KTS-Potassium Thiosulphate – A Liquid Potassium and Sulphur Fertilizer for Cotton Production

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ABSTRACT

KTS is a clear liquid fertilizer product containing 25% K_20 and 17% sulphur. This product was developed in the early 1990's and currently is being manufactured in the US and distributed throughout the cotton growing regions of North and South America, Australia and the Middle East. KTS can be used as a source of potassium and sulphur for starter fertilizers, sidedress placement, through irrigation water and for foliar applications. The product has been accepted by many cotton production managers to enhance growth and boll development.

Introduction

The theory of manufacturing a liquid potassium thiosulphate product was originally discussed by Bernard J. Kerley, one of the four Kerley brothers that started Kerley Chemical in the late 1940's (E. Krysl 1997. personal communication). This theory was soon abandoned because the Kerley brothers realized that manufacturing a liquid nitrogen-sulphur product for agriculture had more commercial potential than a liquid potassium-sulphur product. In the 1950's Kerley Chemical went on to develop and manufacture liquid nitrogen-sulphur products such as ammonium polysulphide-ammonium hydroxide (NITRO-SUL) and ammonium thiosulphate (THIO-SUL) that represents the most widely used liquid nitrogen-sulphur source for agriculture production in the world.

Development

During the early 1970's, a small pilot plant at one of Kerley's mining sites near Sahuarita, Arizona was used to produce a small amount of potassium thiosulphate. After reviewing the cost associated with this manufacturing procedure and potential customer interest, Kerley management discontinued development of a commercial grade of potassium thiosulphate.

As the liquid fertilizer industry began to expand in the 1980's, renewed interest in potassium thiosulphate began to surface. During this period Kerley had established a research and development laboratory at Sahuarita. Kerley was sold to Hickson International (Leads, England) in 1988 and began operating as Hickson-Kerley. After the change of ownership a new challenge was directed to the R and D group in 1989 to develop an efficient manufacturing process for the commercial production of potassium thiosulphate.

In early 1990, potassium thiosulphate was synthesized in the laboratory according to well-described reactions between KOH and sulphur dioxide to generate potassium sulphite that was then reacted with elemental sulphur (S. Bierle. 1997. personal communication). Small quantities (a few gallons) were sent to Hickson-Kerley agronomist for field evaluation. Field observations were positive and additional production was requested. By August 1990, 275 gallons had been prepared in a Sahuarita, Arizona pilot plant for additional field trials in California.

Commercialization

Results from these field trials indicated that potassium thiosulphate was a viable and effective source of potassium and sulphur for agriculture production. After a review of potential manufacturing sites and accessibility of raw materials, a decision was made to produce a commercial thiosulphate product at Hickson-Kerley's plant near Pasadena, Texas.

Several refinements were developed in the manufacturing process to improve the quality and stability of potassium thiosulphate. This product is now produced and marketed by Tessenderlo Kerley and sold under the trade name of KTS (Tessenderlo Chemie, headquartered in Brussels, Belgium purchased the company from Hickson in 1996). The characteristics of KTS are outlined in Table 1.

Agronomic Use

KTS is now used as a fertilizer source of liquid potassium and sulphur in a variety of ways. It has been evaluated as a preplant sulphur source for cotton production. Mullins (1998) found that cotton yields could be increased from the addition of 20 pounds/acre of sulphur applied preplant to sandy soils in Alabama. The addition of KTS to liquid nitrogen-phosphorus starter fertilizer such as ammonium polyphosphate has been used for many crops including cotton. Starter N-P_20_5-K_20-S fertilizer grades such as 8-27-5-3, 7-25-6-4, 6-21-10-7 and 5-

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17-13-9 are possible when KTS is mixed with ammonium polyphosphate.

KTS has been evaluated as a band application placed beside the cotton row during cultivation at the early square growth stage. In this evaluation 60lbs/A of K_20 from KTS gave a higher lint yield and lower micronaire value than from the standard broadcast application of KCL at 60 lbs/acre of K_20 (Table 2).

The foliar application of potassium has received considerable attention during recent years. Since KTS is a high analysis clear liquid potassium source the use as a foliar product has been significant. Hons and Sanders (1993) reported higher cotton yields from four foliar applications of KTS compared to traditional preplant broadcast potassium applications in Texas. In this study, 18 pounds of K_20 were applied in the four KTS applications as compared to preplant applications of up to 120 lbs/ K_20/acre.

