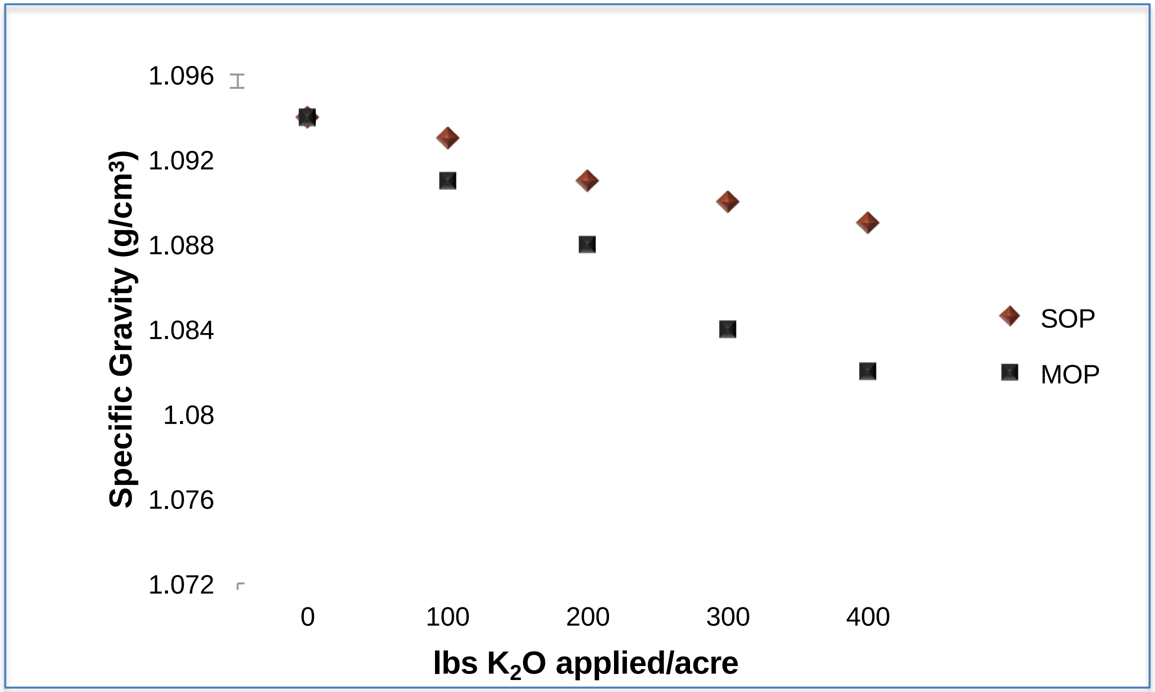
PGI March 1995– Bill Dean of WSU

Decreased Chloride

- Improves skin set
- Reduces bruising
- Prevents “shrink loss”
- Reduces disease incidence

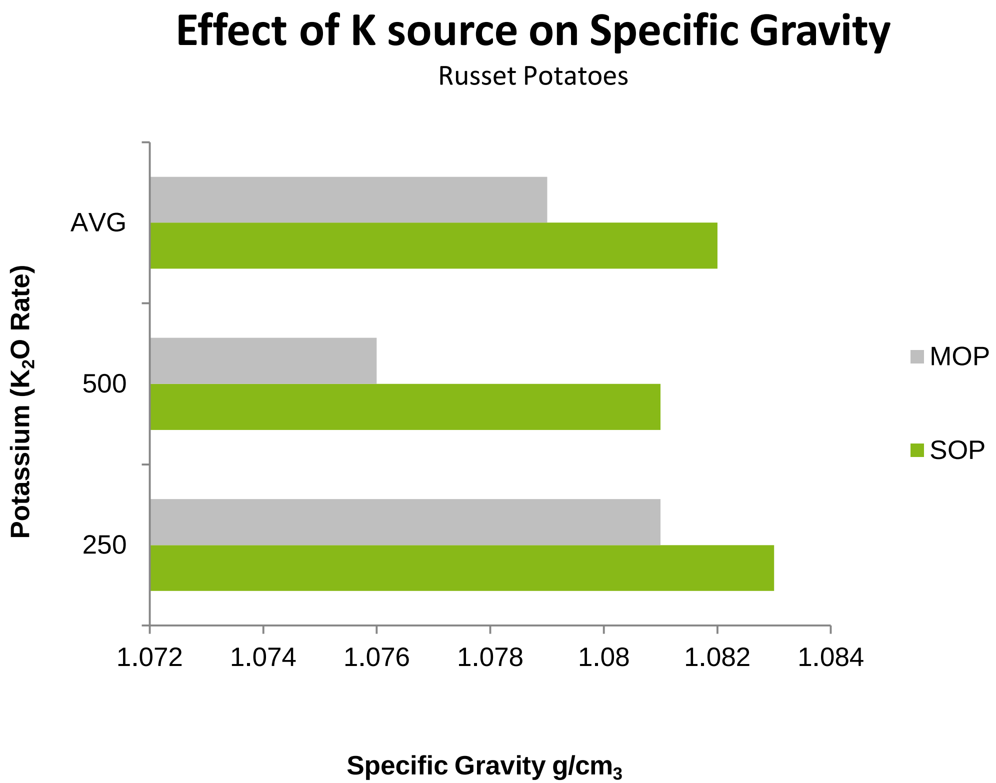
Effect of K source on Specific Gravity

Russet Potatoes



University of Wisconsin--Spooner 1994

Increased Specific Gravity in Idaho



McDole et al., 1978 - Idaho

Chloride Removal by Crops

Crop	Plant Part	Cl Content
Alfalfa	Shoot	7.6 lb/ton
Barley	Grain	0.024 lb/bu
Potatoes	Tubers	0.06 lb/cwt
Wheat	Grain	0.026 lb/bu

Soil Chloride Levels 7 Months After Application

- Willamette Valley Western Oregon
- Fertilizer applied October 2003
- Samples taken April 2004

		meq / liter			
Depth (Inches)	UTC	SOP 488#	KCl 475#	SOP 1468#	KCl 1486#
3.6	0.5	0.6	1.8	0.6	3.0
7.2	0.4	0.5	2.5	0.4	2.2
10.8	0.3	0.5	2.8	0.5	2.5
14.4	0.5	0.4	3.5	0.5	3.1
18.0	0.5	0.5	3.7	0.5	3.5

After 50 inches of rain there is still enough chloride in the top 14 inches of soil to hurt production.

