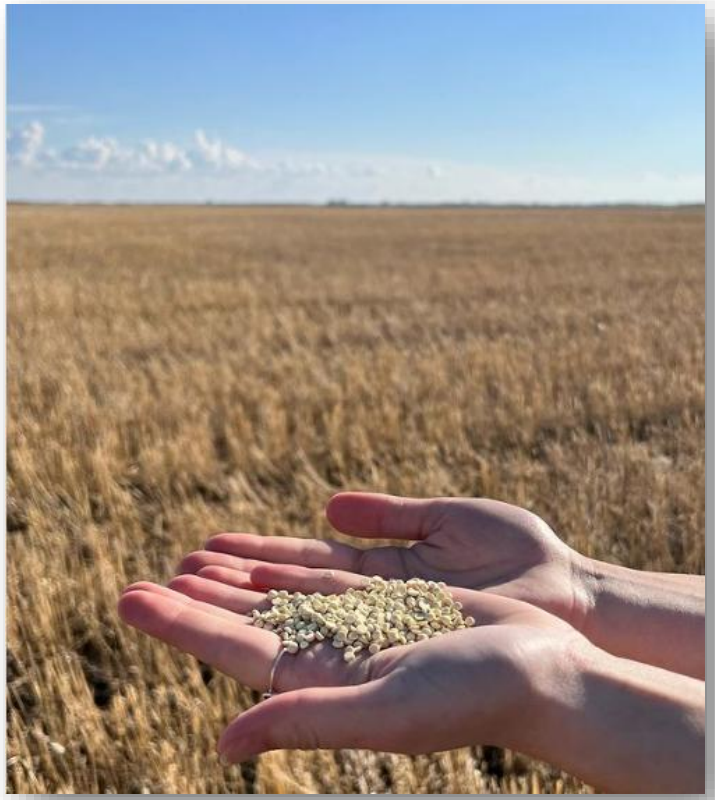
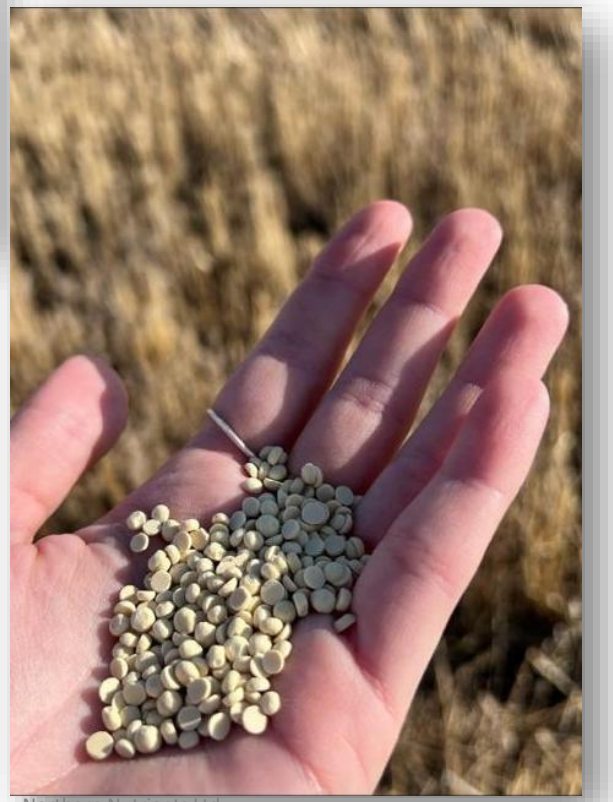
ARCTIC S
11-0-0
WITH 75% SULPHUR

Sulphur Made Easy

www.northernnutrients.com





What is **Arctic S**- Mission statement

Arctic S is a 75% micronized elemental Sulphur, low salt fertilizer that can be used as a source of all or some of a growers Sulphur demands.

