Sweet Potato Response to Potassium

By Lu Jian-wei, Chen Fang , Xu You-sheng, Wan Yun-fan, and Liu Dong-bi

Sweet potato is an important crop for the mountainous regions of Hubei province and accounts for 3 percent of Hubei's total cultivated area. Low soil fertility is presently restricting yields.

Average yields for sweet potato in Hubei are low...about 15 t/ha...because of low soil fertility (**Table 1**) and unbalanced fertilization. Almost no potassium (K) is traditionally applied except that contained in organic manure. Field trials and balanced fertilization demonstrations were carried out in the major sweet potato production region to better understand the importance of K fertilizer on crop yield and quality.

Table 1. Nutrient content of different sweet potato soils, Hubei province.

Site	pH (H_2O)	Organic matter %	Available N, ppm	Available P, ppm	Available K, ppm
1	7.2	2.6	120.0	8.1	79.5
2	-	2.2	125.0	15.0	90.0
3	6.0	-	49.0	6.7	140.0
4	5.7	1.7	82.6	20.2	39.0
5	7.3	2.2	109.0	13.4	45.0
6	8.0	0.7	35.0	3.1	55.0

Table 2. Yield and K-use efficiency responses to optimal K applications at nine sites, Hubei province.

Site	Yield, t/ha CK	+K	Increment t/ha	%	K use efficiency, kg yield/kg K_2O
1	24.4	27.4	3.0	12.3	13.1
2	26.4	28.9	2.5	9.5	16.7
3	42.2	63.6	21.5	50.7	95.3
4	22.1	26.8	4.7	21.3	20.9
5	45.7	61.8	16.1	35.2	71.3
6	41.4	61.3	19.9	48.1	88.6
7	25.3	34.5	9.2	36.4	60.4
8	31.1	32.7	1.6	5.1	10.5
9	30.3	34.5	4.2	13.9	18.6
Average	32.1	41.3	9.2	28.7	43.9

Sweet potato yield and quality showed strong improvement with K fertilizer application in Hubei studies.

Effect of Potassium on Sweet Potato Yield

All nine field trials showed that adequate K inputs greatly increased sweet potato yields (**Table 2**). Yields were increased by 1.6 to 21.5 t/ha (average 9.20 t/ha) with responses of 5.1 to 50.7 percent (average 28.7 percent). Yield response per kg K_2O was 10.5 to 95.3 kg (average 43.9 kg). Data also indicated the K benefit was greater in high yielding fields than in low yielding fields. More nitrogen (N) and phosphorus (P) were applied in the high yielding fields, which lead to a larger imbalance between K and N and P.

Table 3. Sweet potato yield response to K rates in different sites, Hubei province.

K_2O rate, kg/ha	Site 1 Yield, t/ha	Site 1 Relative, %	Site 2 Yield, t/ha	Site 2 Relative, %	Site 3 Yield, t/ha	Site 3 Relative, %
0	22.5	100	61.0	100	38.0	100
75	—	—	70.0	115	—	—
150	27.4	122	73.0	120	44.3	117
225	26.2	117	78.0	128	46.3	122
300	27.5	122	80.0	131	48.0	126

Table 4. Effect of K rates on sweet potato quality, Hubei province.

K_2O rate, kg/ha	Average weight of single sweet potato, kg	Average weight of single sweet potato, Relative, %	Starch content, %	Starch content, Relative, %
0	0.28	100	60.6	100
75	0.31	111	—	—
150	0.32	114	63.5	105
225	0.35	125	65.2	107
300	0.33	118	64.5	106

Table 5. Effect of K sources on sweet potato yield and quality, Hubei province.

