

Organic Tuber Production Fosters Food Security and Soil Health: A Decade of Evidence from India

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Abstract : Worldwide concerns regarding food safety, environmental degradation and threats to human health have generated interest in alternative systems like organic farming. Tropical tuber crops, cassava, sweet potato, yams, and aroids are food-cum-nutritional security-cum climate resilient crops. These form staple or subsidiary food for about 500 million global population. Cassava, yams (white yam, greater yam, and lesser yam) and edible aroids (elephant foot yam, taro, and tannia) are high energy tuberous vegetables with good taste and nutritive value. Seven on-station field experiments at ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, India and seventeen on-farm trials in three districts of Kerala, were conducted over a decade (2004-2015) to compare the varietal response, yield, quality and soil properties under organic vs conventional system in these crops and to develop a learning system based on the data generated. The industrial, as well as domestic varieties of cassava, the elite and local varieties of elephant foot yam and taro and the three species of *Dioscorea* (yams), were on a par under both systems. Organic management promoted yield by 8%, 20%, 9%, 11% and 7% over conventional practice in cassava, elephant foot yam, white yam, greater yam and lesser yam respectively. Elephant foot yam was the most responsive to organic management followed by yams and cassava. In taro, slight yield reduction (5%) was noticed under organic farming with almost similar tuber quality. The tuber quality was improved with higher dry matter, starch, crude protein, K, Ca and Mg contents. The anti-nutritional factors, oxalate content in elephant foot yam and cyanogenic glucoside content in cassava were lowered by 21 and 12.4% respectively. Organic plots had significantly higher water holding capacity, pH, available K, Fe, Mn and Cu, higher soil organic matter, available N, P, exchangeable Ca and Mg, dehydrogenase enzyme activity and microbial count. Organic farming scored significantly higher soil quality index (1.93) than conventional practice (1.46). The soil quality index was driven by water holding capacity, pH and available Zn followed by soil organic matter. Organic management enhanced net profit by 20-40% over chemical farming. A case in point is the cost-benefit analysis in elephant foot yam which indicated that the net profit was 28% higher and additional income of Rs. 47,716 ha⁻¹ was obtained due to organic farming. Cost-effective technologies were field validated. The on-station technologies developed were validated and popularized through on-farm trials in 10 sites (5 ha) under National Horticulture Mission funded programme in elephant foot yam and seven sites in yams and taro. The technologies are included in the Package of Practices Recommendations for crops of Kerala Agricultural University. A learning system developed using artificial neural networks (ANN) predicted the performance of elephant foot yam organic system. Use of organically produced seed materials, seed treatment in cow-dung, neem cake, bio-inoculant slurry, farmyard manure incubated with bio-inoculants, green manuring, use of neem cake, bio-fertilizers and ash formed the strategies for organic production. Organic farming is an eco-friendly management strategy that enables 10-20% higher yield, quality tubers and maintenance of soil health in tuber crops.

Keywords : eco-agriculture, quality, root crops, healthy soil, yield

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