For foliar KTS applications, the addition of a urea-triazone based liquid nitrogen has been beneficial for enhanced cotton production. Urea-triazone liquid nitrogen fertilizer was developed by the Triazone Corporation (Clapp and Parham, 1991). This technology now belongs to Tessenderlo Kerley. Urea-triazone products have proven safer to crop foliage than foliar nitrogen products containing all urea, ammonium or nitrate sources (Clapp, 1993).

One of these urea-triazone based nitrogen products, TRISERT-CB (26-0-0-.5B) has been used in combination with KTS by University of California Extension personnel for foliar field trials on cotton. These field trials were designed to evaluate rates of application, single vs. multiple applications and growth stages over a five-year period. Results from these trials indicate that a combination of KTS at 6 quarts per acre with 2 qts of TRISERT-CB applied at the early bloom growth stage can enhance cotton yields (Table 3). The foliar application of KTS at 1 gal/acre plus TRISERT-CB at 1 qt./acre was also increased cotton yields in Southeast Missouri. In this study yields were increased by 15.7% when four applications were made during the boll development growth stage (Table 4).

Summary

KTS is being used as a source of potassium and sulphur for cotton production. This liquid product containing 25% $K_20$and 17% S can be applied alone or mixed with other liquid fertilizers such as ammonium polyphosphate or urea-ammonium nitrate solutions for soil applications. The product can also be applied through irrigation water where cotton is irrigated. KTS can also be used alone or in combination with urea-triazone nitrogen solutions for foliar applications.

The use of this versatile source of potassium and sulphur is expected to expand rapidly. The major cotton growing regions of North and South America, Australia and the Middle East should see increased availability of KTS as Tessenderlo Kerley expands the manufacturing capacity for this product.

References

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Hons, F. and J.L. Sanders. (1993): Potassium spells relief for cotton. Potash and Phosphate Institute News and Views. Ref. No. 93076.

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Table 1. Characteristics of KTS-potassium thiosulphate.

Plant Nutrient Content wt. %	
Soluble Potash (K_20)	25.0
Total Sulphur (S)	17.0
Typical Properties	
Specific Gravity	1.46
pH	7.0 to 8.2
Appearance	Clear; Colorless
Salting Out Temperature (°F)	15
Formulation and Application Factors, 60° Fahrenheit	
Density; lbs/gallon	12.2
Volume; gallons/ton	164.0
Pounds K_20 per gallon	3.0
Pounds S per gallon	2.1
Plant Nutrient Source	
Potassium Thiosulphate	$K_2S_20_3$

Table 2. Evaluation of banded KTS rates for cotton production in North Alabama.

KTS [a]	Relative Yield	Lint	Micronaire	Quality Factors		
lbs K_20/acre	%	%		Length (in.)	Strength (g/tex)	Uniformity
0	100	40.4	4.7	1.14	25.4	81.9
20	120	41.0	4.7	1.14	22.1	82.8
30	149	39.9	4.8	1.13	24.8	82.2
60	179	41.3	4.4	1.16	23.7	82.8
Standard [b]	156	41.1	5.0	1.13	24.4	82.1

[a] Applied at early square growth stage and injected 8-10 inches beside the row during cultivation.
[b] Applied as KCL at 60 lbs K_20/acre broadcast and incorporated before planting.
[c] *Machine* harvested from 1.55 acre plots.

Source: Dixie Ag Supply, Leighton, Alabama

Table 3. Response of cotton to foliar application of KTS and TRISERT-CB.

Treatment	Application and Growth Stage	Lint (lbs/acre)				
		96[a]	95[a]	94[a]	93[b]	92[a]
Control		1352	1306	1427	965	1291
KTS + T-CB	1 application	1502	1573	1623		
6 qts - 2 qts	2 wks after 1st bloom					
KTS + T-CB	2 applications		1477			
6 qts =1 qt	2 and 4 wks after 1st bloom					
4. KTS + T-CB	2 applications			1657		
6 qts - 2 qts	1st bloom and 2 wks later					
5. KTS 6 qts	4 applications				1091	
6. KTS + T-CB	3 applications					1375
1.8 gal - 2 qts	1;2;3 wks after 1st bloom					

[a]Merced County
[b]Kings County
Weir, B.L., University of California Cooperative Extension, Merced, CA

Table 4. Foliar application of KTS and TRISERT-CB on Cotton in Southeast Missouri.

Treatment[a]	Yield-lbs/acre[b]
Control	642
KTS @ 1 gal/acre TRISERT-CB@ 1qt/acre	743

[a] Applied at spray volume of 10 gal/acre at bloom and repeated at 7-10 day intervals 4 applications
[b] Average of six replications
Aycock Ag Services, Parma, MO