HISTORY OF 11-0-0-75

Developed by Shell, first factory built in Korea

From 2018 until 2021 imported by NN into North America

April of 2022 Northern Nutrients commissioned own factory

5 full years on the market in Western Canada and USA with an estimated 2 million acres used in 2023 between W. Can & the USA

Physical Properties	Sample		
	Urea Pastilles	**Super-S**	Sulphur Pastille
Crushing Strength (Average*, kg/pastille)	1.46	3.48	2.31
Crushing Strength (Range*, kg/pastille)	0.90 – 2.05	1.05 – 6.35	1.60 – 3.10
Abrasion Resistance (% degradation)	1.31	1.94	4.25
Impact Resistance (% shattered pastilles)	0.44	1.14	16.23

+ APPLICATION FEATURES

Blends well with most conventional dry fertilizer
SGN : 300
Bulk Density : 62.5 lbs/ft3
Angle of Repose : 32 Low
Salt Index : 17.8

TECHNICAL FEATURES

Analysis:

11% Nitrogen

75% Elemental Sulphur

Arctic S Salt index of 17.8

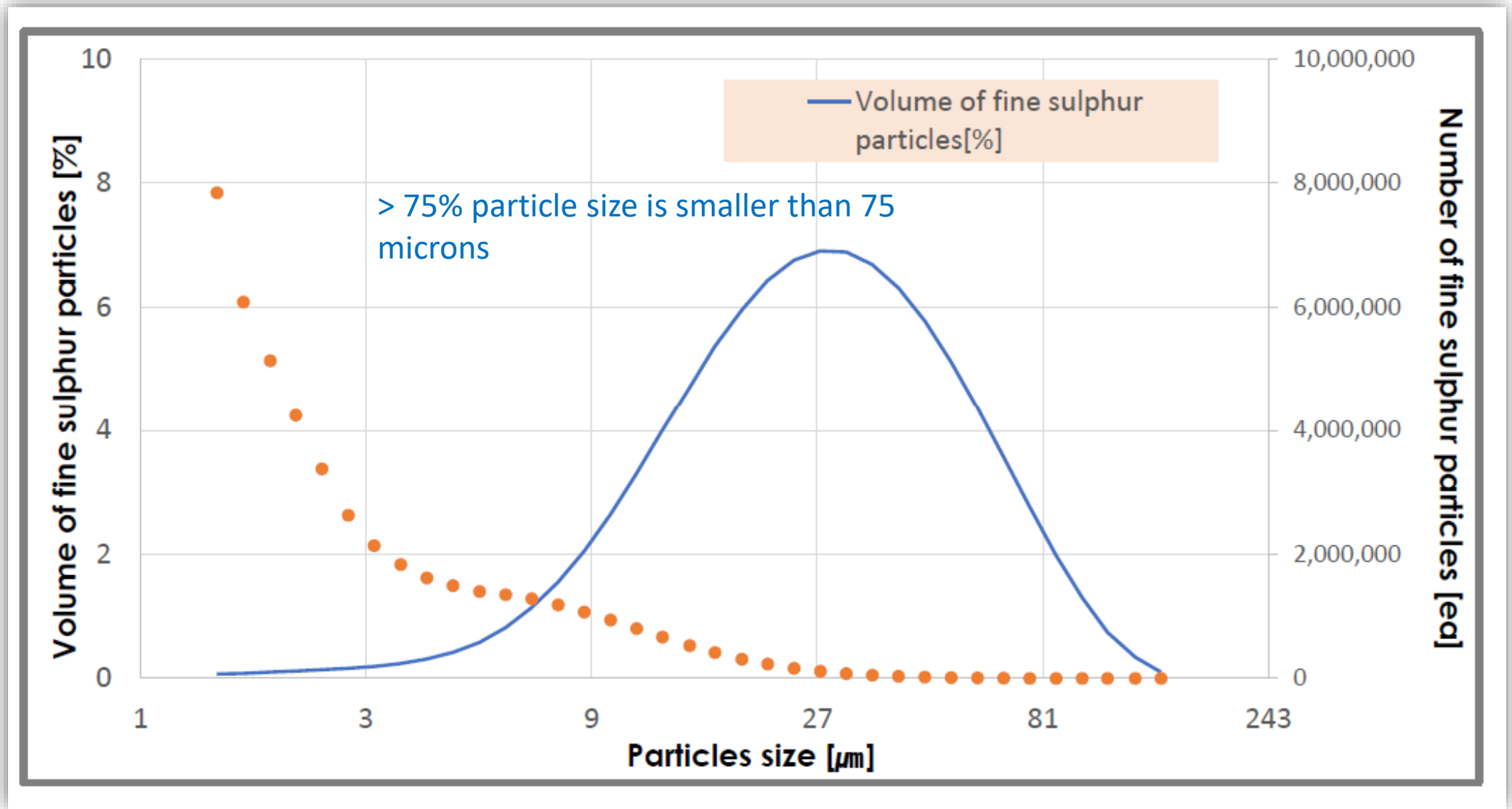
Ammonium sulphate: 68.3

Ammonium thiosulphate: 90.4

Size and Solubility are Key Features

- Urea base with Micronized particle size allows for quick breakdown & conversion from elemental S to plant available S04