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Pasco, WA Potash Trial

- Results
  - **SOP**
    - — Average specific gravities for the potassium sulfate was 1.080
    - — Specific gravity incentive paid over $300 per acre
  - **MOP**
    - — Average specific gravities for KCl (MOP) was 1.077

Pasco, WA Potash Trial				
	Yield (tons)	**Tons Out**	**Shrink**	**Final Yield (tons)**
SOP	2172.69	36.82	154.82	34.2
MOP	2076.93	35.8	268.51	31.18

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2005 Chipping Potato Trial

Location: Klamath Falls, OR

Variety: FL 1867

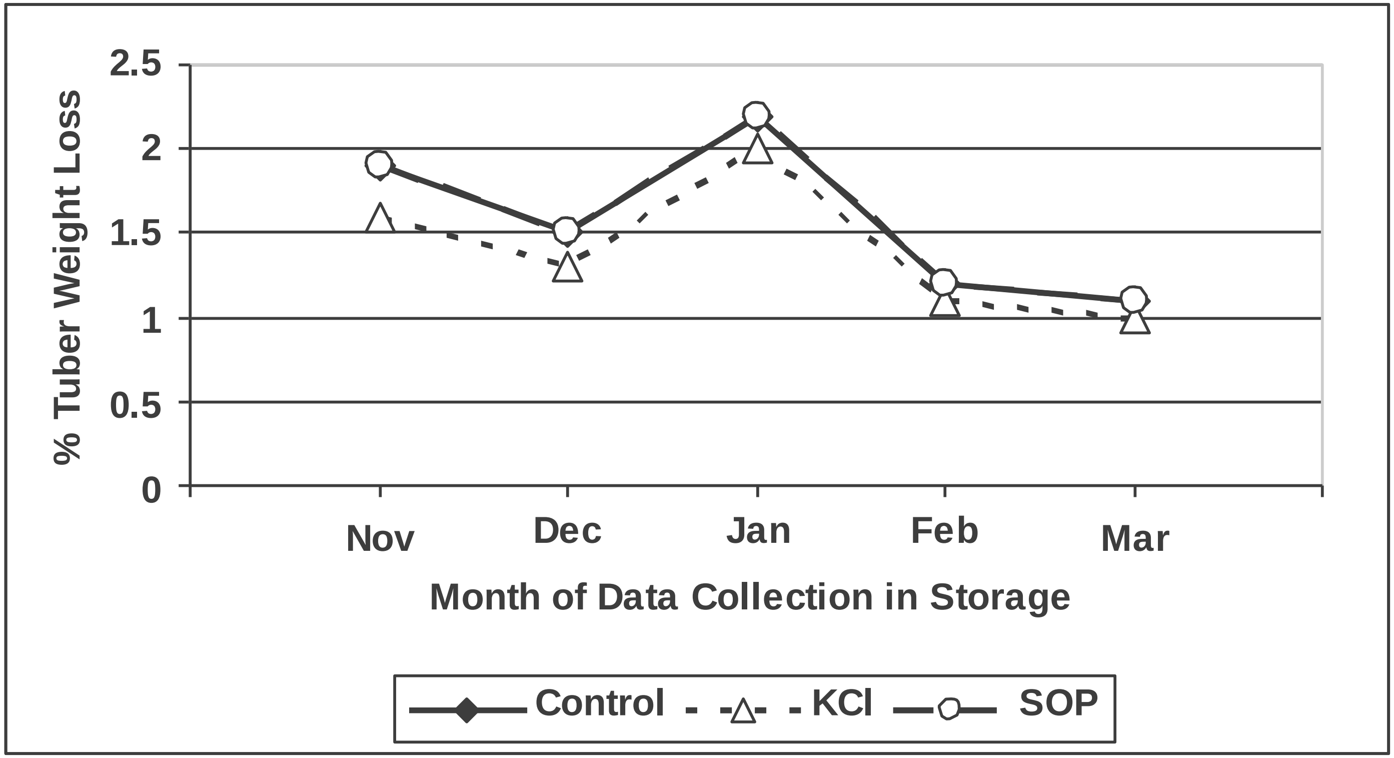
Vine Kill: West ½ September 14, 2005

- **7.7 pH**
- **3.6 % O.M**
- **N 160 units**
- **P 170 units**
- **K 155 units**
- **Zn 6 units**

	Yield	<1 oz	1–2oz	2–4oz	4–10oz	>10oz	Sugars & S.G.
E ½ -KCl 32 Acres	461 cwt/A	6 tubers	11 tubers 16.95 oz	48 tubers 142.55 oz	52 tubers 317.05 oz	3 tubers 31.5 oz	Sucrose 301 S.G. 1.091
W ½ -SOP 31 Acres	535 cwt/A	6 tubers	10 tubers 14.2 oz	43 tubers 127.8 oz	70 tubers 411.55 oz	3 tubers 36 oz	Sucrose 260 S.G. 1.095

