# Coffee Sustainability in Kenya: Role Played by Improved Varieties

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## SUMMARY
Coffee production in Kenya has been sinking since 1980s. The condition has been worsened by climate change phenomenon which has brought new production challenges in recent years. The biggest challenge is the changing dynamics of coffee pests and diseases, for example, Coffee Leaf Rust, which has become of a major concern globally. Variety improvement through breeding is believed to be one of the most sustainable ways of reducing production costs and mitigating climate change. Over the years, considerable success has been made in Arabica coffee breeding to improve yields, quality and to manage some biotic and abiotic stresses. Kenya produces mainly Arabica coffee from five commercial cultivars. These include three traditional varieties namely SL28, SL34 and K7, all of which are also susceptible to major coffee diseases, and two improved varieties namely Ruiru 11 and Batian. Owing to the current production challenges and the rising demand of Kenyan coffee in the world market, improved Arabica coffee cultivars with better quality, higher yield potential, resistance to diseases and tolerant to drought are largely replacing traditional varieties on a large scale in Kenya. This paper highlights the foreseeable role of these improved varieties in reversing the tumbling production trend and ensuring coffee sustainability in Kenya.

**Key words**: Arabica Coffee, Improved Varieties, Climate Change, Kenya

## INTRODUCTION
In Kenya, coffee was introduced as a cash crop in 1900's by European colonialists, and has remained one of the most important products of the country's agriculture. Over 90% of the total Kenya coffee acreage is under Arabica coffee, while the rest is occupied by Robusta coffee (Omondi *et al*., 2001; Gichimu *et al*., 2010). Production of *C. arabica* is seriously constrained by diseases (Gichuru *et al*., 2008; Gichimu *et al*., 2013). The major diseases are Coffee Berry Disease (CBD) caused by *Colletotrichum kahawae*, Coffee Leaf Rust (CLR) caused by *Hemileia vastatrix* and Bacterial Blight of Coffee (BBC) caused by *Pseudomonas syringae* pv. *garcae* (Gichimu *et al*., 2013). CBD mainly infects the green immature berries, a stage in which it can cause up to 80% crop loss if not controlled and conditions are favourable (Gichimu *et al*., 2014). On the other hand, CLR is a disease of foliage that causes premature leaf fall, yield loss and even death of the tree in severe cases (McDowel and Wolffenden, 2003). BBC causes dark, water-soaked necrotic lesions on leaves, tips and nodes of vegetative and cropping branches culminating in a die-back (Ithiru *et al*., 2013)

Control of the three diseases on susceptible coffee varieties is by intensive spray programmes that accounts for up to 30% of the total cost of production. This is a major constraint to economic coffee production especially to the small-holders who find the use of pesticides beyond their financial and technical capabilities (McDowel and Wolffenden, 2003). In view of the economics and to minimise the chemical input for disease management, the development and cultivation of tolerant cultivars is encouraged as the most effective and viable option. Due to these production

challenges and the rising demand of Kenyan coffee in the world market, improved Arabica coffee cultivars with better quality, higher yield potential, resistance to diseases and tolerant to drought are largely replacing traditional varieties on a large scale in Kenya. This paper highlights the foreseeable role of these improved varieties in reversing the tumbling production trend and ensuring coffee sustainability in Kenya.

## KENYAN COFFEE PRODUCTION TREND

Kenya coffee production increased rapidly in ripples in the two decades after independence. Total production for both estates and cooperative sub-sectors rose from 43,778 tons in 1963–64 to 128,941 tons in 1983–84 but fell to below 60,000 tons after 2000. Since then, the downward trend has continued except for a brief spell in 2006/07. The lowest production of 32460 tons was realized in 2008/09 after which the trend reversed as production started rising.

