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Opinion

Tap the Production Potential of Root and Tuber Crops to Ensure Global Food Security

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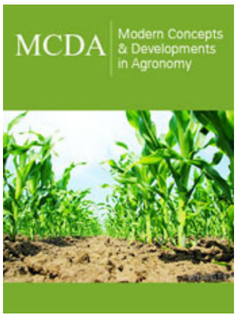

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Abstract

Root and Tuber Crops (RTCs) have high yield, strong resistance and wide use, and play an important role in global food security. This paper summarizes the important progress in the research of RTCs in recent years, analyzes the main reasons why the yield potential of RTCs has not been fully exploited, and puts forward the countermeasures for tapping the production potential of RTCs.

Opinion

Population growth, war conflicts, natural disasters and COVID-19 outbreak will cause food shortages, exacerbate global food insecurity and seriously threaten human survival and development. According to the report of World Food Security and Nutrition in 2022, about 828 million people around the world are suffering from food shortage. It is estimated that the world population will reach 8.38 billion in 2030 and 670 million people will still face the problem of hunger. Root and Tuber Crops (RTCs) mainly include sweet potato, cassava, potato, yam, taro and other RTCs, which play an important role in global food security. Nearly 2 billion people in the world mainly feed on RTCs, which are mainly distributed in Asia, Africa and Latin America. 25% of the global total food output comes from RTCs. Compared with other cultivated crops, the yield per unit area of RTCs is high, 60-90 tons per hectare. In 2020, the global total yield of RTCs reaches 800 million tons. RTCs has strong resistance to drought and barren. It can be planted in hills, plateaus and plains because of wide adaptability. The starch rate is high, generally between 15-25%. It has a wide range of uses, providing a large number of raw materials for the production of feed, energy and chemical materials.

In recent years, a series of important research achievements have been made on RTCs. For example, the genome sequencing of potato [1], cassava [2], sweet potato [3], yam [4] and taro [5] has been completed and the assembly at the chromosome level has been realized. The hybrid potato has entered the era of genome design and the implementation of the "excellent potato plan" makes it possible for hybrid potato seeds to reproduce instead of tubers [6]. The acquisition of sweet potato multi-omics data and high-throughput phenotype will effectively promote the mining and utilization of functional genes in sweet potato [7]. The genetic mechanism of the formation of important agronomic traits such as cassava yield, quality and stress resistance has been revealed [8]. The molecular mechanism of genetic evolution and formation of important agronomic traits of taro was solved [9].

According to the experts' prediction, RTCs have great potential for increasing production. For instance, the current average yield of cassava is 1.5-2 tons, and the estimated photosynthetic yield is 6 tons [10]. The theoretical yield of potato and sweet potato is 4-5 tons, but the current average yield is 1.5-2 tons. The main reasons why the yield potential of RTCs has not been fully exploited are as follows. Firstly, compared with "big crops" such as rice, maize and wheat, the basic research of RTCs is weak and the gap is large. Secondly, there is little policy support. Inadequate attention has been paid to the production of RTCs, which is mainly reflected in the layout of agricultural science and technology and project arrangement. The construction of RTCs research team and international cooperation also need to be strengthened. Thirdly, the waste is serious. The world wastes 1.3 billion tons of food every year, 14% of which is lost in harvesting and retail, 17% in catering and consumption, resulting in a loss of 400 billion dollars. In order to fully tap the potential of increasing yield of RTCs and ensure global food security, the following countermeasures can be taken.

First, scientific research on RTCs should be strengthened. We will carry out important gene mining for the growth and development of RTCs, formation of storage organs, transportation and accumulation of photosynthates, analyze the regulatory mechanism of sugar transportation and starch accumulation, and improve the efficiency and accuracy of molecular breeding. We will strengthen the research on the mechanism of RTCs adaptation to adversity, create new RTCs germplasm adapted to extreme environments, and reduce the impact of climate change and environmental pollution on RTCs yield. We will strengthen the research on important issues of different RTCs, such as low temperature saccharification and late blight of potato, sweet potato virus and stem nematode disease, and post-harvest physiological deterioration of cassava, and develop the relevant applied technologies.

Second, policy support for RTCs production should be enlarged. We will implement the strategy of potato as staple food, provide farmers with subsidies for improved varieties, and reduce or exempt taxes for processing enterprises. We will establish a national modern agricultural industrial technology system, effectively organize experts from all aspects to form a technical service team and provide technical support for RTCs production. We will strengthen the international cooperation of the Belt and Road Initiative, promote the exchange of germplasm resources of RTCs and the orderly development of international trade of RTCs.

Third, the concept of big food should be established, and the concept of healthy consumption should be guided. We will develop RTCs food resources and promote the concept of balanced nutrition. RTCs are rich in minerals, vitamins and dietary fiber, with lower calories than cereals and lower glycemic index. Eating more RTCs can reduce the incidence of obesity, hypertension, diabetes, constipation, cancer and other diseases. The Dietary Guidelines for Chinese Residents (2022) recommends that adults consume 50-100g of RTCs every day. We should advocate the 'Clean Your Plate' campaign to reduce food waste. If 10% of food is saved every year, we can reduce the number of hungry people by 740 million. We will promote cooking methods and learn to eat in a variety of ways. For example, potatoes can be made into bacon cakes, chips, cheese balls, mashed potatoes, shredded potatoes, potato chips, etc., so that people can eat more healthily. According to CIP statistics, there are more than 100 kinds of potato eating methods in the world.

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