- 258 lbs KCl = 103 lbs Cl
- Eliminating 103 lbs of chloride positively affected yield
- SOP consistently raises specific gravity, even on chipping potato varieties

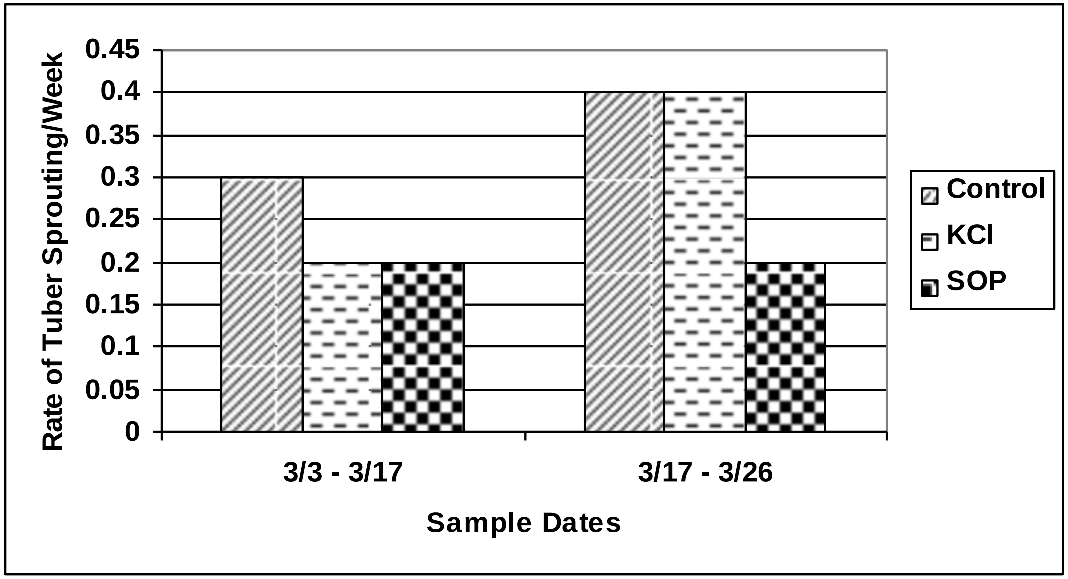
Colorado State University



Effect of potassium source on tuber weight loss (while potatoes are in storage)

Colorado State University

- As tubers stayed longer in storage, the rate of sprout development significantly increased in tubers harvested from the **MOP** and control plots.
- The rate of sprout development had decreased by 50% in tubers harvested from the **SOP** plots.



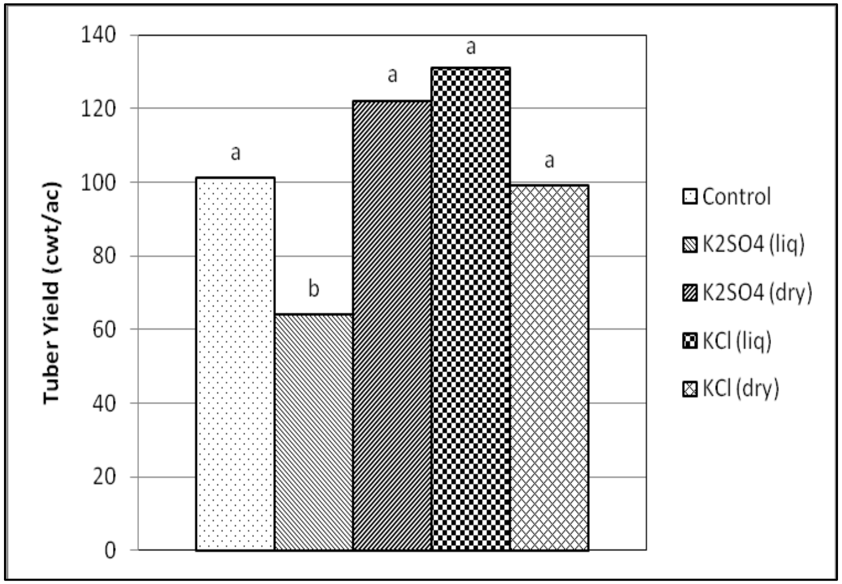
Effect of potassium source on rate of tuber sprouting

Colorado State University

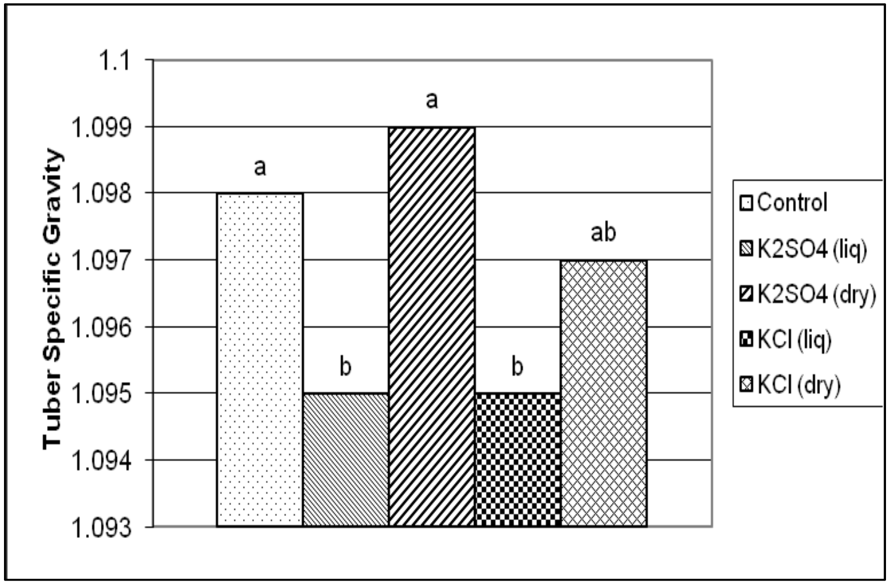
Treatment	Total	>4 oz	4–16oz	4–10oz	> 6 oz	6–16oz
Control	542 b	455 b	444 a	354 a	306 b	294 a
K_2SO_4 (liq)	480 d	368 d	359 b	304 b	244 c	234 c
K_2SO_4 (dry)	576 a	489 a	456 a	358 a	354 a	321 a
KCl (liq)	510 c	412 c	382 b	275 b	295 bc	264 b
KCl (dry)	517 c	400 c	388 b	298 b	273 c	261 bc