Treatment	Flesh yield t/ha	Flesh yield %	Starch content %	H_2O content %	Starch yield t/ha	Starch yield %
CK	22.1	100	61.3	60.1	5.41	100
KCl	28.4	128	62.0	59.7	7.08	131
K_2SO_4	25.8	116	62.6	59.1	6.59	122
½KCl + ½K_2SO_4	26.8	119	—	—	—	—

*K rate: 225 kg K_2O/ha

Yield and Quality Response to Potash Application Rate

In three selected sites, yields increased with added K up to the highest rate of 300 kg K_2O/ha (**Table 3**). However, the best economic response for site 1 was achieved with 150 kg K_2O/ha; at site 2 with 225 kg K_2O/ha; and, site 3 with 300 kg K_2O/ha (**Figure 1**). Both average tuber weight and starch content, indicators of quality, increased with K rates up to an optimum of 225 kg K_2O/ha (**Table 4**).

Yield and Quality Response to Potassium Sources

Both potassium sulfate (K_2SO_4) and potassium chloride (KCl) had positive yield and quality effects on sweet potato (**Table 5**). However, KCl was more efficient, in terms of yield, than K_2SO_4 applied at the same rate. Starch content of sweet potato tubers tended to be higher with K_2SO_4 than with KCl. However, total starch yield was higher with KCl treatments due to the higher fresh sweet potato yield. The southern mountain area of Hubei has an annual rainfall of more than 1,100 mm. As a result, soil profiles of this region commonly have chloride (Cl) contents below 20 parts per million (ppm).

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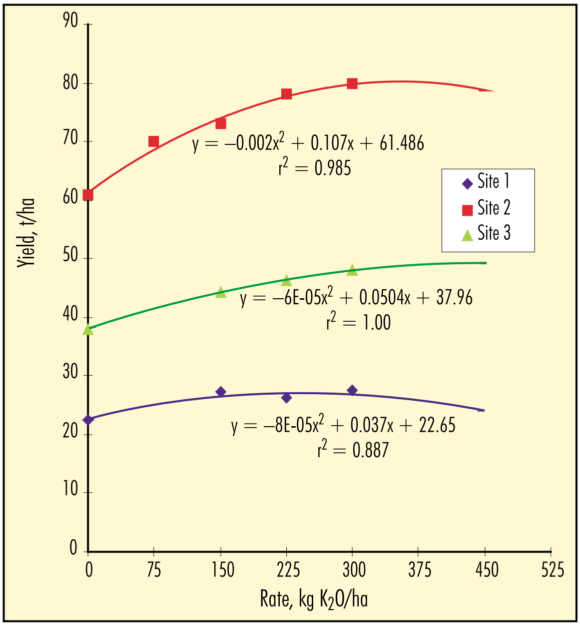
Figure 1. Sweet potato yield response to K rates, Hubei province.



PPI/PPIC Wuhan Office Moves to Wuhan Institute of Botany

The PPI/PPIC office for Eastern China is now located at the Wuhan Institute of Botany.

After three years of excellent cooperation from the Hubei Academy of Agricultural Sciences (HAAS), the PPI/PPIC Wuhan Office has moved to the Wuhan Institute of Botany of the Chinese Academy of Sciences, due to a personal decision of Dr. Fang Chen, PPI/PPIC Deputy Director, Eastern China. PPI/PPIC wishes to thank Dr. Liu Dingfu, President of HAAS, for the support he and his Academy and staff provided to the PPI/PPIC office over the past three years. PPI/PPIC looks forward to continuing close cooperation with the HAAS Soil and Fertilizer Institute on soil and fertilizer-related research and educational activities.

Effective April 2001, the PPI/PPIC Wuhan Office is now located in the Wuhan Institute of Botany, of the Chinese Academy of Sciences, in Wuhan, Hubei province. Dr. Chen will continue with his responsibilities of developing agronomic research and educational programs in the provinces of Anhui, Hubei, Hunan, Jiangsu, and Zhejiang, and the city of Shanghai. The new address is:

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Conclusions

This study indicates that low soil fertility, especially low availability of soil K, in sweet potato production areas in Hubei is presently restricting yields and lowering profits. Sweet potato yield and quality respond strongly to K applications. The optimal K rate in these areas varies from 150 to 300 kg K_2O/ha. Potassium sulfate application resulted in the highest tuber starch content; however, KCl produced greater fresh weight and overall starch yields. It was evident that more K should be used in fields with better soil fertility and higher yield potential. **BCI**

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