THE IMPORTANCE OF POTASSIUM ON GROWTH, YIELD AND QUALITY OF SUGAR CANE

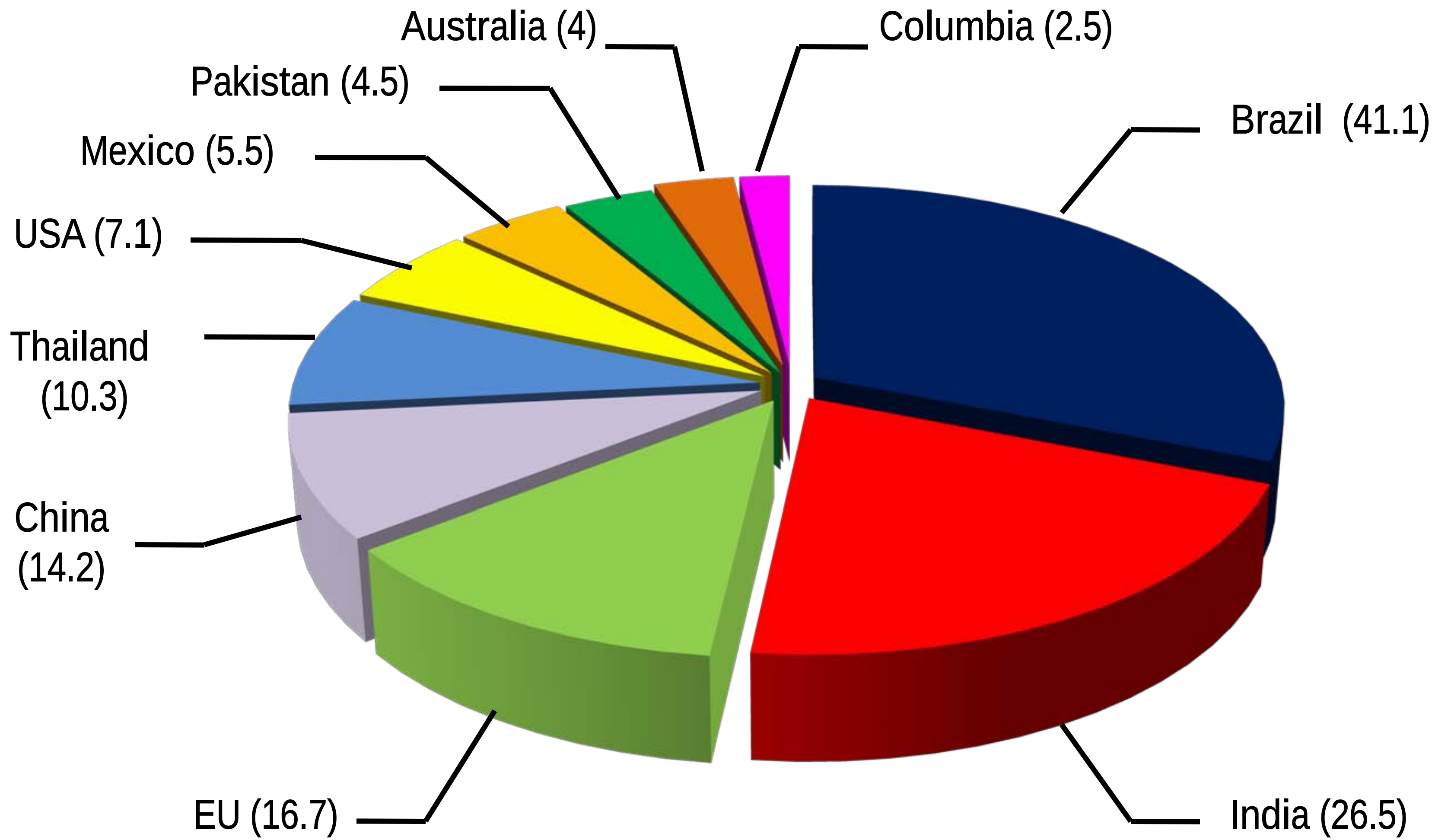
Assenjee Bholah

Head of Farms
Ramzan Sugar Mills Ltd

8 September 2014

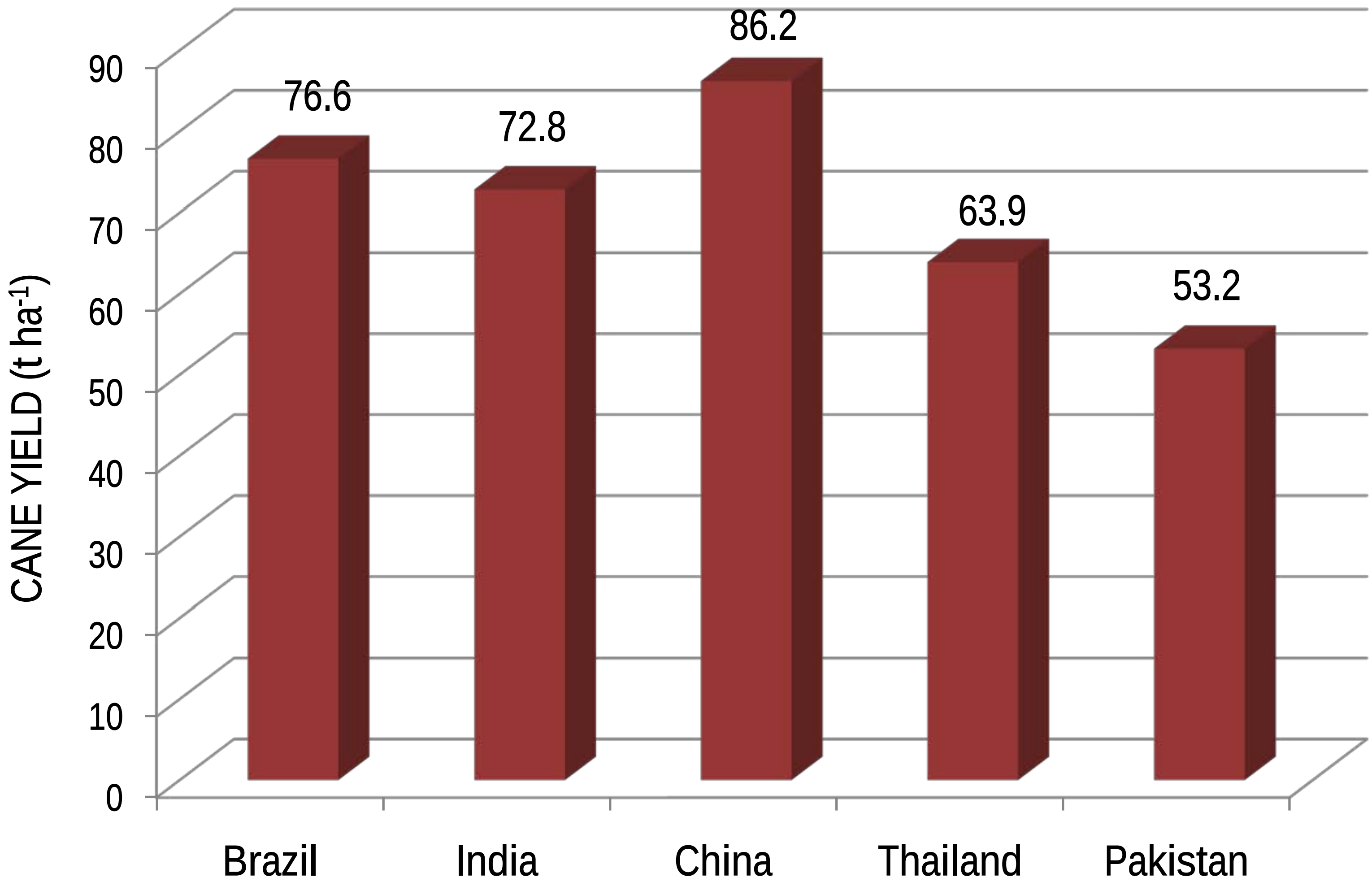
BRAZIL AND INDIA DOMINATE WORLD SUPPLY

2013 Sugar Production (million tons) **TOP TEN COUNTRIES**



Source: International Sugar Organization

AVERAGE SUGARCANE YIELDS



CONSTRAINTS TO PRODUCTION IN PAKISTAN