Yield (cwt/acre)

Colorado State University



Yield of tubers > 2 inches in diameter and > 10 oz



Effect of source and form of potassium fertilizer application on tuber specific gravity of Rio Grande Russet

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Colorado State University

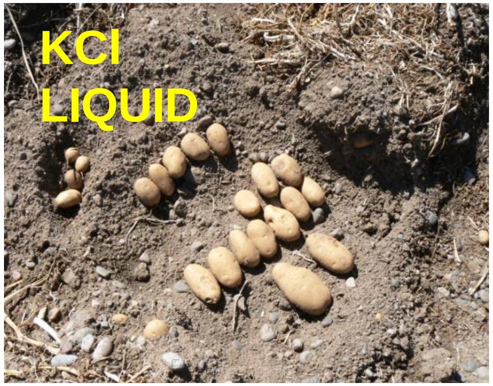
- In general, no significant difference was observed in marketable tuber (>4, >6, >10 oz) yield among the treatments in 2010.
- The use of SOP significantly increased the yield of large marketable size (14–16 oz) tubers when compared to all other treatments

Treatment	Total	> 4 oz	> 6 oz	> 10 oz	14–16oz
Control	563 ab	453 a	270 b	65 b	4 c
SOP (Dry)	540 b	435 a	284 ab	96 a	22 a
SOP (Liq)	585 a	438 a	294 ab	91 a	26 a
KCl (Dry)	581 a	444 a	290 ab	103 a	12 b
KCl (Liq)	552 b	435 a	304 a	91 a	13 b

Yield (cwt/acre)

Response of potato to source and form of potassium application, 2010

Colorado State University



Summary and Conclusion

- Source and form of K fertilizer applied can influence potato tuber yield and quality.
- Dry formulate of potassium sulfate increased tuber yield and produced more bulky tubers compared to KCl.
- Tuber specific gravity was significantly improved by incorporating dry formulation of potassium sulfate in the soil before planting.
- The use of liquid KCl can result in more culls as a result of increased production of tuber external defects.
- In soils with high soil test K levels, dry formulations of potassium sulfate can be used to increase potato tuber yield and quality.

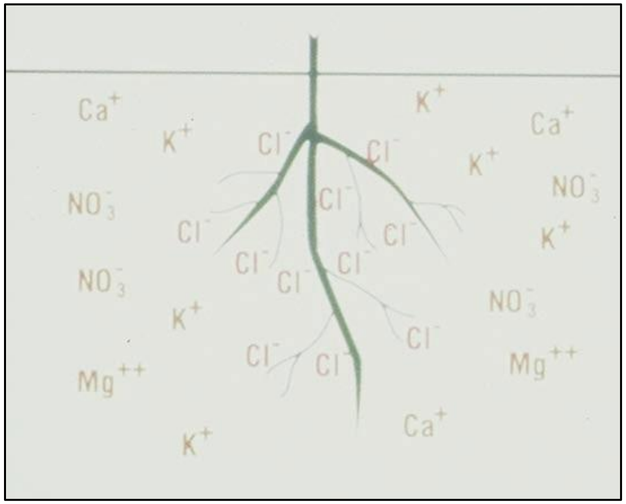
Pasco Potash Trial and 2005 Chipping Trial Insights

- Higher specific gravity
- More US #1's
- More "payables"
- High processor bonus
- Improved russeting
- Less shrinkage in storage

Tobacco

Flue Cured Tobacco & Potassium

- Good crop will remove
  - **90–200 lbs K_2O from the soil**
    - 180–400 lbs of Potassium Sulfate per acre
  - **Up to 20 lbs chloride from the soil**
    - Sufficient chloride present in soil
      - (90/.60=150*40=60 lbs Cl)
    - Use of MOP results in excess of 40 lbs Cl



Remember! Excess chloride interferes with nutrient uptake and plant development…

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Effects of Excess Chloride on Tobacco

- Fat stems
- High levels of chloride in the leaves resulting in:
  - Mold and rot during curing and storage
  - Highly hygroscopic, causing discoloration during storage
  - Reduced burn rate and unpleasant flavors
  - Ultimately greatly reduced quality and usability of the cured leaf

Flue Cured Tobacco & Sulfur

- Deficiencies most likely on deep sandy soils with low organic matter
  - **Sulfur will leach over fall and winter with heavy rains**
    - Sulfur not as available in wet soils in spring
  - **20–30lbs S/acre recommended**
  - **90–200lbs K_2O from Potassium Sulfate will deliver 31-68lbs of Sulfur**
- Symptoms of sulfur deficiency
  - **Begin with yellowing in the buds**
  - **Leaves gradually pale from top to bottom**
    - Lower leaves do not burn up unless there is an N deficiency
- Results
  - **Decreased yield potential**

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Tobacco Trial

Table 1. Soil analysis for the pot experiments (P_2O_5 Joret Hebert).