- Allows for in row application where traditionally elemental Sulphur's required spreading applications to oxidize where Arctic S can be seed row and side band placed

ARCTIC-S DISOLUTION/DISPERSION	SULPHUR BENTONITE SWELLING/DISPERSION
Dispersion mechanism involves urea dissolving in water leaving clusters of sulphur particles which then 'crumble' Timeframe: minutes (3-5)	Dispersion mechanism consist of the swelling clay expand, breaking the solid elemental sulphur matrix in small pieces Timeframe: hours (24-48)


Volume of fine sulphur particles[%]
> 75% particle size is smaller than 75 microns
Volume of fine sulphur particles [%]
Number of fine sulphur particles [ea]
Particles size [㎛]
10
8
6
4
2
0
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
1
3
9
27
81
243

Particle Size	% S Oxidized	
(microns)	2 Weeks	4 Weeks
> 2,000	1	2
840 – 2,000	2	5
420 – 840	5	14
180 – 420	15	36
125 – 180	36	68
90 – 125	61	81
60	80	82

Canola.okstate.edu

	Micron Size Average
Arctic S	30-40um
Sulphur 90	200-300um
Human Hair	80um

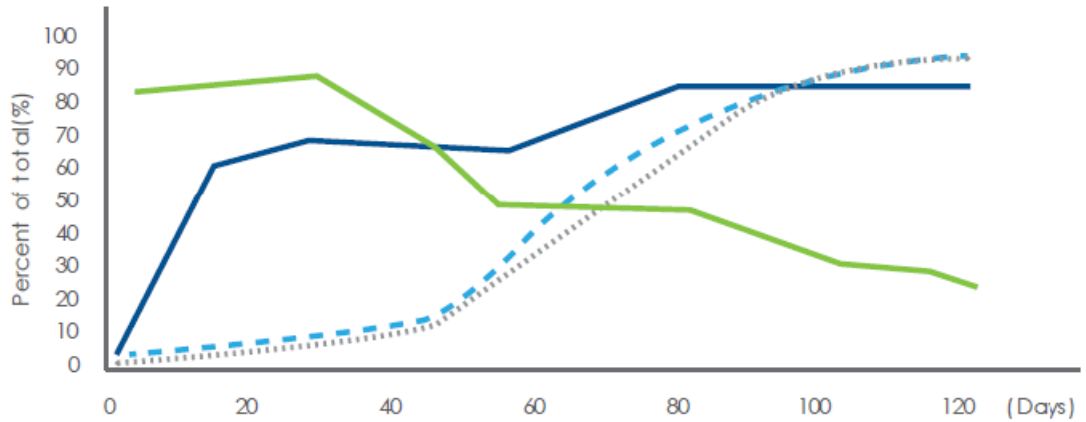
TECHNICAL FEATURES

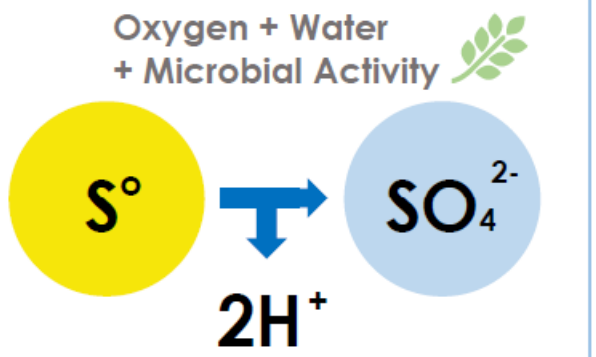
Particle size is key to the transition to sulphate

