EVALUATION OF POLY4 (POLYHALITE) AS A FERTILIZER IN COMPARISON TO SULPHATE OF POTASH FOR TOBACCO

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INTRODUCTION

- Potassium deficiencies can be observed across the Yunnan province in China. Tobacco crops consume an average 100 kg K_2O ha^{-1}.
- Low chloride potassium nutrition is critical for the production of high yielding, quality tobacco. Potassium content in tobacco influences leaf colour, texture, contents of reducing sugars and alkaloids, combustibility, hygroscopic properties, burning properties, reduces tar quantities and thus may influence reduction in harmful substances.
- POLY4 is an alternative potassium source to SOP and SOP-M – both used as standard practice across the province – having advantages in terms of unit cost and availability on a large scale. This could ultimately lead to decreased reliance on SOP as a potassium source for tobacco.
- Lack of research evaluating polyhalite as a K_2O source in tobacco motivated establishing two trials in the province.

OBJECTIVES

- To assess whether the tobacco crop responds to potassium and other nutrients present in POLY4 in the Yunnan region of China
- What is the effect of POLY4 as a K_2O source on tobacco yield, yield attributes and quality parameters?
- Are POLY4 and SOP rate response curves similar in terms of yield, yield attributes and quality parameters?

METHODOLOGY

- Location was Xundian Daheqiao farm, Yunnan Agricultural University.
- Genotype was FCV tobacco – YN-87.
- N and P_2O_5 were applied at local recommended rates.
- Plant population was 15,000 plants ha^{-1}.
- Method of fertilizer application was in a hole 5 cm away from plant at the time of transplanting by hand.
- Transplanting date was 2 May 2014 and harvesting was done five times.
- Crop was cultivated under rainfed conditions.
- Experimental design at each site was a randomised block design with three replications.

Treatment number	K_2O source	Nutrients applied (kg ha^{-1})			
		K_2O	CaO	MgO	S
1	Control	0	0	0	0
2	POLY4	88	107	38	119
3	POLY4	117	142	50	159
4	POLY4	175	213	75	238
5	POLY4	263	319	113	357
6	SOP	88	-	-	32
7	SOP	117	-	-	42
8	SOP	175	-	-	63
9	SOP	263	-	-	95

Table 1 – Type, rate and amount of the nutrients supplied by each treatment for rate response study

- Plot area was 30 m^2.
- Statistical analysis was carried out using GenStat software version 17 (VSN International, 2011) using ANOVA and regression analysis. Treatments of interest in source study were compared by using single degree of freedom contrasts.

Year	pH	Organic matter (g kg^{-1})	Alkali-hydrolyzable N (mg kg^{-1})	Available P (mg kg^{-1})	Available K (mg kg^{-1})
2014	7.2	22	95	5	125
2015	7.4	27	109	28	216

Table 2 – Regression analysis of tuber yield and dry matter

RESULTS

2014

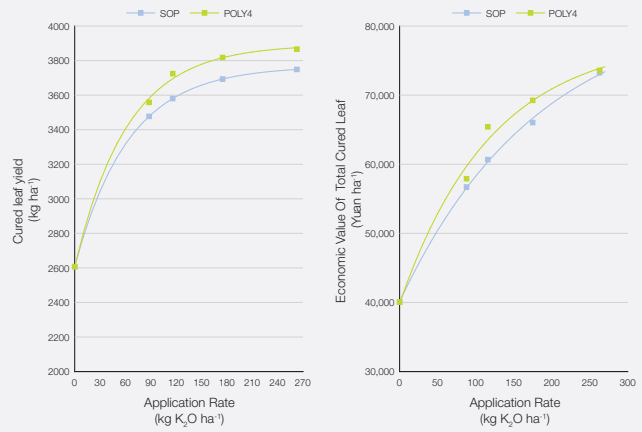

Figure 1 – Total cured leaf yield and financial returns in 2014

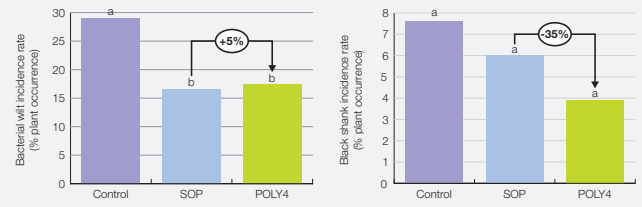

Figure 2 – Average bacterial wilt and black shank disease incidence rate as influenced by source of K_2O in 2014