	Clay	Silt	Sand	pH	O.M.	CEC	P_2O_5	K_2O	K/CEC	MgO	CaO	Cl
	-----%-----				%	*meq 100 g^{-1}*	----*ppm*----		%	-----*ppm*-----		
Content	15.6	76.8	5.5	6.2	2.12	10.2	153	73	1.52	100	2.87	11

Table 2. Quantities of fertilizers applied on the pot experiments.

Flue-cured			Air-cured		
Fertilizer	*g pot^{-1}*	*kg ha^{-1}*	*Fertilizer*	*g pot^{-1}*	*kg ha^{-1}*
KNO_3	17.61	80N+270K20	KNO_3+urea	25.98+5.06	200N+400K20
K_2SO_4+urea	14.82+4.98	80N+270K20	K_2SO_4+urea	21.98+12.41	200N+400K20
KCl+urea	12.64+4.98	80N+270K20	KCl+urea	18.74+12.41	200N+400K20
K_2CO_3+urea	11.34+4.98	80N+270K20	K_2CO_3+urea	16.81+12.41	200N+400K20

IPNI Effect of Potassium on the Production and Quality of Tobacco Leaves, *Marchand, M e-ifc No. 24 Sept. 2010*

Tobacco – Dry Matter

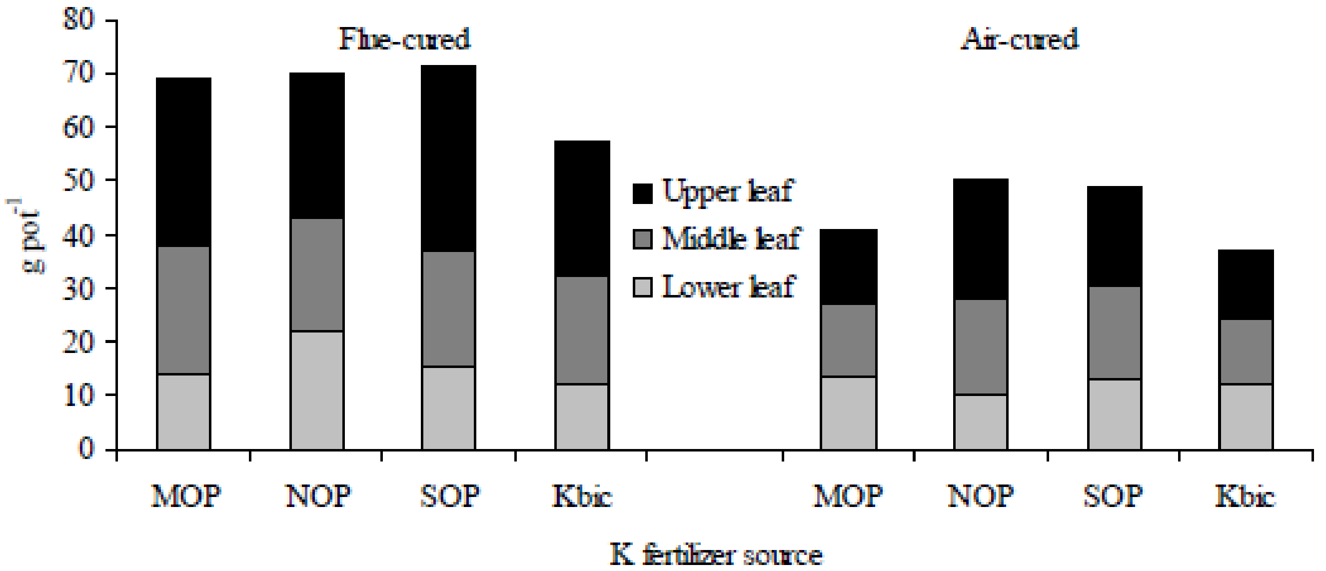

Fig. 1. Dry matter production of flue-cured and air-cured tobacco leaves with different sources of K fertilizers.

IPNI Effect of Potassium on the Production and Quality of Tobacco Leaves, *Marchand, M e-ifc No. 24 Sept. 2010*