Conversion rates are subject to the environmental and soil conditions

Super S Oxidation Compared with Crop Need

Measured Using PRS Probes, Crop Uptake Source IPNI





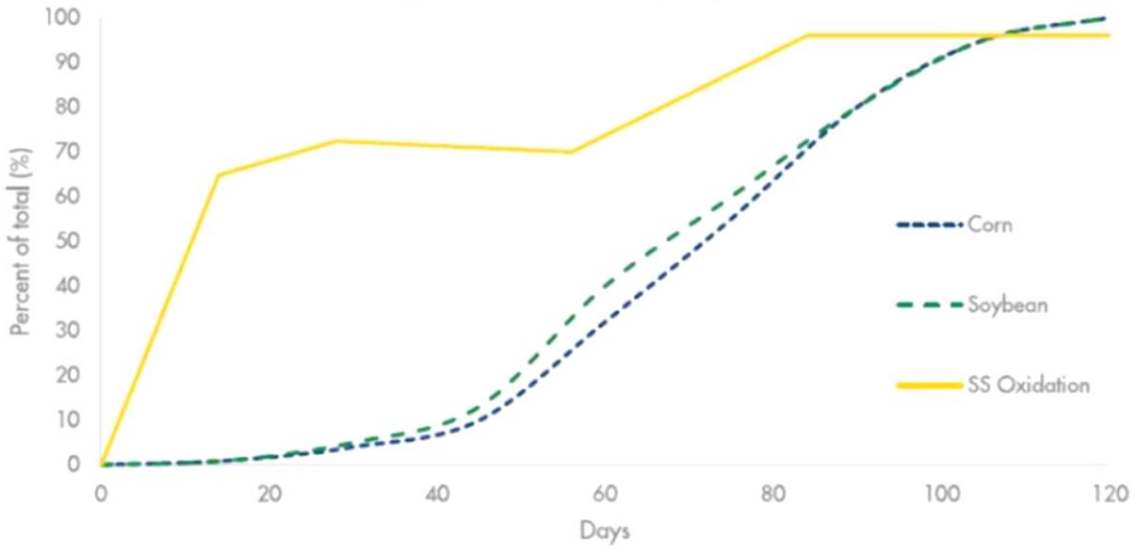
CIRRUS TRIALS 2018 – SPECIAL-S OXIDATION (Probe Test)

By applying elemental Sulphur in Micronized form, growers can access the in season availability of a Sulphate product while reducing the risk of losses through leaching.

Delivering Sulphur when your crops needs it most ensures you see a return on your fertilizer investment!

Special-S Oxidation Compared with Crop Need

Measured Using PRS Probes, Crop Uptake Source IPNI



Oxidation test conducted in controlled environment to determine maximum oxidation potential of Special-S. Variable climatic conditions in first 40 days would likely show Special-S availability closer to uptake curves.

Shell Thiogro Technologies

May 2019

Sulphur deficient wheat

Benefits Compared to Ammonium Sulphate Pt 1

Low salt index for safer seed placement eliminating or reducing chances of seed burn

Less plugging/caking of drills and floaters in humid conditions

Save time & money with less product to handle blend and ship. 1/3 to ½ the product to handle

Benefits Compared to Ammonium Sulphate Pt2

Improved soil health & biological activity especially with repeated applications as thiobacillus and other soil health factors improve

Improved uptake of Phosphate by reducing P tie up in high PH or calcium rich soils

Lower acidity vs Ammonium sulphate prevents PH decreases and Mn toxicity

Provides a season long source of Sulphur with reduced leaching, beneficial in wet conditions

Benefits Compared to Ammonium Sulphate Pt 3

More flexibility in blends without the worry of caking

Improves storage space required for retailers freeing up bin space for other products and turns/sq. ft.

