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Case Study 7.2-3 The right source and rate of potassium for processing tomato in Xinjiang, China.

Xinjiang province is the largest producer of processing tomato in China and has favorable conditions such as more sunshine hours (2,600 to 3,400 hours annually), large differences in day and night temperatures, and low humidity. Tomatoes for processing need large amounts of K for adequate growth. However, farmers often omitted K in nutrient management in production of processing tomato for years, leading to significant soil K depletion and decreased soil K availability. So, yield and benefit of processing tomato in the northwestern province are often restricted by inadequate K nutrition. The most common sources of fertilizer K are potassium chloride (KCl), mono potassium phosphate (KH_2PO_4), potassium nitrate (KNO_3), and potassium sulfate (K_2SO_4). Of these sources, KCl is the least expensive.

Outcomes

Experiments conducted by IPNI China program showed that at the same rate of N, P_2O_5 and K_2O/ha, KCl produced an average of 7.2 and 7.8% more processing tomato yield and US$277 and US$204 more income than potassium magnesium sulfate ($K_2SO_4 \cdot 2MgSO_4$) and K_2SO_4, respectively (**Table 1**), indicating that KCl was the most economic source of K.

Table 1: Effect of different sources of K on yield and benefit of processing tomato in Xinjiang (2004-2005) (Hu et al., 2007; Zhang et al., 2008)

K source	2004				2005	
	Toutunhe farm 1		Toutunhe farm 5		Toutunhe farm 5	
	Yield, kg/ha	Income from K application, $/ha	Yield, kg/ha	Income from K application, $/ha	Yield, kg/ha	Income from K application, $/ha
KCl	78,510	1,144	63,225	655	97,366	407
K_2SO_4	73,350	972	57,900	478	90,725	143
$K_2SO_4 \cdot 2MgSO_4$					90,862	130

Note: N-P_2O_5-K_2O rates at Toutunhe 1 and 5 in 2004 were 173-104-72 kg/ha and 173-110-49.5 kg/ha, respectively, and that in Toutunhe 5 in 2005 was 179-108-90 kg/ha. The price of tomato fruit: $0.03/kg, K_2O: $0.64/kg KCl, $0.67/kg K_2SO_4, $0.84/kg $K_2SO_4 \cdot 2MgSO_4$. Income was calculated based on the difference between K treatment and K omission plots.

Often the K requirement of processing tomato exceeds its N requirement. Studies showed that an average of 3.27 kg N, 0.86 kg P_2O_5, and 4.02 kg K_2O was required for producing each tonne of processing tomato within the yield range of 75 to 112 t/ha (Zhang et al., 2002; Tang et al., 2009; Tang et al., 2010), suggesting at least 300 to 400 kg K_2O/ha is required. The rate of K applied depends on the soil supply of K and the expected target yield. Experiments conducted in 2003-04 showed that when soil available K was 181 to 197 mg/kg applications of 180-108-180 kg N-P_2O_5-K_2O/ha increased fruit yield by 15 to 18% over the K omission plot. Fruit quality characters such as lycopene and vitamin C were improved by K application at the appropriate rate. Lower or higher K rate than 180 kg K_2O/ha produced less yield and quality as well as reduced farmer's income (**Table 2**). Cheng et al. (2007) determined the optimum rate of fertilizer for a drip-irrigated processing tomato yield goal of 112 t/ha under plastic mulch in Xinjiang was 300-105-75 kg N-P_2O_5-K_2O/ha when soil available K was 260 mg/kg.

Table 2: Effect of K rates on yield, quality and income from fertilizer application in processing tomato in Xinjiang (Zhang, et al., 2008)

	K_2O rate, kg/ha	Yield, t/ha	Lycopene, mg/100g	Solids, %	Vitamin C, mg/100g	Income from fertilizer application, $***
2003*	0	86.1 b**			10.5	
	90	92.6 b			19.2	159
	180	101.3 a			11.1	388
	270	91.7 b			9.2	11
2004*	0	95.1 b	6.1	8.9	8.0	
	90	98.8 b	8.0	8.9	8.3	64
	180	109.0 a	10.5	10.5	9.7	341
	270	95.4 b	8.6	8.5	8.9	-164

*All the treatment received 180-108 kg N-P_2O_5/ha.

**Within a column, numbers followed by a different letter are significantly different at $p<0.05$.

***The price of tomato fruit: $0.03/kg; K_2O: $0.64/kg.

In summary, high yield and more benefit of processing tomato in Xinjiang can be achieved through precisely matching the crop's nutrient needs using the right source and right rate.

References

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