Tobacco – Leaf N Concentration

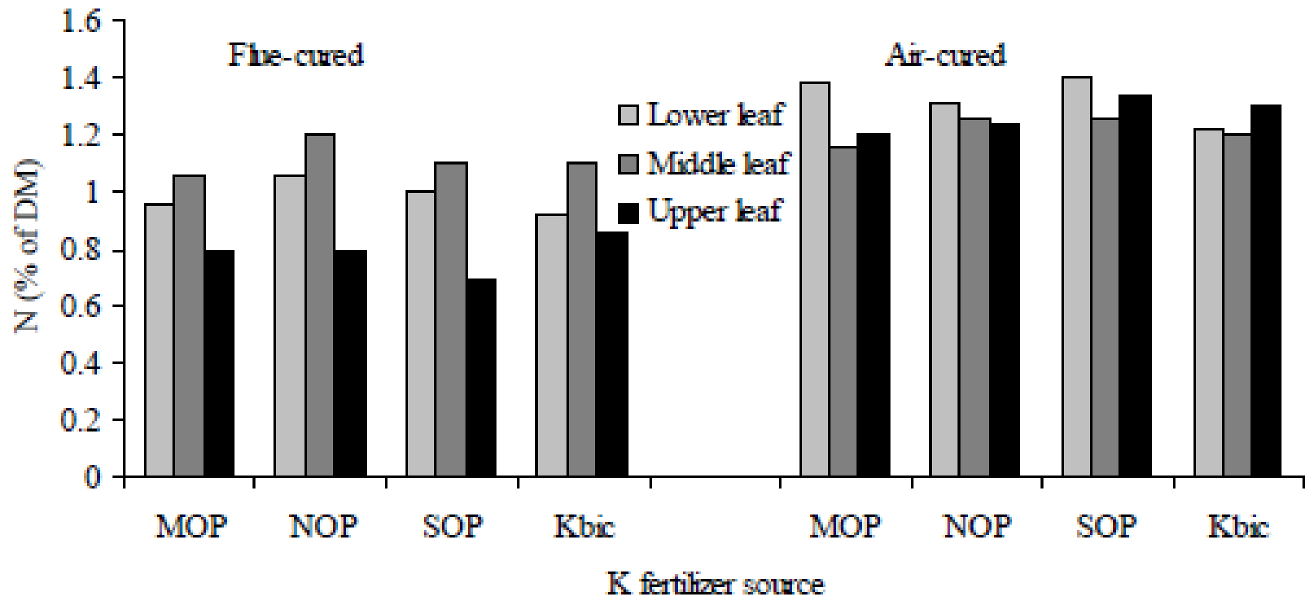

Fig. 2. N concentration (percent in DM) in flue-cured and air-cured tobacco leaves with different sources of K fertilizers.

IPNI Effect of Potassium on the Production and Quality of Tobacco Leaves, *Marchand, M e-ifc No. 24 Sept. 2010*

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Tobacco – Leaf Chloride Concentrations

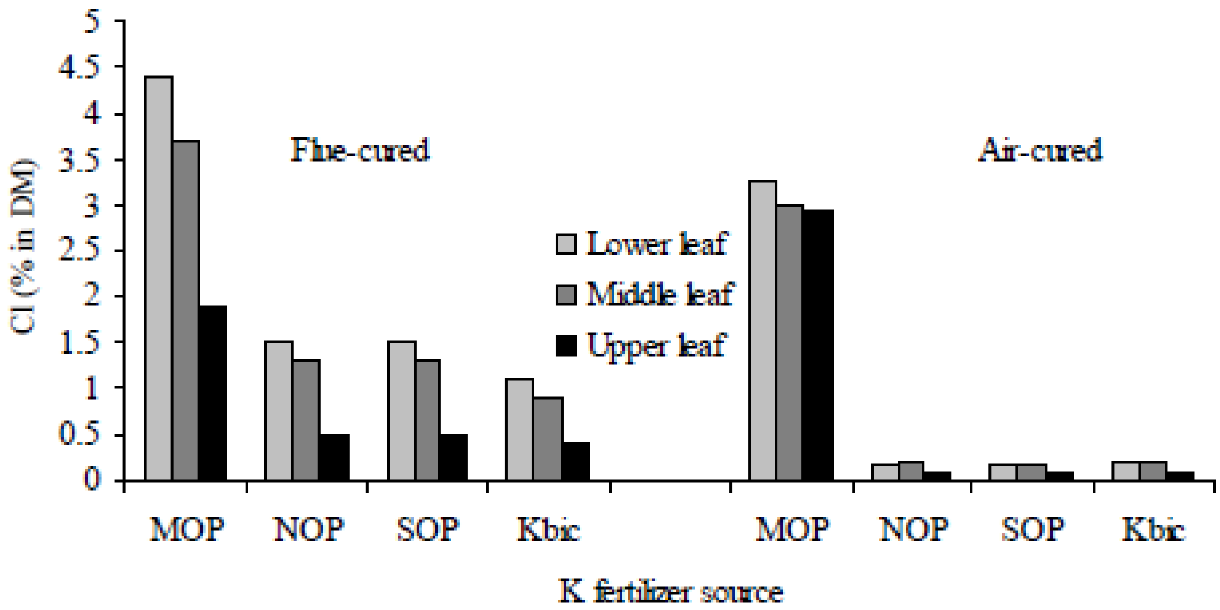

Fig. 5. Chloride concentration (percent in DM) in flue-cured and air-cured tobacco leaves with different forms of K fertilizers.

IPNI Effect of Potassium on the Production and Quality of Tobacco Leaves, *Marchand, M e-ifc No. 24 Sept. 2010*

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Turf

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Why is Protassium+ Important for Turf?

Protassium+ Enhances Turf:

- Quality
- Rooting
- Hardiness

Protassium+ Promotes Turf:

- Growth
- Uptake of water
- Disease resistance
- Wear Tolerance

Potassium Deficiency Symptoms

- Low K on Bentgrass & Bluegrass appear as
  - Leaves initially appear as droopy
  - Moderate yellowing on intervienal areas especially tips of older leaves
  - Rolling and withering of leave tips