Constraints to sugarcane production:

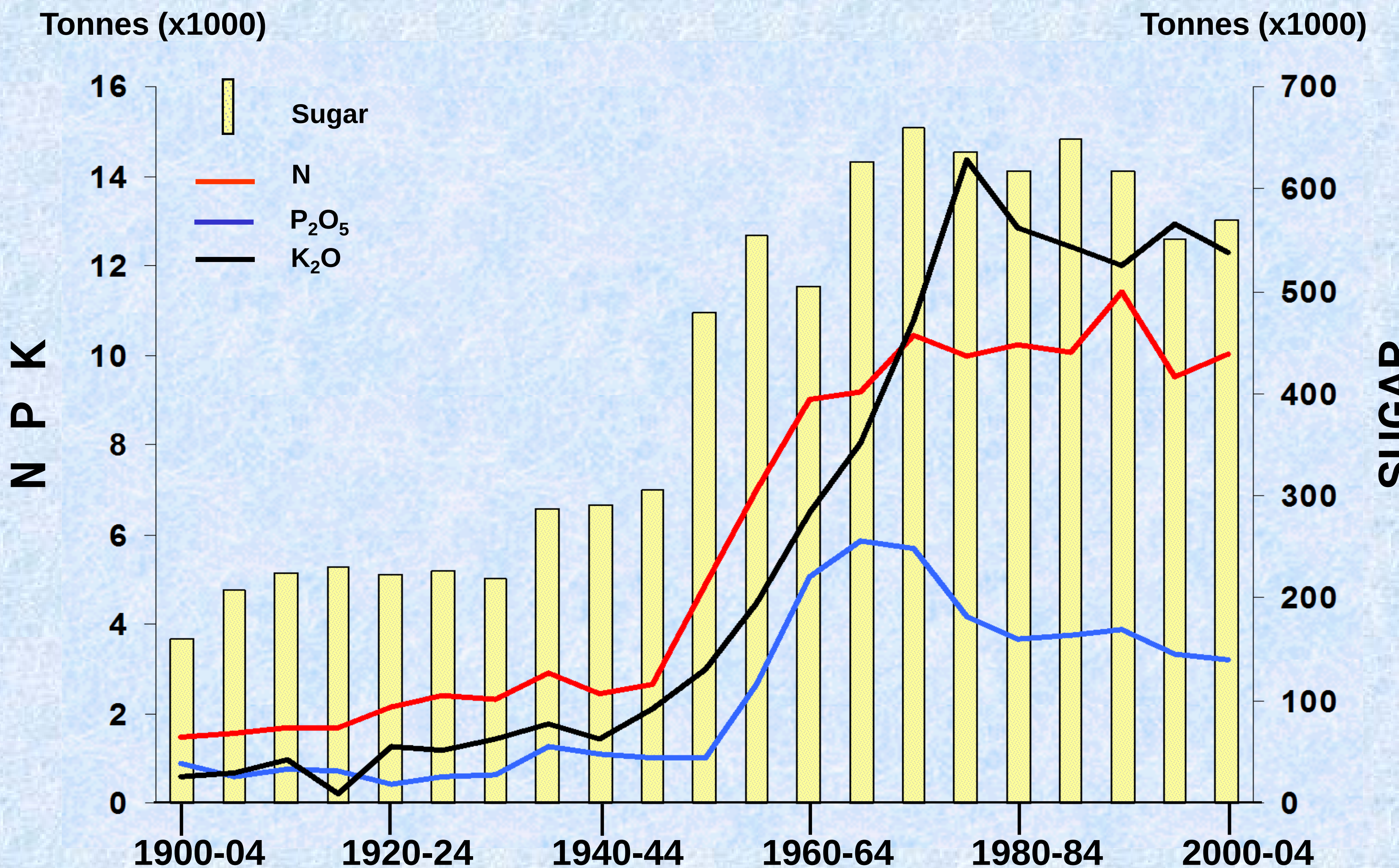
High weed infestation and inadequate control
Improper time of planting and quality of planting material
Unbalanced fertilizer rates
Water availability and irrigation
Inadequate pest and disease control

In general, fertilizer use in Pakistan is low for sugarcane (77 kg N and 22 kg P_2O_5 per hectare)

Use of potash is almost neglected (Karstens et al., 1992)

