

BREEDING GINGER AND TURMERIC

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ABSTRACT

Ginger and turmeric are two important rhizomatous spices produced and exported from India. About 50 cultivars each in ginger and turmeric are grown in the country at present. This include 3 high yielding ginger varieties and 12 improved selections of turmeric. Apart from the conventional techniques, bio-technological approaches are also being pressed into service at NRCS, Calicut, to develop high yielding and disease resistant varieties.

GINGER

Ginger (*Zingiber officinale* Rosc.-Zingiberaceae) is a rhizomatous herbaceous perennial, the underground rhizome of which forms one of the important spices used by man all over the world. Ginger of commerce is the dried rhizome. The name 'Zingiber' is originated from Sanskrit word 'Singabera' which means horn shaped. Ginger forms an important ingredient in most of the traditional medicines. It is also used in certain toiletry articles. Ginger is marketed in different forms around the world such as raw ginger, dry ginger, bleached dry ginger, ginger powder, ginger oil, ginger oleoresin, gingerale, ginger candy, ginger beer, brine ginger, ginger wine, ginger squash, ginger flakes etc.

Zingiber zerumbet and mango ginger (*Curcuma amada*) are two of the other very closely-related economic species of ginger family.

Ginger has probably originated in the south-east Asia. At present, ginger is cultivated in almost all tropical countries like India, China, Taiwan, The Philippines, Sierra-Leone, Singapore, Jamaica, Fiji, and Nigeria on a commercial scale. India produces about 1,48,520 tonnes of ginger annually from an estimated area of 53,300 hectares, ranking first among the countries producing and exporting it. India's annual export of ginger during the year 90-91 was 6555 tonnes. Kerala is the leading state in India in area and production of ginger followed by Orissa, Meghalaya, Himachal Pradesh, Karnataka, Mizoram, Manipur, Tamil Nadu, Maharashtra, Bihar, Tripura, Gujarat, Uttar Pradesh, Nagaland, Rajasthan, Haryana, Assam and to some extent Jammu & Kashmir, Sikkim and Arunachal Pradesh. The crop is cultivated in an area of 14040 ha in Kerala with a total production of 44500 tonnes.

Crop improvement in ginger

Crop improvement work in ginger, so far, was limited to germplasm selection and mutation breeding. Crop improvement in ginger through recombination breeding is handicapped by the absence of viable seed set. Eventhough good flowering and moderate pollen fertility (8-45% as estimated through staining) are observed in ginger, lack of viable seed set in Indian condition is a major barrier for recombination breeding of ginger. However, studies conducted at the National Root Crops Research Institute, Umudike, Umuhia, Nigeria have shown that seed set can be achieved in ginger. However, these seeds were non-viable. Another observation on seed set in ginger cultivars indicates that by planting large-size sets (> 30 g) profuse flowering and good seed set can be obtained.

The chromosome number of cultivated ginger is $2n=22$. Crop improvement work by polyploidy breeding is in progress at the National Research Centre for Spices, Calicut. One tetraploid line cv 'Maran' is undergoing field evaluation at two locations and another tetraploid line of cv 'Manathodi' is under initial evaluation at NRCS, Calicut. Eventhough the tetraploid line of Maran is inferior to its diploid parental line in fresh rhizome yield, it is definitely superior as far as the dry recovery is concerned.

Cultivars

About 50 commercial types of ginger are cultivated. They are generally known after the locality or place from where they are collected or cultivated. Barring 3 improved cultivars, all other cultivars are land races or indigenous lines. The most important indigenous cultivar of ginger are Maran, Himachal, Wynad Local, Nadia, Bajpai, Kuruppampadi etc.

Rio-de-Janeiro, Taffin Giwa, Jamaica, China are some of the popular exotic cultivars in India. The three improved cultivars in ginger are Suprabha, Suruchi and Suravi. These varieties are expected to yield well throughout the country. The details of these varieties are given in Table 1.

High-yielding and good-quality ginger cultivars

Eventhough quality traits in ginger such as dry recovery, oleoresin, fibre content etc. are observed to vary with the soil type, location, season, cultural condition, climate, genotype etc., there exist many local types which excel in yield and one or other quality traits (Table 2). These cultivars are identified through traditional knowledge as well as through research.

Similarly, cultivars like Burdwan-1, Anamika, Poona and Himachal are reported to be less susceptible to soft rot whereas Maran and Kunduli Local are less susceptible to leaf spot. Cultivar Anamika is also somewhat tolerant to scale insect attack.

Future strategy

None of the existing ginger cultivars possess tolerance/resistance to soft rot, bacterial wilt and leaf spot disease, the major production constraints of ginger in Kerala at present. Screening of the 360 odd germplasm for locating tolerance/resistance to these serious maladies are in progress at NRCS, Calicut. *In-vitro* pollination for seed set, induction of somaclonal variation and *in-vitro* screening of somaclones and cell lines can be exploited further in developing high yielding and disease-resistant ginger cultivars. Work on these lines is in progress at NRCS.

TURMERIC

Turmeric (*Curcuma longa* Syn. *C. domestica*), the ancient and sacred spice of India is another major rhizomatous spice produced and exported from India. Turmeric is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies.

Turmeric is thought to be originated in south-east Asia like ginger. At present, turmeric is extensively cultivated in India, Bangladesh, Pakistan, China and to some extent in Sri Lanka, Haiti, Indonesia, Jamaica and Peru. In India, Andhra Pradesh ranks first in the list in area and production of turmeric with an estimated area of 46,300 ha and a production of 1,44,700 tonnes of turmeric followed by Tamil Nadu, Orissa, Karnataka, Gujarat, West Bengal, Maharashtra, Assam, Bihar, Meghalaya, Tripura and to some extent Uttar Pradesh, Rajasthan and Arunachal Pradesh.