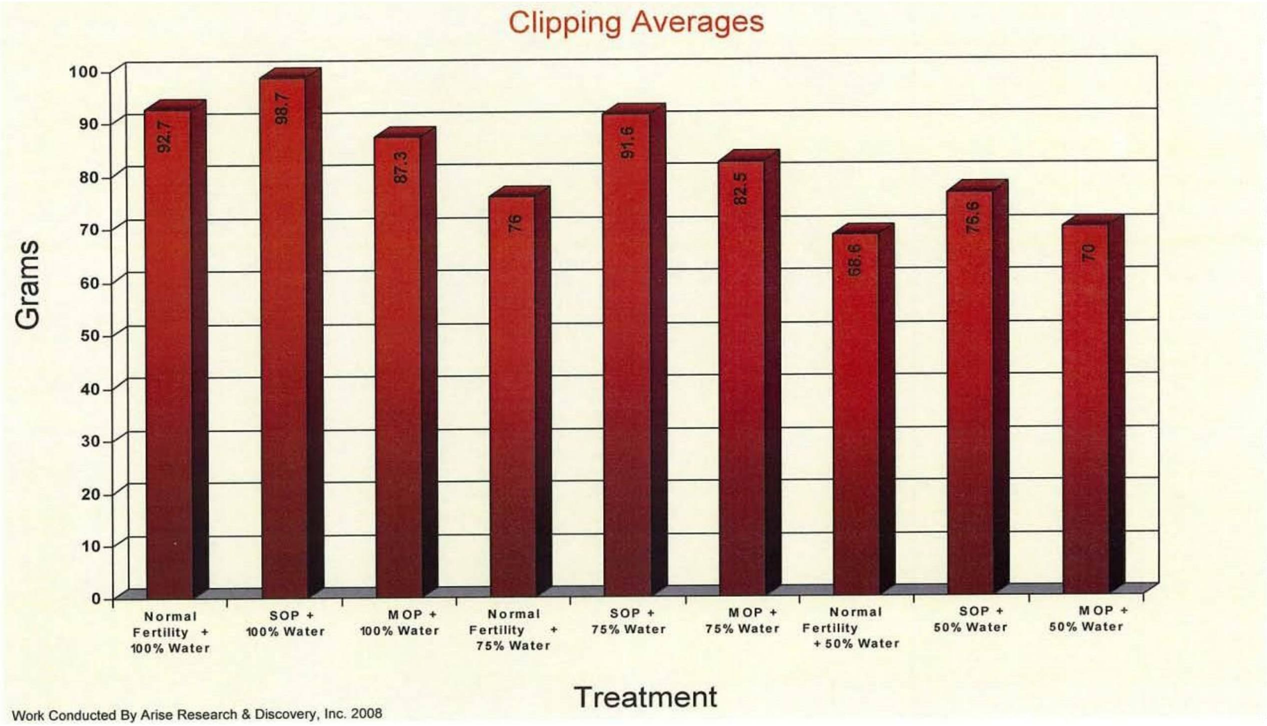
- Low K fosters disease
  - Thin cell walls
  - Breakdown of cells
  - Accumulation of unused nitrates, phosphates and sugars

Increased Need for Sulfur on Turf

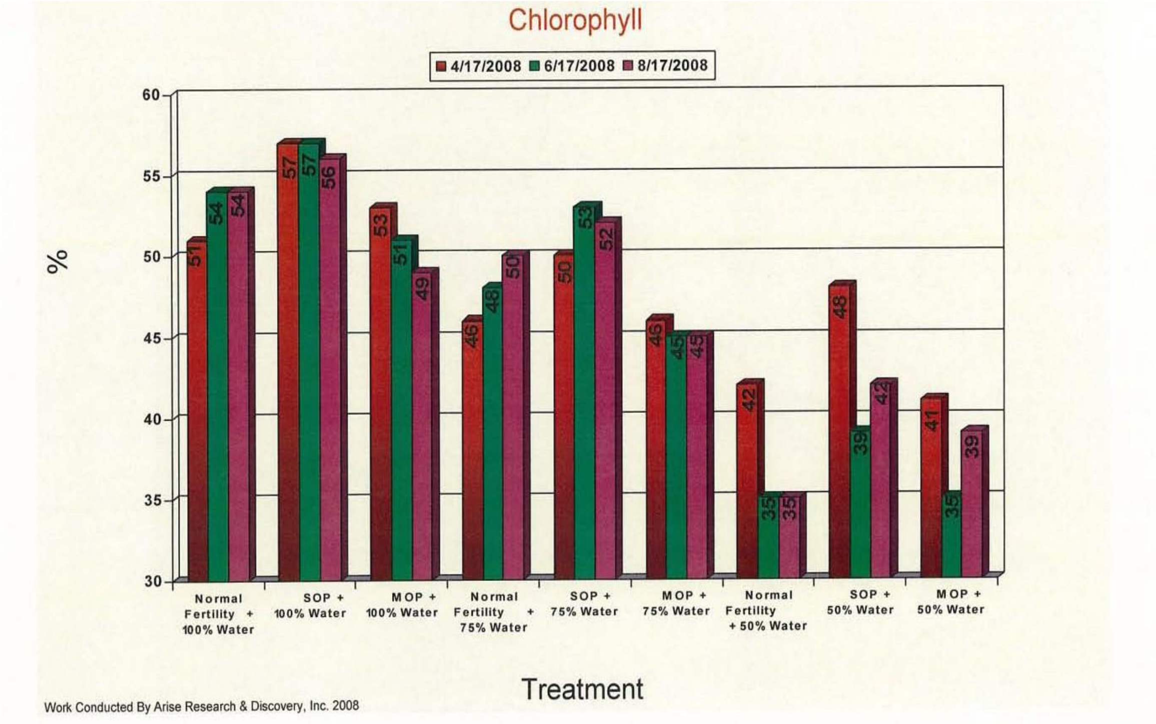
- Decreased sulfur emissions to the atmosphere
- Reduce use of SCU
- Increased amount of clipping removal
- Decreased use of sulfur containing fungicides and insecticides
- Increased awareness of soils deficient in sulfur
- Declining organic matter levels

The following slides include…
The Evaluation of Protassium+ Water Sequestration vs. MOP in Kentucky Bluegrass to a Standard Fertility Program in a Greenhouse Environment

