Polyploidy breeding in greater yam for tuber yield improvement

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Abstract
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The greater yam (*Dioscorea alata* L.) is an important starchy staple or a subsidiary food crop in the Caribbeans, Pacific countries, Asia as well as in some parts of Africa. Genetic improvement of this vegetatively propagated crop had been solely by clonal selection until recently years. Breeding by hybridization was initiated in greater yam about two decades back from CTCRI. Pollination studies revealed that the 2n = 40 clones were sexually fertile whereas the clones with 2n=60 chromosomes are steriles. A joint study by CTCRI in India and CIRAD in France led to the discovery of the high fertility of the clones with 2n = 80 chromosomes. Citological studies showed that 2n = 40 types had normal meiosis with bivalent formation at diakinesis or metaphase 1. On the other hand the 2n = 60 types had abnormal meiosis with trivalent formation at metaphase I and subsequent irregularities leading to very high pollen sterility. The 2n = 80 types had near normal meiosis with 4-6 quadrivalents at metaphase I but later stages were normal and the pollen fertility was very high.

Pollinations between tetraploids (2n = 80 x 2n = 80) and between tetraploids and diploids (2n=80 x 2n = 40) were successful, producing tetraploid and triploid progenies respectively. The artificial production of tetraploids and triploids in greater yam were accomplished for the first time which has led to a new line of breeding to produce high yielding yam hybrids as a relationship between higher ploidy levels and higher tuber yield was observed among accessions. A positive relationship between allelic heterozygosity and higher tuber yield was also observed. As triploids and tetraploids have a higher number of alleles per locus than diploids, hybridization between distant genotypes appears to be promising in the genetic improvement of greater yam, making it possible to maximise heterozygosity and heterosis.