Better product availability in season with high-capacity plant in Saskatoon compared to AMS which is reliant on domestic and imported product

Benefits compared to Sulphur bentonite 90

High availability and efficiency of Arctic S technology may outweigh the added benefits of lower cost Sulphur bentonite *Spring focus

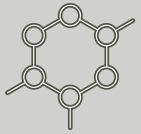
Very Safe high elemental product on the market

-Self extinguishing material

-Dust levels below minimum explosion levels of elemental

Can be blended easily with other products and soil applied (oxidization in soil)

Benefits compared to Phosphate + Sulphur fertilizers



Phosphate prills are often slow to breakdown resulting in the Sulphur portion being unavailable as well, compared to the urea based Arctic S prills which dissolve quickly

Customizable blend of MAP + Arctic S where P+S are in a fixed ration, often requiring Sulphur top ups for Canola

Improved margin *and* competitive per acre costs. Often a blend of Arctic S + MAP can be significant discount to P+S single prills

* In Canada Artic S is being handled 100% in bulk transport/blending

ARCTIC S HANDLING

SAFETY FEATURES

Non-Hazardous Fertilizer as per OSHA

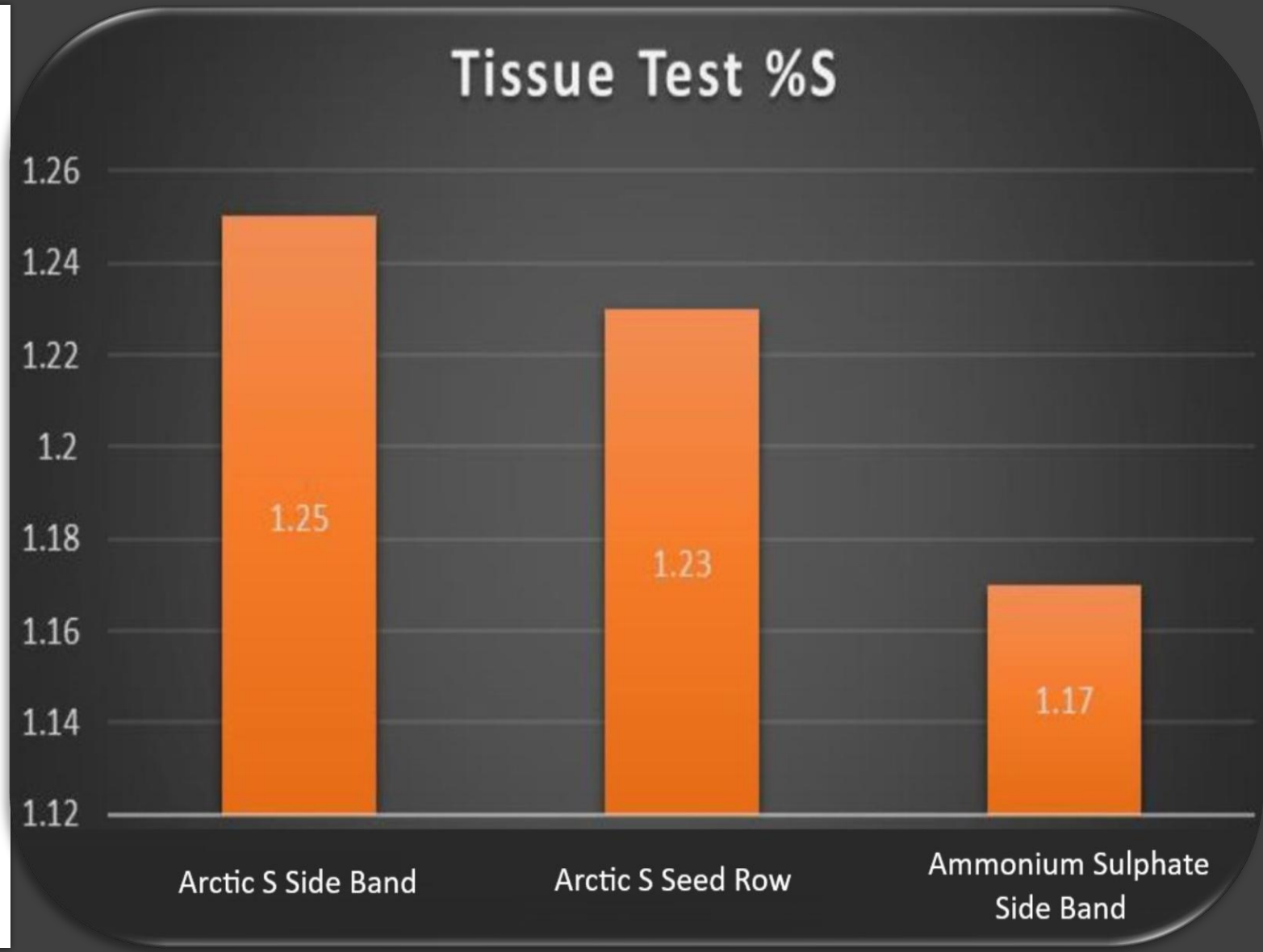
Strong prills create less potential dust compared to Sulphur bentonite that test at a fraction of minimum explosion limits