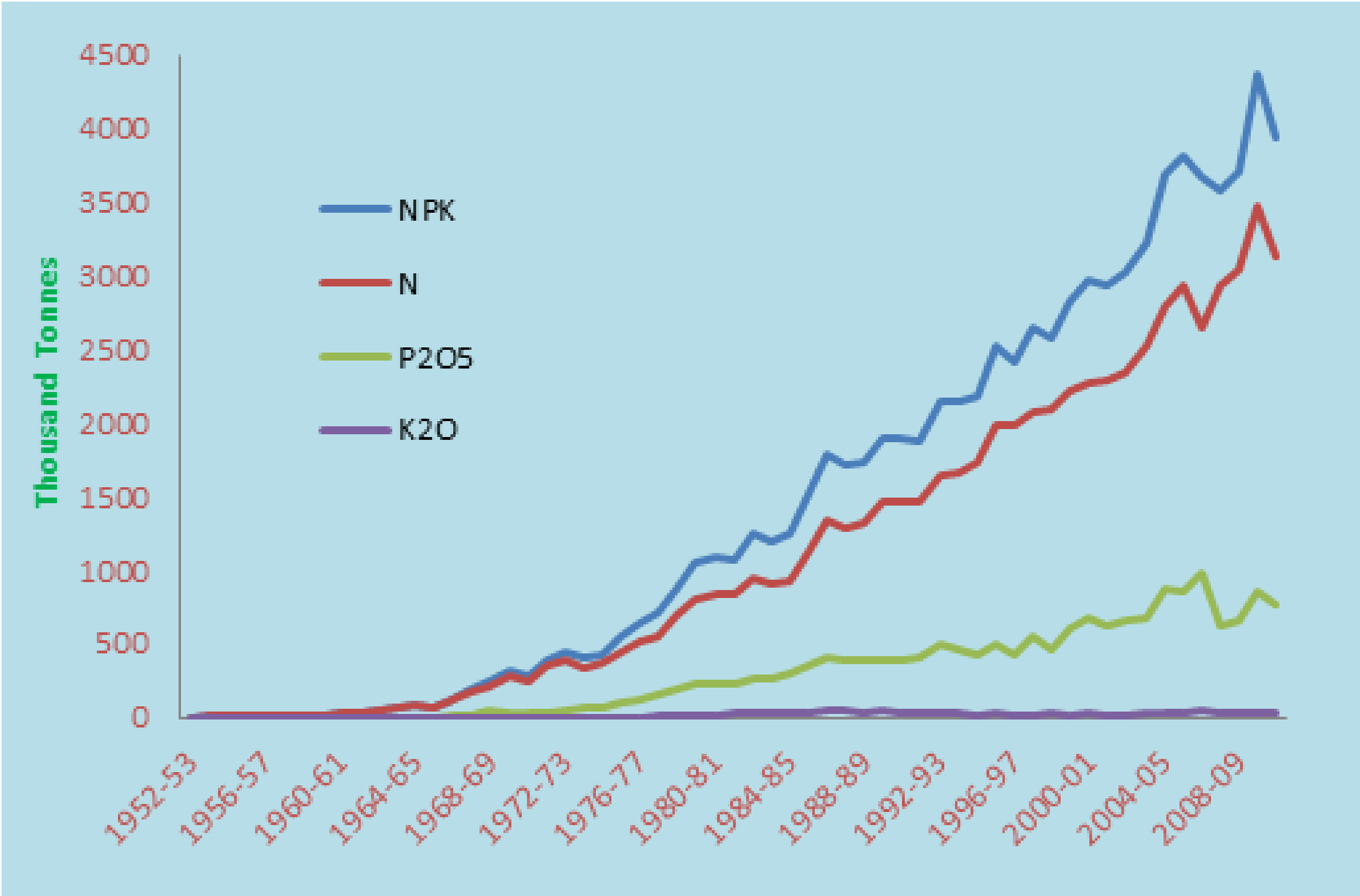
Khan et al. 2005 found that optimum and balanced use of NPK fertilizers improved cane yield and quality of different cultivars and gave maximum economical benefit to the farmers