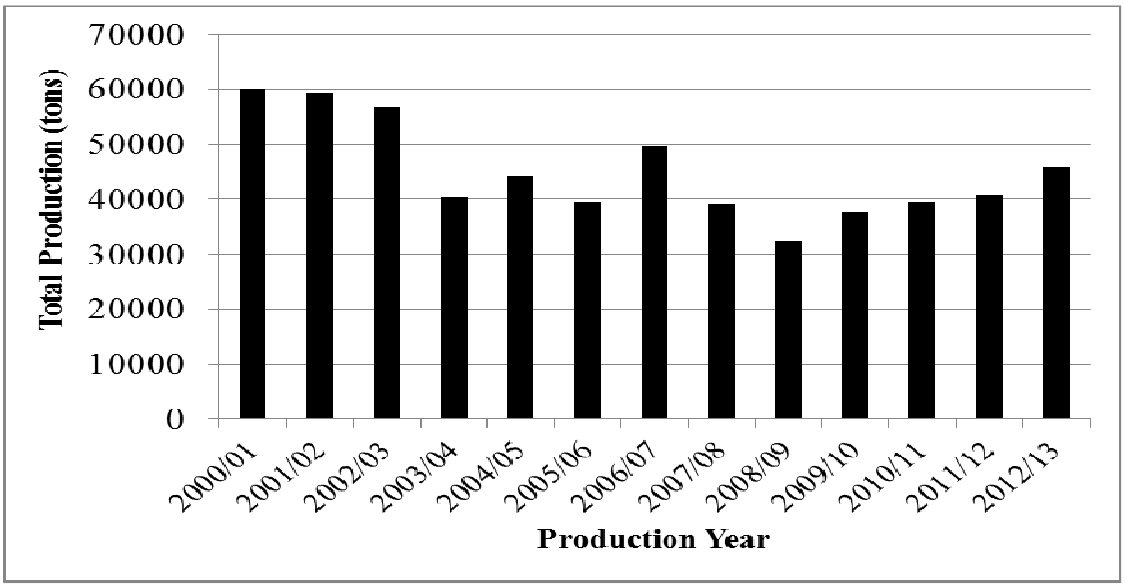


Fig. 1: Kenyan Coffee Production Trend

## KENYAN COFFEE CULTIVARS

Coffee breeding in Kenya started in 1920s (Thorold, 1947). Emphasis in selection was primarily for high yields, better bean size and liquor quality (Walyaro, 1983). This saw the selection and subsequent release of the first Kenyan coffee varieties (SL28, SL34 and K7) in 1930s. These cultivars produce high yields of fine quality coffee but are susceptible to CBD, CLR and BBC although K7 has resistance to some races of CLR as well as partial resistance to CBD. A breeding programme for disease resistance started in 1971 after the outbreak of CBD and CLR in the late 1960s. The main breeding goal has been to develop cultivars that combine resistance to diseases with improved yields and quality (Van der Vossen, 1973; Walyaro, 1983). In 1985, the first disease resistant hybrid cultivar, Ruiru 11, that is also high yielding, of fine quality and compact growth was released (Omondi *et al*., 2001). Further research and development culminated to the release of other disease resistant cultivars namely Batian 1, Batian 2 and Batian 3. Their unique features include tall stature, true breeding and resistance CBD and CLR. They are also high yielding with good bean and liquor quality (Gichimu *et al*., 2010).

## EMERGING CHALLENGES IN COFFEE PRODUCTION IN KENYA

The increase of greenhouse gas emissions (carbon dioxide and methane) in the atmosphere is causing wide changes in atmospheric events, influencing climate change and variability with critical impacts on coffee production (Kimemia, 2010; Gichimu, 2012). These include, shifting of optimal growing zones, changes in rainfall (amount and distribution), changes in dynamics of crop diseases and pests, changes in crop yields and quality, loss of agricultural land due to either rising sea levels and/or desertification (Kimemia, 2010; Gichimu, 2012). For a long time, BBC was restricted to the west of the Great Rift Valley in Kenya (Kairu 1985). However, with the current shifts in weather pattern caused by climate change, the disease is becoming more widespread. For CBD, although there are no physiological races for *C. kahawae* that have been identified, there are recent cases of infection on varieties hitherto considered resistant thus showing some weakened resistance probably caused by changes in climate, increased variation in pathogen virulence and/or pathogenicity (Gichimu, 2012). For *Hemileia vastatrix* recent work by Gichuru *et al*. (2012) using Kenyan isolates found that there are six new races (III, XVII, XXIII, XXXVI, XLI and XLII) carrying three new virulence genes (v1, v7, v8) and possibly v9. This represents a serious threat to CLR resistant varieties including Hibrido de Timor as well as resistant commercial varieties in Kenya.

## POTENTIAL OF IMPROVED VARIETIES

Since their release, improved varieties, Ruiru 11 and Batian, have been attracting appreciable demand from farmers indicating that they have a wide acceptance by farmers. This has been attributed to their desirable agronomic characteristics including resistance to CBD and CLR, their high yielding capacity and their good cup quality which makes them attract high demand in the world market. In addition, these varieties have a wide adaptability making them suitable for all coffee growing areas in Kenya. Owing to their tall statured morphology, Batian cultivars have deep and extensive root system which makes them relatively more tolerant to drought than the compact Ruiru 11 cultivar. Both Ruiru 11 and Batian are planted in a relatively closer spacing of 2m x 2m compared to the recommended spacing of 2.75m x 2.75m for traditional varieties. Coupled with their high yields per tree, their closer spacing contributes further to their higher productivity per unit area. These varieties are therefore playing a major role in reversing the tumbling production trend and ensuring coffee sustainability in Kenya.

## CONCLUSION

All the Kenyan coffee varieties are potentially high yielding and of good quality if properly managed under suitable production conditions. However, over 90% of Kenyan coffee is of Arabica type and therefore susceptibility to diseases have been the major constraits of coffee production in the country. Other production challenges are associated with climate change and can be managed through climate change mitigation. Adoption of improved disease resistant varieties can therefore play a major role in ensuring coffee production sustainability in Kenya.

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