Self extinguishing material- Class 3 compared to Sulphur bentonite which is Class 5 which provides mitigated fire risk

Dust Hazard analysis available upon request

EXCELLENT FOR BLENDS

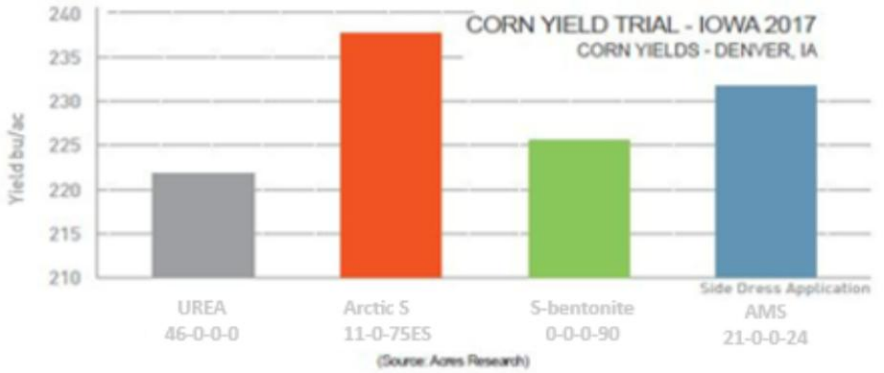
TISSUE RESULTS ICMS TRIALS 2018
SASKATOON



CORN YIELD TRIALS 2017
IOWA, USA

4 Increases Crop Yields

Continuous Sulphur supply increases crop yield



(Source: Acres Research)

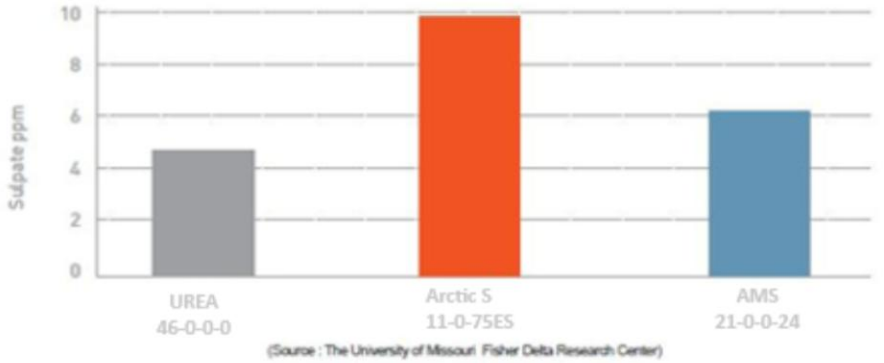
Soil Type : Loamy Fine Sand

Treatments tested provide Sulphur requirement to crop. N,P,K and S rate were applied uniformly for all treatments and at the recommended rates for the region, the exception being a control treatment with no S:Urea.

5 High Levels Of Residual Soil Sulphate After Harvest

Arctic S - Economical and Sustainable

Residual soil Sulphate levels post harvest combined with comparable yield results suggest sufficient oxidation for Super-S within the growing season, while offering residual benefits for future crops.