NPK CONSUMPTION AND SUGAR PRODUCED



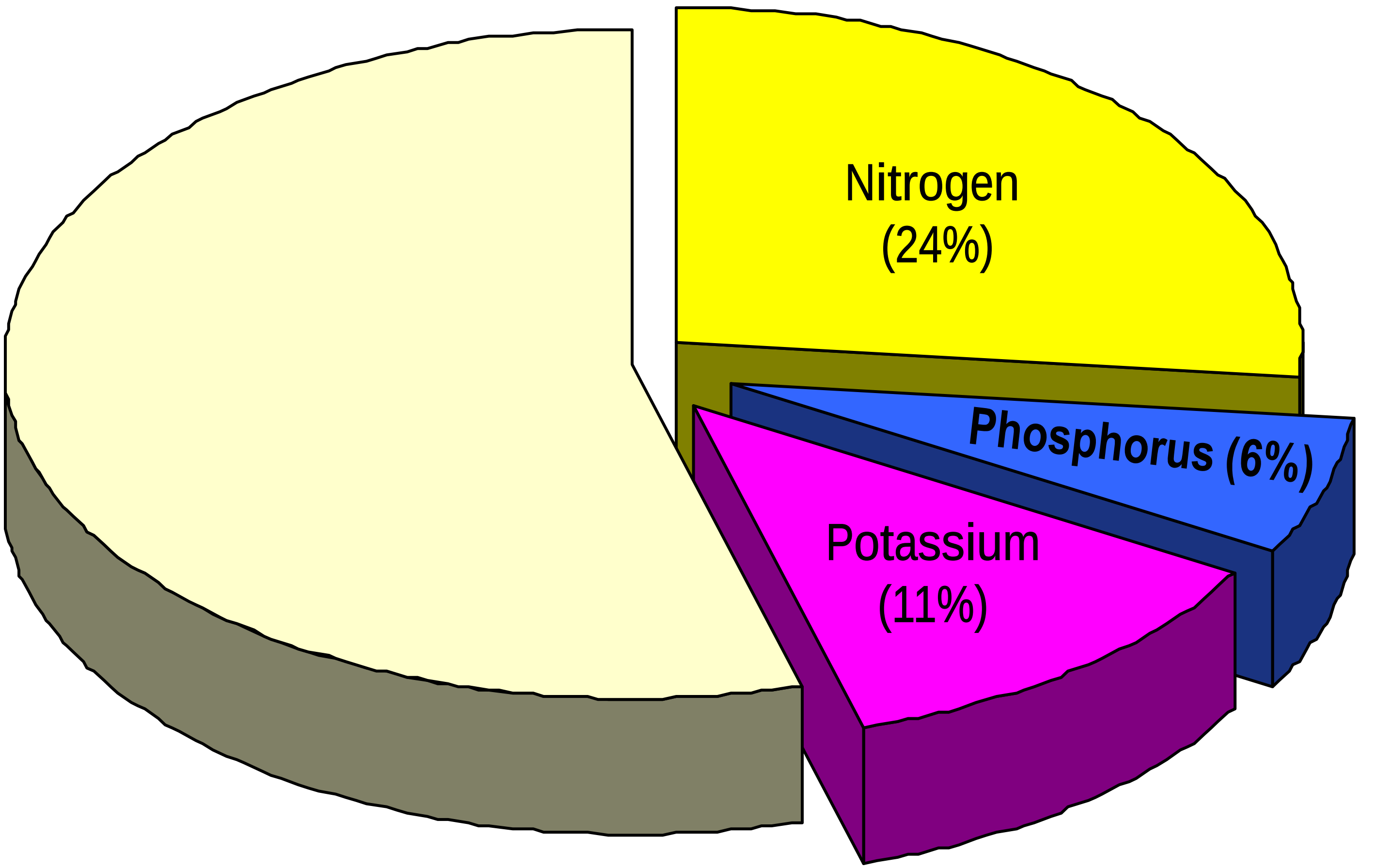
Source: ***Mauritius***

TRENDS IN NPK USAGE IN PAKISTAN

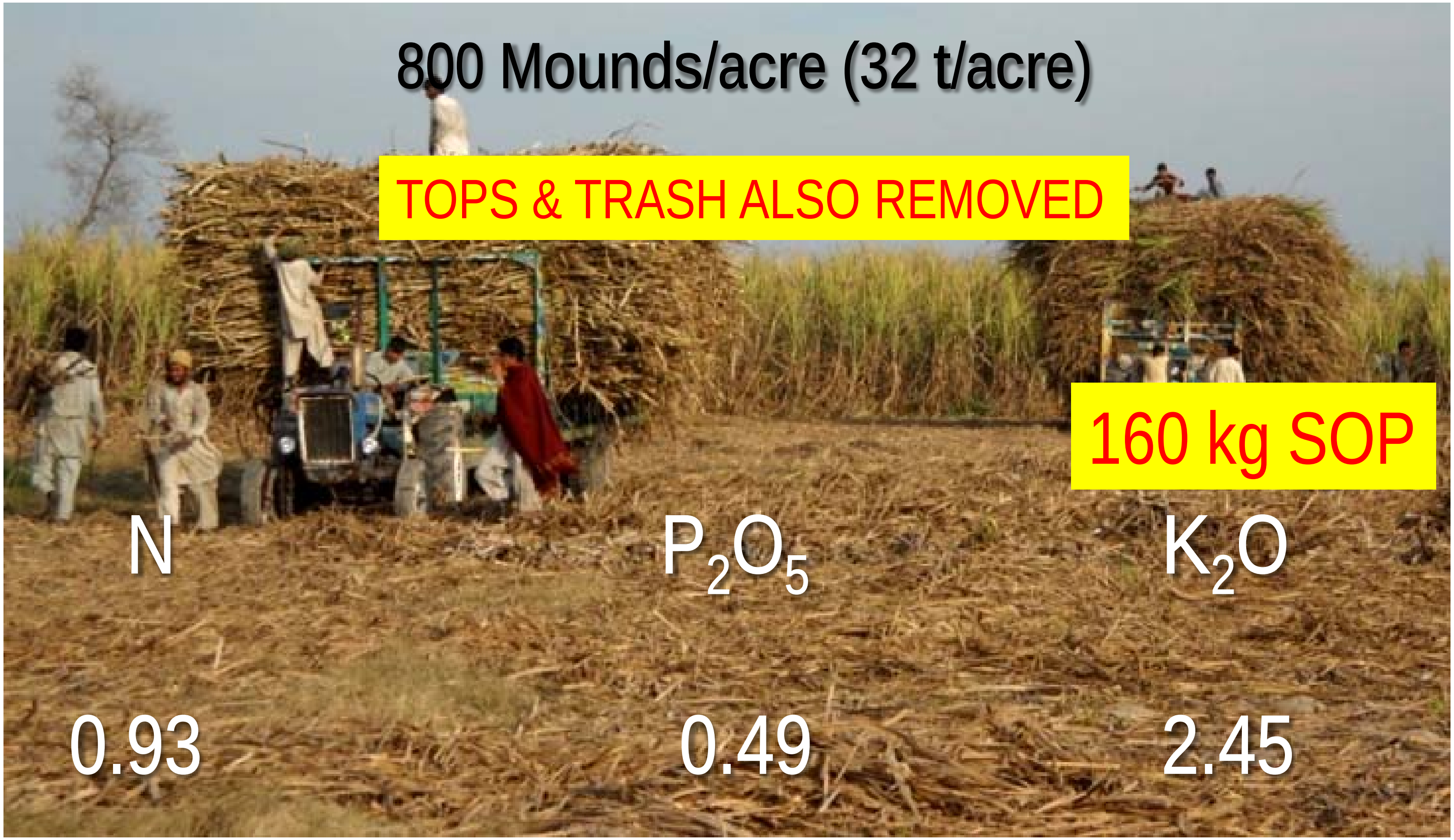


Source: Economics Survey of Pakistan, 2012-13

NPK AND SUGAR PRODUCED

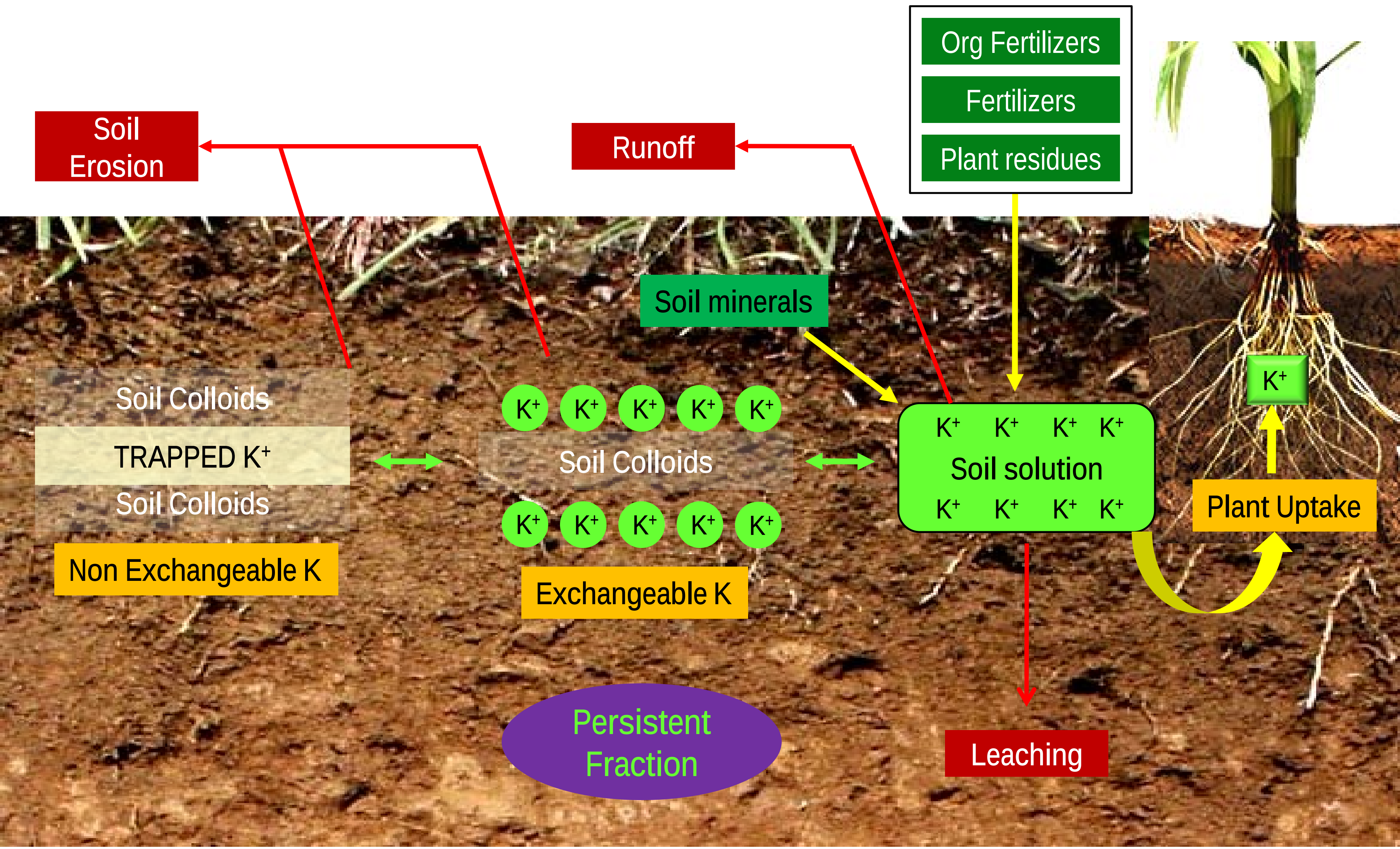


NUTRIENTS REMOVED BY SUGARCANE
(Kg ton^{-1} millable cane)



(30 kgN) (16 kgP_2O_5) (80 kgK_2O)

POTASSIUM CYCLE IN SOIL-PLANT SYSTEM AND FATE OF K



ROLE & FUNCTIONS OF K IN SUGARCANE

Essential for plant growth and photosynthesis

Regulates stomatal opening and closure

Helps the plant use other nutrients and water mo

Maintains turgor and reduces water loss and wilt

Synthesis and translocation of sucrose from lea

Promotes root development

Regulates at least 60 enzymes involved in plant

Potassium application raises millable stalk yield

Builds cellulose and reduces lodging

Helps in protection against diseases

Potassium plays many vital roles and functions in crop plants that are directly related to increased crop yields