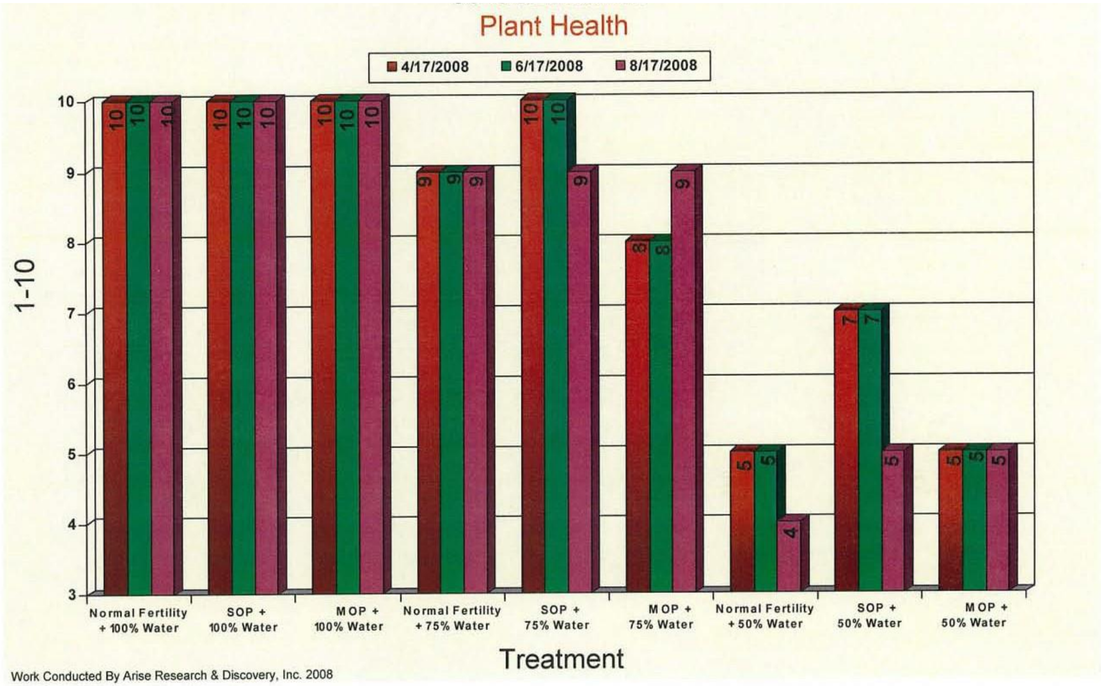
Clipping Averages



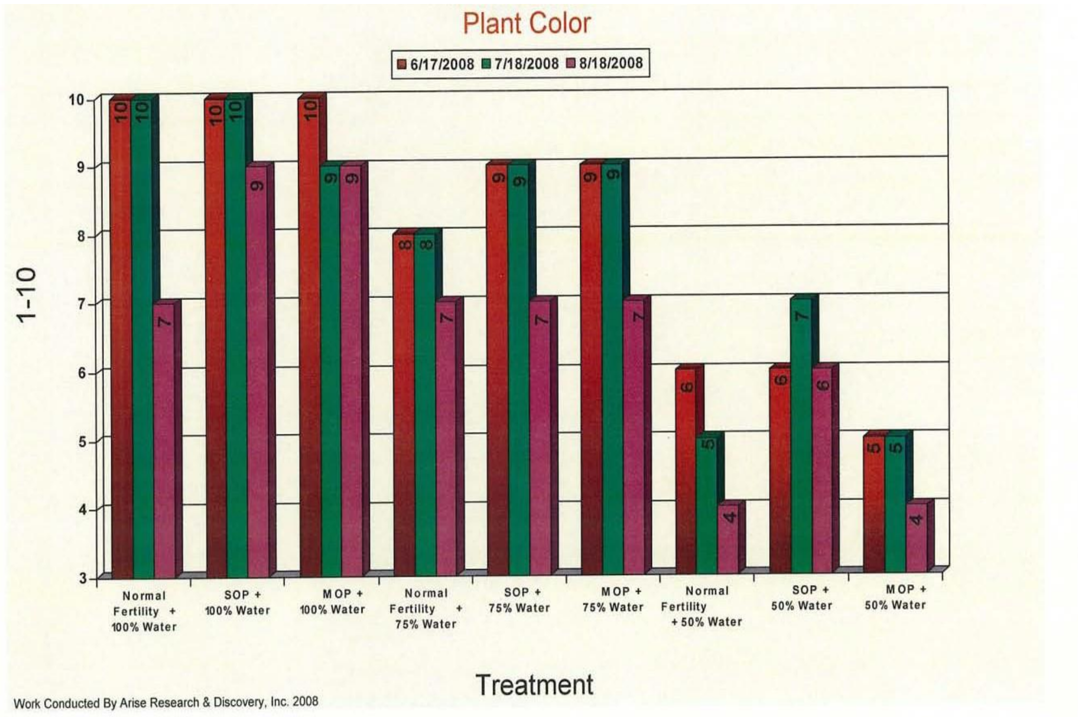
Chlorophyll



Plant Health



Plant Color



Plant Color
6/17/2008
7/18/2008
8/18/2008
1-10
10
9
8
7
6
5
4
3
Normal Fertility + 100% Water
SOP + 100% Water
MOP + 100% Water
Normal Fertility + 75% Water
SOP + 75% Water
MOP + 75% Water
Normal Fertility + 50% Water
SOP + 50% Water
MOP + 50% Water
Treatment
Work Conducted By Arise Research & Discovery, Inc. 2008

High Chloride Risks

- Leaf and "Tip burn"
- Poor seed germination
- Nutritional imbalances
- Stunted root and shoot growth

Remember! The Salt Index gives an indication of relative effect of a fertilizer on soil solution….

Salt Index		
Potassium Fertilizers	Salt Index	Salt Index/Unit of K_2O
MOP (Potassium Chloride-60%)	116.2	1.936 (K_2O)
Sodium Nitrate	100	6.06 (N)
Potassium Nitrate	73.6	1.58 (K_2O)
SOP (Potassium Sulfate)	46.1	0.88 (K_2O)
K-MAG (Sulfate of Potash Magnesia)	43.2	1.96 (K_2O)

Why Protassium+?

- Quality
- Particle Sizes

Protassium+	Particle Size (SGN)	Use
Turf Gran	220	Roughs & Fairways
Mini Gran	140	Fairways & Tees
Greensgrade	90	Greens
Soluble Fines	10	Fairways, Tees & Greens

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Questions?