(Source : The University of Missouri Fisher Delta Research Center)

RESIDUAL SOIL SULPHATE levels POST HARVEST
(Plant Sulphur Uptake Not Included)

Customer Experience Retailer in Northern Saskatchewan

Spring 2023

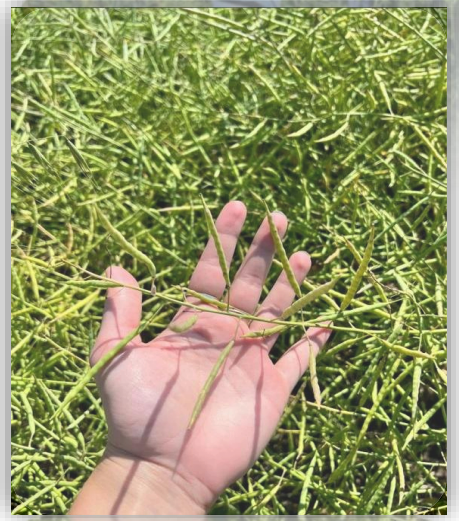
- Used 1000 tons of Arctic S as a cold turkey replacement to Ammonium sulphate, on over 80,000 acres
- Enjoyed only needing a single 160mt bin for Sulphur and the ability to have product available on a few hours' notice
- Retailer set up dozens of side by sides vs Ammonium sulphate
- Arctic S was consistently darker green cabbage with more cabbage mass
- Customer reordered 1,000mt in summer fill of 2023

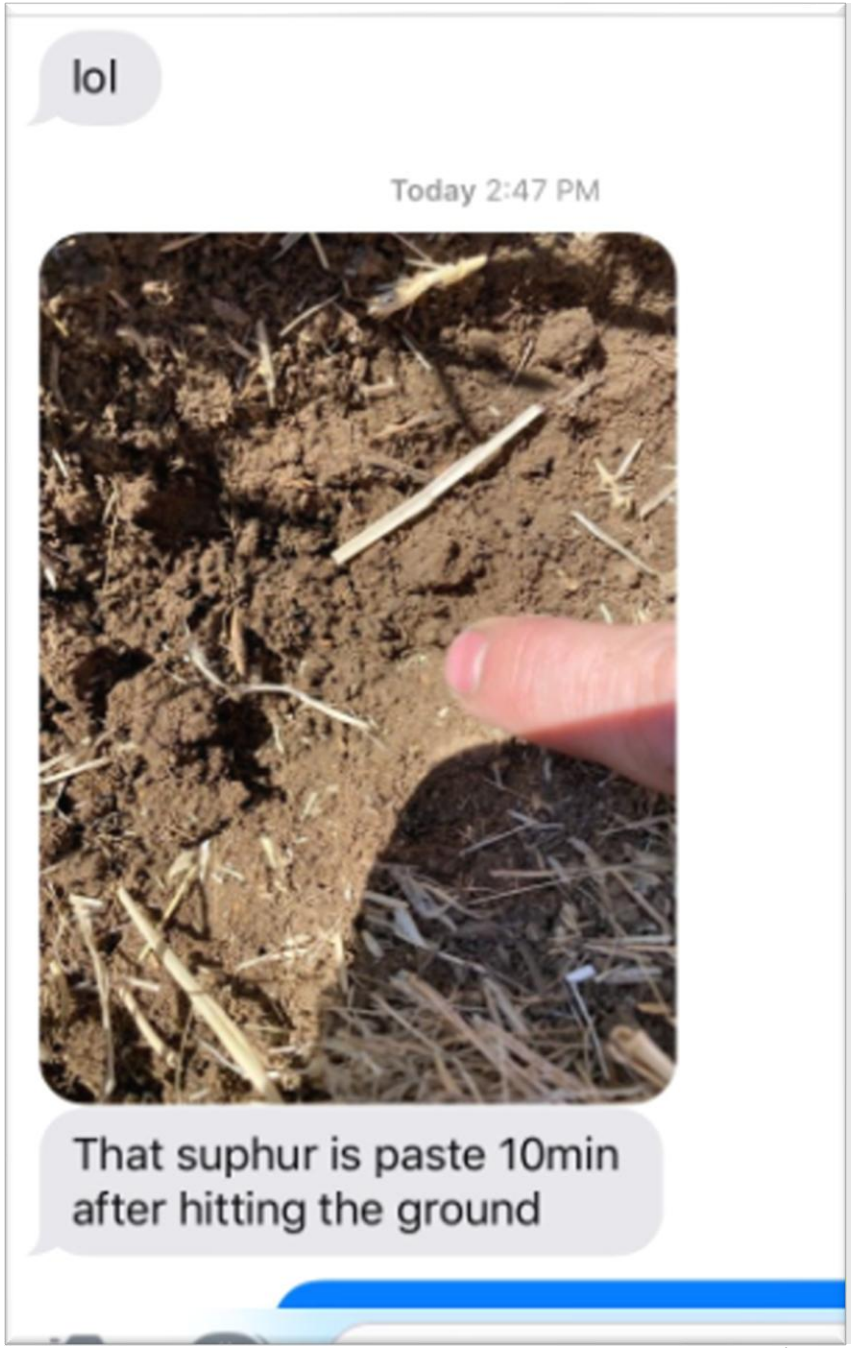
Farmer photo with **4 inches of rain and first year use of Arctic S*