ROLE & FUNCTIONS OF K IN SUGARCANE

Role of K in translocation of sugars

In well fertilized sugarcane with adequate K, translocation of sugars from leaves to storage tissues proceeds at the rate of 2.5 cm/minute

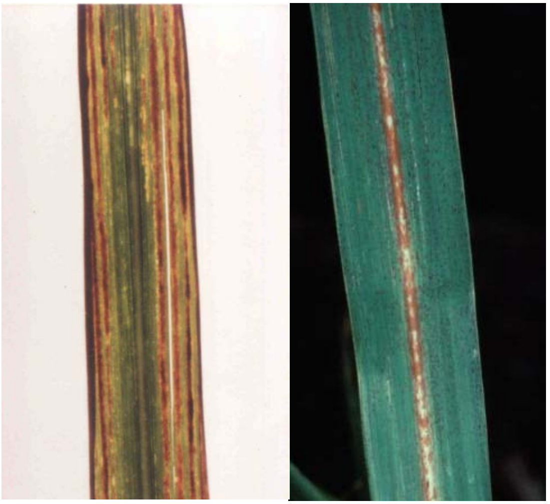
This translocation rate is reduced to below half the value whenever there is an inadequacy in K nutrition

More importantly, inadequate supply of K will result in cane having high reducing sugars BUT low sucrose levels

On the contrary, over-application of K has a negative impact on cane quality. Reduces recovery of sugars due to elevated levels of ash in sugarcane juice

POTASSIUM DEFICIENCY SYMPTOMS

Since K is a highly mobile nutrient in the plant, early symptoms of K deficiency are first seen in the older leaves



Thin stalks and spindle may have fan appearance

Leaf borders and tips show yellow to orange chlorosis

Mid-rib may have red coloration

On older leaves, dead areas or dark red stripes may occur between leaf veins and along leaf edges and tips