In Kerala the crop is grown in about 3000 ha with a total production of 5,900 tonnes.

India is the leading producer and exporter of turmeric in the world. During the year 1990-91, India exported turmeric worth Rs. 14,43,89,510.00 and the export target of turmeric for 93-94 is 20,000 t worth

Rs. 40.0 crores. Turmeric is traded as whole-dried turmeric and turmeric powder besides value-added products like curcumin, turmeric oleoresin and turmeric oil. 'Alleppey', 'Erode', 'Duggirala', 'Nizamabad', 'Cuddappa', 'Rajapuri' etc. are some very popular export-quality turmeric brands.

Kasturi turmeric (*Curcuma aromatica*) is another closely-related economic species used mainly in cosmetic industry. This species has got a characteristic aromatic flavour and is low in curcumin content.

Crop improvement in turmeric

For the past many years crop improvement in turmeric has been limited to germplasm selection and mutation breeding. But with the recent success of viable seed set in turmeric, recombination breeding programme is also in full swing in this clonally propagated crop. Lines derived from open-pollinated progeny selection are in the pre-release trials at NRCS, Calicut.

Cultivated turmeric (*C. longa*) is considered to be triploid with a somatic chromosome number of $2n=3x=63$. *Curcuma aromatica* is tetraploid ($2n=4x=84$). Polyploidy breeding and *in-vitro* induction of soma clonal variation are other breeding strategies being followed at NRCS, Calicut.

Cultivars

About 50 commercial types of turmeric are cultivated in India. Like in the case of ginger, these turmeric varieties are also known after the place of cultivation or collection. Barring 12 improved varieties, all others are land races. These land races, mostly from Andhra Pradesh or Orissa, are classified as short duration types, medium duration types and long duration types. G.L. Puram, Kasturi, CA-69, Jabedi, Dughi, Dindigram, Katigia, Pakistan, G. Udayagiri and Amalapuram are the important short duration types. These cultivars got long thick rhizome with shiny skin and aroma. Yield potential is 8-20 t/ha with dry recovery of 26-30% and takes about six months for maturity. They are low in curcumin content.

ACC 317, Kesari, Kothapeta, Gorakpur, Amruthapani, Panamalur, Rajapuri, Amalapuram etc. are medium duration varieties with a maturity range of 8 months. These types have rhizomes which are medium long and thick with narrow constructions. Its yield potential is 14-35 t/ha with a dry recovery of 18-20%.

Armoor, Duggirala, C11-325, C11-327, Mydukur, Tekurpet, Avanigadda, Sugandham, Ethamukkala etc. are long duration types which take about 9 months for maturity. These cultivars have got long, stout, smooth and hard rhizomes with pale yellow colour. Its yield ranges from 15-37 t/ha with a dry recovery of about 20%.

Within these groups also, there are selections. For example, CA-9 is a selection of Dindigram type of Orissa, C11-317 is another selection from the Amruthvani Kothapeta type. C11-326 a Mydukar type selection and C11-327 a selected Tekurpet type turmeric. These selected lines possess high yield as compared to their parental line.

High curcumin varieties

Even though curcumin content and dry recovery of turmeric varieties are reported to vary with location, season, soil type, cultural conditions, etc. there exists many land races which contain more than 6% curcumin. 'Aieng' turmeric of Manipur; Wynad local,

Edapalayam, Thodupuzha, Manathody, Pulpally types of Kerala; Aizwal type of Mizoram and Sugantham of Gujarat are rich in curcumin content.

Future strategy

Keeping in view the demand for high curcumin turmeric varieties for value added products, from industry sector, the emphasis will be given for evolving turmeric varieties having high curcumin content/ha. Similarly rhizome rot is another serious problem of turmeric in the main producing state of Andhra Pradesh. Screening of existing varieties/germplasm material in order to locate a rhizome rot tolerant/resistant variety will be another important objective of turmeric breeding.

Table 1 : Improved cultivars of ginger released for cultivation

Variety	Pedigree	Released from	Average yield (fresh) t/ha	Potential yield (fresh) t/ha	Maturity (days)	Dry recovery (%)	Crude fibre (%)	Oleoresin (%)	Essential oil (%)
Suprabha	Clonal selection of 'Kunduli local	High Altitude Research Station Pottangi, OUAT Orissa	16.6	22.8	229	20.5	4.4	8.9	1.9
Suruchi	"	"	11.6	21.8	218	23.5	3.8	10.0	2.0
Suravi	Mutation breeding of UP	"	17.5	21.6	225	23	4.0	10.2	2.1

Table 2 : High yielding and good quality ginger cultivars

Trait	Cultivars
High yield (fresh)	Rio-de-Janeiro, Suprabha, Suruchi, Suravi, Jugujan, Thing Pui, Wynad Local, Himachal, Karakkal, Acc. 64
Bold rhizome	China, Taffingiva, SG-35
High dry recovery	Zahirabad, Jorhat Local, Kuruppampadi, Ernad Chernad, Suruchi, Maran, Assam, China, Mowshom, Thing Pui
Low fibre	Zahirabad, Kuruppampadi, Mizo, PGS-16, China, UP, Nadia, Poona, Jamaica
High oleoresin	Wynad Kunnamangalam, Ambalavayalan, Ernad Chernad, Santhing Pui, Rio-de-Janeiro, Kuruppampadi, Himachal, China
High gingerol and shogaol	Wynad Kunnamangalam, Ambalavayalan, Ernad Chernad, Santhing Pui, Rio-de-Janeiro