Importance of Potassium in Sugarcane

Sugarcane is grown widely in Southeast Asia (see Table 1). Potassium (K) plays a pivotal role in sugarcane production. It is an essential nutrient for plant growth and its role in sugarcane has been well documented. It is an enzyme activator in plant metabolisms such as photosynthesis, protein synthesis, starch formation, and translocation of proteins and sugars (Filho, 1985; Kwong, 2002, Wood and Schroeder, 2004). Under conditions of K deficiency, translocation of photosynthates in sugarcane can decrease substantially (Hartt, 1969). A sustained supply of K^+ throughout the growing season will facilitate greater shifting of dry matter from leaf to stem, enhancing the translocation of more assimilates from source to sink (Mengel and Haeder, 1977).

Potassium enables sugarcane crops to take up a balanced suite of nutrients and is better able to withstand the drought conditions that periodically occur in sugarcane growing regions (Wood and Schroeder, 2004). Potassium regulates stomatal opening and closing, and thus maintains turgor pressure under unfavorable soil moisture conditions.

Potassium content of sugarcane stalks varies considerably. Previous studies reported a wide range of K uptake from 0.27 to 2.7 kg K per ton of cane yield (Filho, 1985). In Australia, K removal ranged from 2.1 to 2.4 kg K/ton of cane yield (Wood and Schroeder, 2004). A healthy sugarcane crop contains generally more than 200 kg K/ha in its aboveground parts (Kwong, 2002).

Responses of sugarcane to K fertilization reflect to a large extent the available K status of soil, where significant responses are obtained only in soils low in available K (Kwong, 2002). Potassium deficiency can result in reduced yields. Application of fertilizer K to a deficient soil can increase both cane yield and quality (Wood, 1990, El-Tilib *et al.,* 2004; Asraf *et al.,* 2008). In general, sugarcane responds to K fertilizers by an increase in cane yield without any change in sucrose concentration in the cane (Kwong, 2002; Shukla *et al.,* 2009).

Shukla et al., 2009 reported the following effects of K fertigation (i.e. 66 kg K/ha is applied with irrigation water) in standing plant cane: (i) increased dry matter accumulation at all growth stages with an increase of 19% over no K fertilization at harvest, (ii) increased number of sprouted buds in ratoon cane stubble, and (iii) higher number of millable cane in ratoon, due to vigorous tillers formed in ratoon cane. Wood and Schroeder (2004) reported that where K was deficient, moisture stress negatively affected yield, but where K was applied (at 120 kg/ha), moisture stress did not impact negatively on yield.

Table 1. Production (in million tons, mt) and average yield in Southeast Asian sugarcane producing countries (FAOSTAT, 2015).

2013 Data	Production (mt)	Yield (t/ha)
Thailand	100.10	75.74
Indonesia	33.70	74.89
Philippines	31.87	73.21
Viet Nam	20.13	64.88
Myanmar	9.65	61.66
Lao PDR	1.18	56.19
Cambodia	0.60	21.05
Malaysia	0.21	47.35

References:

Ashraf, M.Y., F. Hussain, J. Akhter, A. Gul, M. Ross, and G. Ebert. 2008. Effect of different sources and rates of nitrogen and supra optimal level of potassium fertilization on growth, yield and nutrient uptake by sugarcane grown under saline conditions. Pakistan Journal of Botany 40(4):1521-1531.

El-Tilib, M.A., M.H. Elnasikh, and E.A. Elamin. 2004. Phosphorus and potassium fertilization effects on growth attributes and yield of two sugarcane varieties grown on three soil series. Journal of Plant Nutrition 27(4):663-669.

Food and Agriculture Organization of the United Nations, FAOSTAT database (FAOSTAT, 2015), available at http://faostat3.fao.org/home/index.html.

Filho, J.O. 1985. Potassium nutrition of sugarcane. pp. 1045-1062. In: Munson, R.D. (ed.) Potassium in Agriculture. ASA-CSSA-SSSA, Madison, Wisconsin, USA.

Hartt, C.E. 1969. Some effects of potassium upon the amounts protein and amino forms of nitrogen, sugars and enzyme activity of sugarcane. Plant Physiology. pp. 452-490.

Kwong, K.F. 2002. The effects of potassium on growth, development, yield and quality of sugarcane. Potassium for sustainable crop production. pp. 430-444.

Mengel, K., and H.E. Haeder. 1977. Effect of potassium supply on the rates of phloem sap exudation and the composition of phloem sap of Ricinis communis. Plant Physiology 59:282-284.

Shukla, S.K., R.L. Yadav, P.N. Singh, and I. Singh. 2009. Potassium nutrition for improving stubble bud sprouting, dry matter partitioning, nutrient uptake and winter initiated sugarcane (Saccharum spp. hybrid complex) ratoon yield. European Journal of Agronomy 30(1):27-33.

Wood, R.A. 1990. The roles of nitrogen, phosphorus and potassium in the production of sugarcane in South Africa. Fertilizer Research 26:89-98.

Wood, A.W., and B.L. Schroeder. 2004. Potassium: A critical role in sugarcane production, particularly in drought conditions. Proceedings of the Australian Society of Sugarcane Technologists, available at http://www.cabdirect.org/abstracts/20043079912.html.