Poor root system and retarded plant growth

Resistance to diseases is reduced

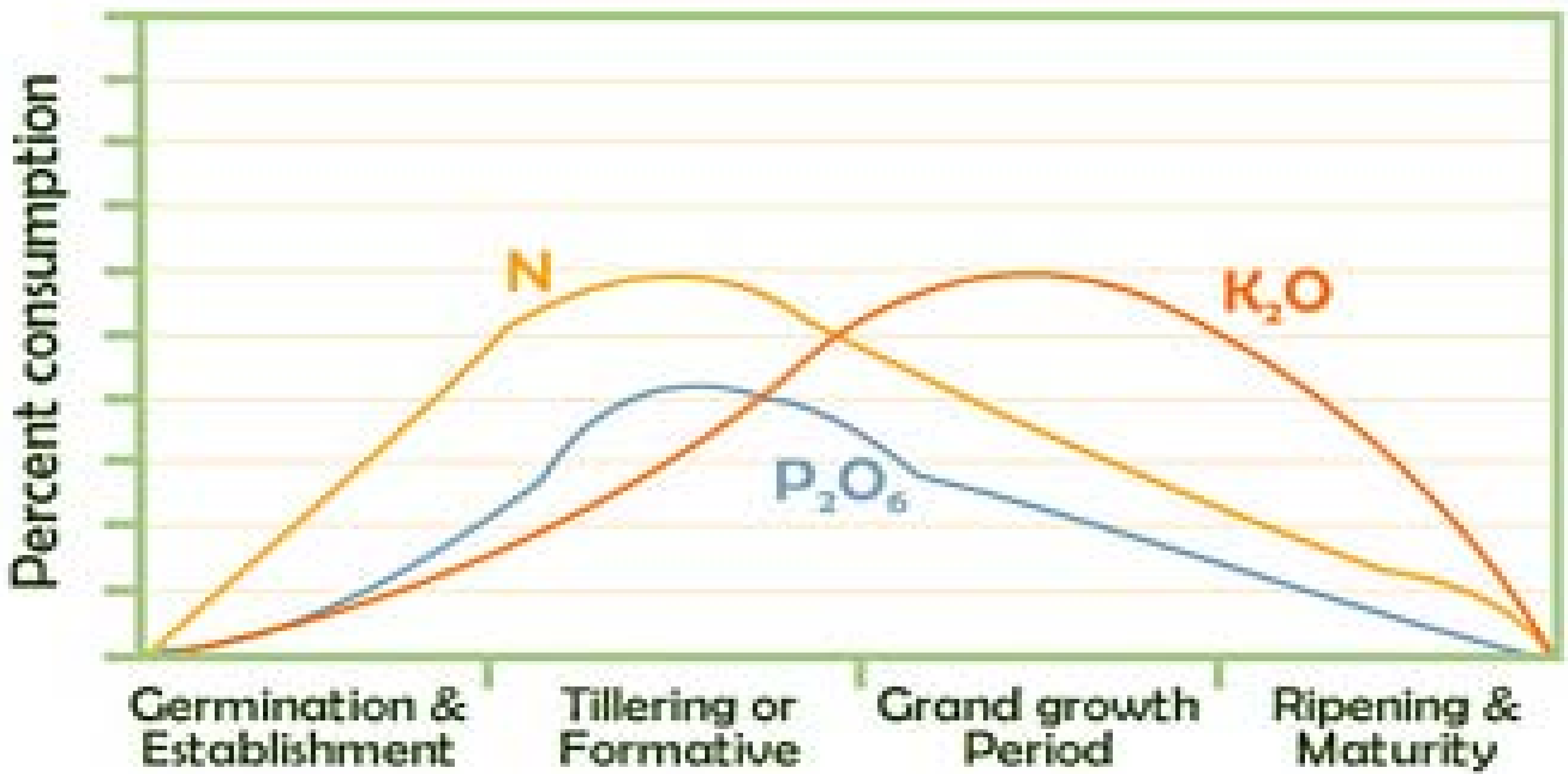
Critical leaf K value varies between 1.00 and 1.20 % dm

POTASSIUM UPTAKE BY SUGARCANE

Countries	Kg K_2O/ha
South Africa	258
Australia	239
Florida	413
Mauritius	300

Hence there is a need for K inputs to balance removal, thus avoiding decline in soil fertility

Relative requirement of NPK at different crop growth stages of sugarcane



EFFECT OF K FERTILIZATION ON CANE AND SUGAR YIELDS

Sugarcane yield responses to K fertilization are highly variable

India

No response to K applied at 50-100 kg K ha^{-1} (Lakholine *et al. (1979))*

Cane yield was increased from 50 t ha^{-1} without K fertilization to 74.5 t ha^{-1} with only 60 kg K ha^{-1} (Prasad *et al.,1996)*

Brazil

Raising application of K to 150 kg K ha^{-1}progressively increased cane yield (Korndorfer,1990)

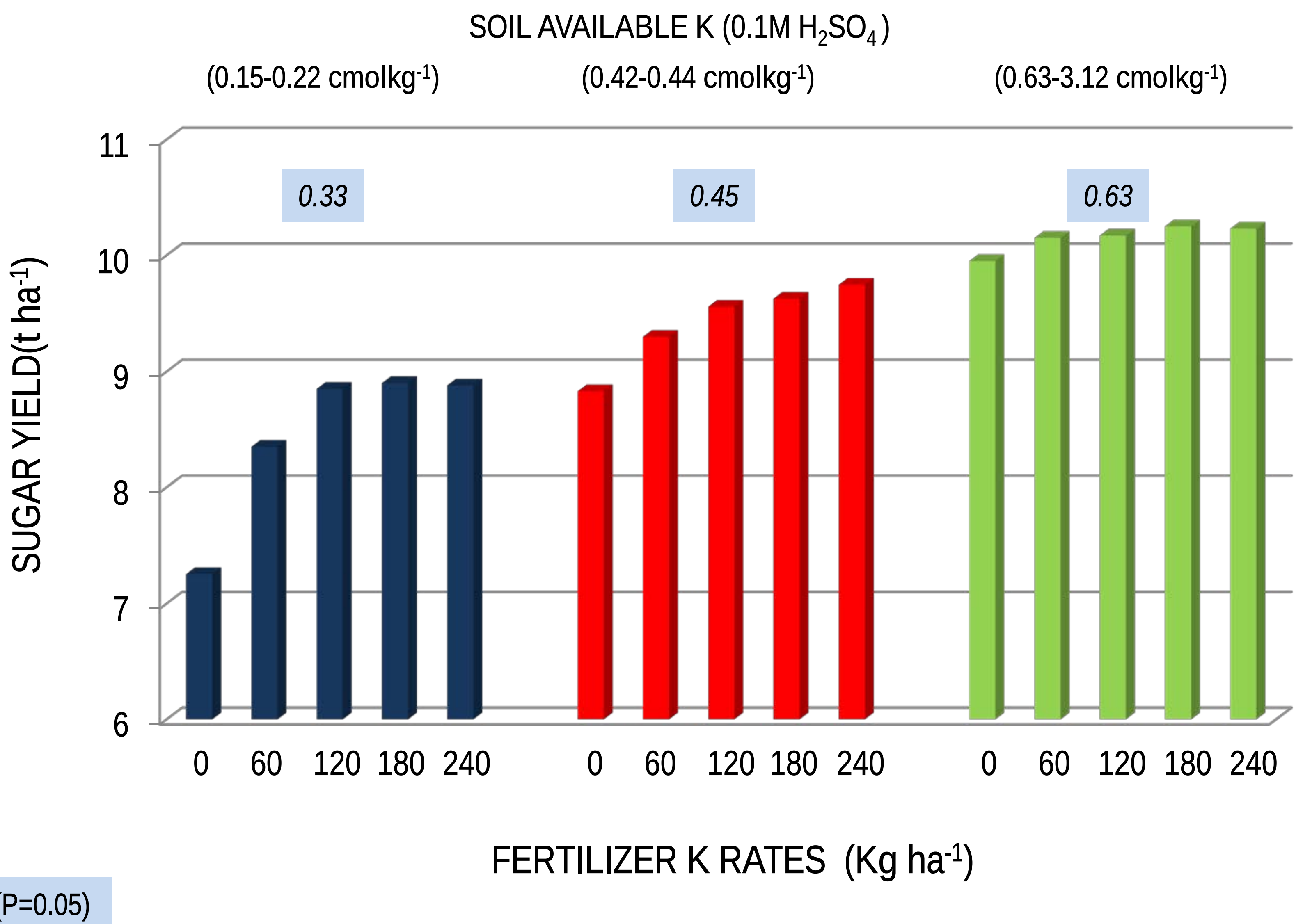
Guatemala:

K applications significantly increased sugarcane yield and sugar content in soils that are deficient in available K

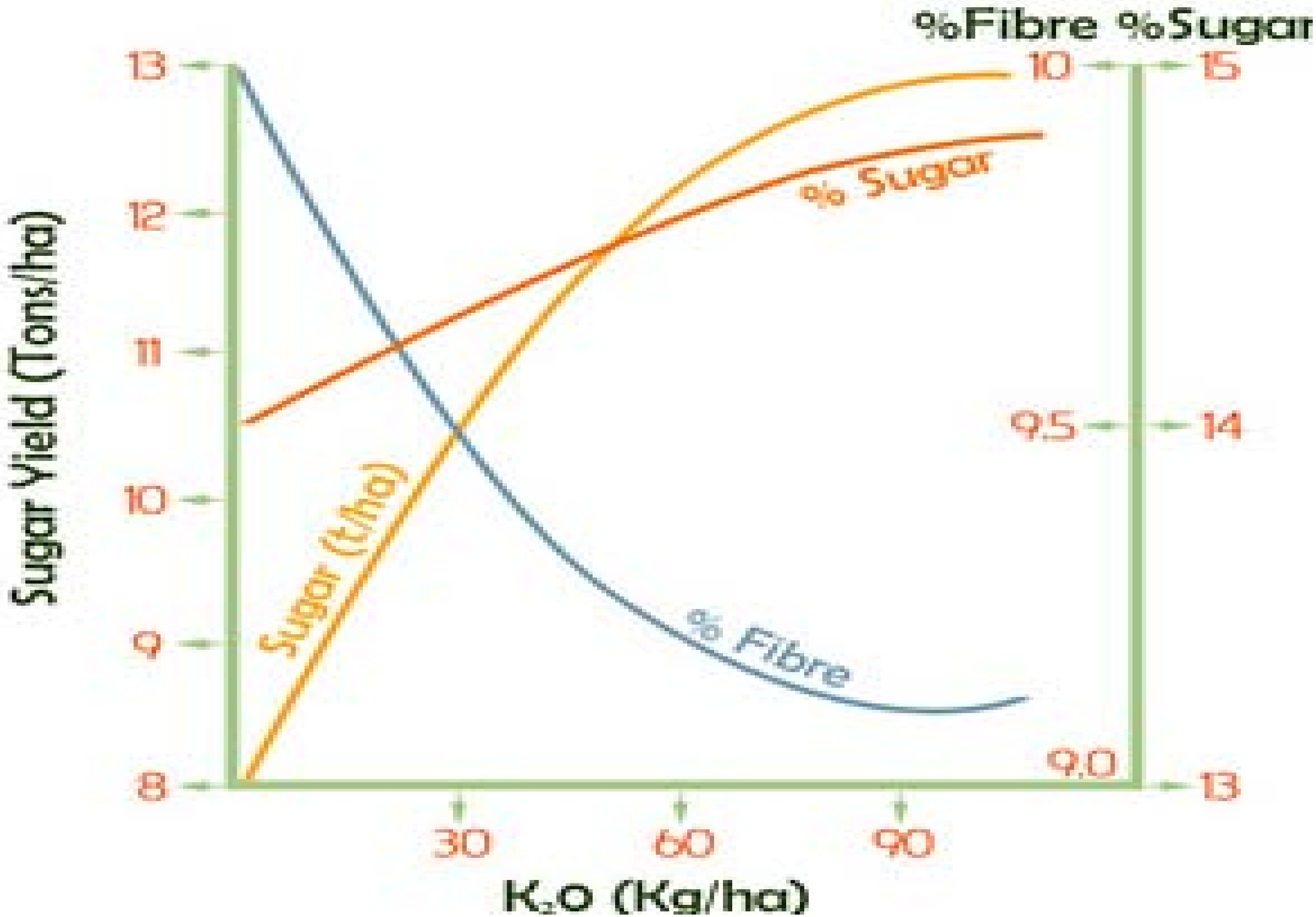
Variable response to K fertilization are largely due to the availability of K in the soil

EFFECT OF K FERTILIZATION ON SUGAR YIELDS

Response to applied K in relation to soil K levels, Mauritius



EFFECT OF K SUPPLY ON SUCROSE YIELD, SUCROSE AND FIBRE CONTENT *(Malavolta, 1994) Brazil*



THE NEED FOR A BALANCED NUTRITION (NPK)

Potassium fertilization of sugarcane cannot be considered in isolation from the requirements of the sugarcane for other nutrients particularly N