Customer Experience Grower in Northern Saskatchewan

Spring 2023

- 3rd year of using Arctic S
- Enjoys using 1/3 the product compared to AMS
- Believes the repeated use of **Arctic S** has led to improved yields compared to Ammonium sulphate users in his area with similar land and rainfall





Customer Experience Grower in Southern Saskatchewan

Spring 2021

1st year applying elemental Sulphur, noticed product breaking down within minutes of application in the seed row in very dry conditions

When & How to use Arctic S?

- Supplementing fields in Spring with previous application history of elemental
- Replacing ammonium sulphate fields with adequate fertilization history
- Spring Blended or broadcast with Urea, phosphate, potash as your sole source of Sulphur
- Blended with S15, 40 Rock, or Polar 42 for two forms of Sulphur or top up your Sulphur for high Sulphur using crops
- Blended with Ammonium sulphate or Amidas
- Strategies to implement from retailers over the last 4 yeas include:
  - Cold turkey switches from AMS in spring blends
  - First year all Sulphur in pulses in cereals with Arctic S and most of canola blends from Arctic S
  - Some Fall spreading annually with Super U or other Nitrogen for all crops
  - In season top dress alone, with Urea or with Urea and AMS

When to consider a supplemental form of S with Arctic S?

- Field with zero residual Sulphur due to under application, for example Manitoba fields often apply only 12-15lbs during the canola rotation and no Sulphur in other rotations resulting in a major deficit of Sulphur over time. We would recommend supplementing with ammonium sulphate or ensuring a sufficient application rate of 30lbs/acre of Sulphur or higher and not in the mid row band in these conditions
- Fields with no fertilization history such as a converted hayfield
- Mid row banding any nutrients can result in nutrient deficiencies, application is recommended as broadcast, seed row, sideband

Pricing

- Arctic S + Ammonia typically lower cost than Ammonium Sulphate
- Arctic S + Urea typically equal cost to Ammonium Sulphate
- Arctic S + MAP typically significantly less cost than P+S single prill products

TESTIMONIALS

"WE ARE NOW ON OUR FIFTH SEASON OF USING ARCTIC S. THE LOW SALT INDEX AND HIGH S CONTENT ARE A PERFECT FIT FOR OUR GROWERS" ~ MATT OWENS, EMERGE AG

"WE LIKED HANDLING LESS PRODUCT & OUR CANOLA IS PROBABLY THE BEST WE HAVE EVER SEEN ON THE FARM" ~ BRANDON SUNDQUIST, WATROUS, SK

"WE HAD A CUSTOMER WHOSE AMS BLENDS WERE CAUSING TROUBLES IN HIS DRILL THIS SPRING. AFTER SWITCHING HIS BLEND OVER TO ARCTIC S, ALL THE PROBLEMS WENT AWAY" ~ SASKATCHEWAN RETAILER