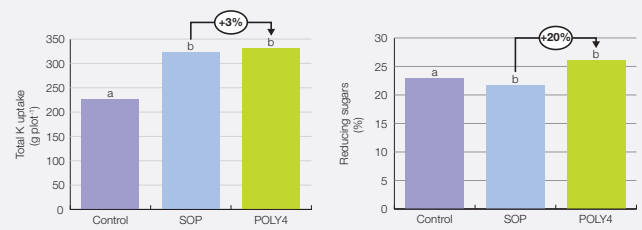

Figure 3 – Total K uptake and reducing sugars as influenced by source of potassium in 2014

Variable	Control	Control * Type	Control * Rate	Control * Type * Rate
Yield (kg ha^{-1})	<0.001	ns	ns	ns
1st class yield (kg ha^{-1})	<0.001	ns	0.003	ns
2nd class yield (kg ha^{-1})	<0.001	ns	ns	ns
3rd class yield (kg ha^{-1})	ns	ns	0.055	ns
Financial returns on total yield (Yuan ha^{-1})	<0.001	ns	<0.001	ns
1st class returns (Yuan ha^{-1})	<0.001	ns	0.003	ns
2nd class returns (Yuan ha^{-1})	<0.001	0.027	0.001	ns
3rd class returns (Yuan ha^{-1})	ns	ns	ns	ns
Total K uptake (g $plot^{-1}$)	<0.001	ns	<0.001	ns
Reducing sugars (%)	ns	0.003	0.094	ns
Bacterial wilt incidence rate (% occurence)	<0.001	ns	ns	<0.001
Black shank incidence rate (% occurence)	<0.001	<0.001	<0.001	<0.001

Table 3 – Summary of ANOVA p values for yield and yield attributes in 2014

2015

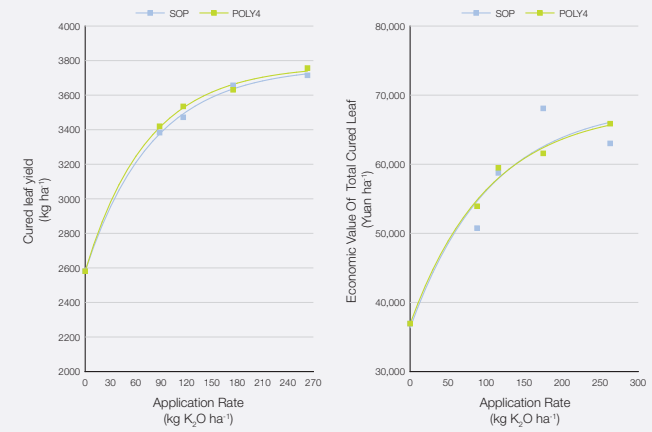

Figure 1 – Total cured leaf yield and financial returns in 2015

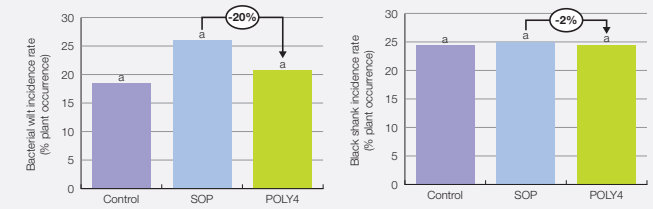

Figure 4 – Average bacterial wilt and black shank disease incidence rate as influenced by source of K_2O in 2015

Variable	Control	Control * Type	Control * Rate	Control * Type * Rate
Yield (kg ha^{-1})	<0.001	ns	ns	ns
1st class yield (kg ha^{-1})	<0.001	0.089	0.052	0.029
2nd class yield (kg ha^{-1})	0.005	ns	ns	ns
3rd class yield (kg ha^{-1})	ns	ns	ns	ns
Financial returns on total yield (Yuan ha^{-1})	<0.001	ns	0.005	ns
1st class returns (Yuan ha^{-1})	<0.001	ns	<0.001	<0.001
2nd class returns (Yuan ha^{-1})	<0.001	0.027	<0.001	<0.001
3rd class returns (Yuan ha^{-1})	ns	ns	ns	ns
Bacterial wilt incidence rate (% occurence)	<0.001	ns	0.083	0.026
Black shank incidence rate (% occurence)	<0.001	0.024	ns	0.013

Table 4 – Summary of ANOVA p values for yield and yield attributes in 2015

CONCLUSION

- POLY4 was as effective as SOP in enhancing tobacco cured leaf yield, economic returns and the cured leaf K uptake values.
- POLY4 resulted in significantly enhanced reducing sugars than SOP in 2014.
- Potassium application consistently reduced Black Shank and Bacterial Wilt incidences in 2014 when soil K levels were 125 mg kg^{-1}. However, in 2015 when initial soil K was 216 mg kg^{-1} Black Shank and Bacterial Wilt incidences were not reduced by potassium fertilizer application.