Inputs of N and K must be balanced to optimize sugarcane production

For high yields, K fertilizers are required in amounts equal to or greater than N and P

Commonly used NPK ratios in most sugarcane producing countries of the world are

2:1:3 or 2:1:2 or 3:1:5

TIMING & SPLIT APPLICATION OF K ON YIELD

Treatment	TSH *(mean 7 sites, 5 ratoons)*
Control (no K)	7.57
175 kg K_2O/ha in September	8.74
175 kg K_2O/ha in December	8.72
175 kg K_2O/ha in 2 split doses (September & December)	8.80

Sugarcane tends to benefit most from single K application
Split application shows no added benefit

SOURCES OF POTASSIUM AND SUGARCANE YIELD

Treatment	*Yield (mean V + 5R, 3 sites)*	
	TCH	TSH
Control	71.9	8.49
K_2O as KCl	82.2	9.53
K_2O as vinasse	82.3	9.61

60 kg K_2O/ha/yr

SOURCES OF K ON SUGARCANE QUALITY

Treatment	NPK (MOP)	NPK (SOP)
Yield	67.50	75.87
Sugar %	14.77	16.06
Purity %	87.55	90.40

SOP was superior to MOP and produced better yield

ECONOMICS OF INCREASED K FERTILIZER USAGE

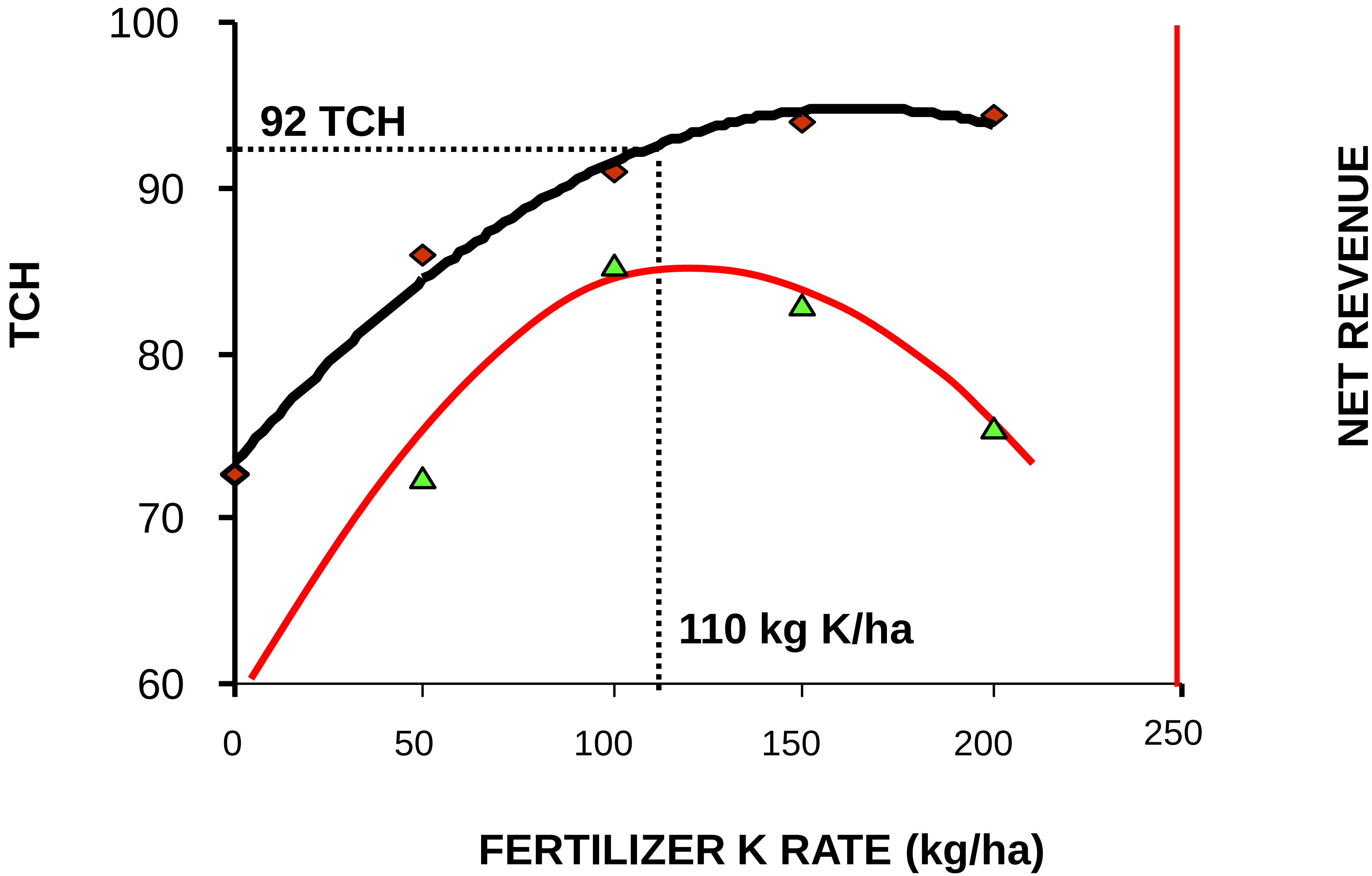
Profitability of K fertilizer usage is determined mainly by

- The Yield responses to added K
- The current price of K fertilizer
- The current price of cane/sugar

From the above, the breakeven amount of cane needed to cover the fertilizer cost is estimated

Given the increasing trend in the price of fertilizers, a greater emphasis needs to be placed on soil testing and foliar diagnosis to ensure that K fertilizers are used efficiently and that the rates applied provide an economical return

SUGARCANE YIELD RESPONSE AND NET REVENUE FROM K FERTILIZATION



CONCLUSIONS

Potassium clearly plays a pivotal role in sugarcane production

Need for optimizing K supply, uptake and utilization by the sugarcane crop

Balanced use of NPK is critical

K must be kept adequate to produce optimum yields and to regulate maturity so that maximum sugar is recovered from the millable stalks

Excessive uptake of K from soil may depress the recovery of sucrose during milling

CONCLUSIONS

Fine-tune and develop crop specific soil critical values for assessing adequacy or deficiency

Quantitative requirements of nutrient based on level of deficiency as indicated by soil test

Develop diagnostic nutrient tissue testing and critical leaf threshold values

Early application of K is preferred

Split application shows no added benefit


Thank you for
your attention