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Editorial

Export Oriented Agriculture in the Agri-History of India

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Abstract

India's agricultural research has the main emphasis on food grains production and rightly so because of short food supply and dependence on import of wheat from USA. Now the country has become self-sufficient in food and its research needs re-orientation because, most farmers remain below poverty line. Some attention was paid to traditional commercial crops such as cotton, sugarcane and potato for raising the level of farmers above poverty lines, but when they had surplus in production of these crops, they could not export these, because it was difficult to compete in the international market. Nevertheless, there are some herbal crops, where it can compete fairly well in the international export. For example, it has global monopoly in isabgol / psyllium and is topmost exporter in turmeric and only next to China in ginger. However, to maintain these positions in herbal crops in the international export market, India needs to invest a little more in agricultural, scientific and marketing research. Agricultural research is needed to develop high yielding varieties and their agronomy with higher content of main active chemicals and of course market research for new countries to export. Government of India needs to identify more such crops, the areas where they are grown and provide necessary research, processing facilities and procurement at pre-fixed price to facilitate their production and export. This will bring home the much needed foreign exchange and certainly raise the status of some farmers above the poverty line.

Keywords: Active chemicals, export, ginger, gingerol, isabgol, senna, turmeric

1. Introduction

Food has always been in short supply in India and several famines have occurred in India in the past (Bhatia, 1985). To mention a few, these include famines in the 1st century during Gupta period in north India (Drèze, 1988) and during Ashoka period in Orissa (Keay, 2001); famines in Tamil Nadu during 13th to 14th century (Currey and Hugo, 1984; Walsh, 2006); famines in the Deccan, Maharashtra and Gujarat during 15th to 17th century (Walsh, 2006; Attwood, 2005). A 12-year drought and famine is mentioned in Mahabharata (Roy, 1889). Therefore, after gaining independence in 1947, the emphasis of agricultural research has been on increasing the production of foodgrains in the country and to great extent they have succeeded in this by introducing high yielding dwarf/semi-dwarf varieties of wheat (Swaminathan, 2013) and rice (Siddiq et al., 2012) and hybrids and composites of maize, sorghum and pearl millet (Kaul et al., 2010; Kumara Charyulu et al., 2011). India's agricultural research has thus centered for meeting dal-roti/chawal needs of the people and very little

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beyond it. Agricultural research in India is conducted by the Institutes under the umbrella of Indian Council of Agricultural Research which comes under Ministry of Agriculture, Cooperation and Farmers Welfare, while the responsibility of agricultural food procurement and distribution is under the Ministry of Food, which is done through Public Distribution System having ration shops throughout the country, certainly a Herculean task and the ministry has done it wonderfully well.

However, high yielding varieties of cereals demanded more inputs, such as better quality seeds, fertilizer and other agrochemicals and the farmers had to take loans from the banks, which many a time they were not able to return timely and many committed suicides (Das, 2011). This brings to the point that one has to think of net profit (preferably foreign exchange) from the farm field and not only the production, which has been the focus of attention of the Government of India and this brings the need for attention to the commercial crops other than the traditional commercial crops of sugarcane, potatoes and cotton etc. As a matter of fact, there have been more suicides, in cotton growing farmers than in those growing cereal crops (Dongre and Desmukh, 2012). Ministry of Food & Agriculture (MOFA), Government of India (GOI) now needs to add a department of Export Oriented Agricultural to recognize the crops that can be exported. They need to demarcate the areas where they can be successfully grown and to initiate research for improving yield and quality of these crops as well as to explore new markets for these crops. Although Agricultural Product Export Development Authority (APEDA) is doing its job fairly well on the marketing front, research aspect is missing and it has to be MOA&FW, GOIs responsibility. This paper draws attention to lesser known four commercial crops, namely, 1) Isabgol, in which India has the monopoly in the world market, 2) Turmeric (*haldi*), where India is number one in the export market, 3) Ginger, where India is next to China in the world export trade and 4) Senna, where again it has a sizeable share in the export market. These crops have not received the attention as they deserve. India has to seriously look into necessary advancements to maintain at least the present position in the export market. A brief discussion of these crops follows for the readers' information.

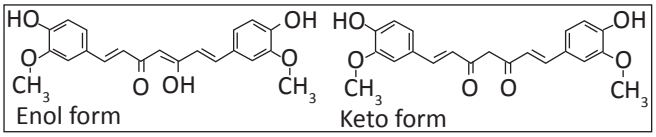
2. Turmeric

Turmeric (*Curcuma longa*) was domesticated in Southeast Asia, most probably in India, which has the greatest diversity of *Curcuma* species; around 40 to 45 species, while Thailand has about 30 to 40 species. Other countries in tropical Asia also have numerous wild species of *Curcuma*. The name of the genus, *Curcuma*, is derived from the Sanskrit *kuṅkuma*, referring to turmeric, used in India since ancient times. India is by far the largest producer and exporter of turmeric in the world. Andhra Pradesh, Tamil Nadu, Odisha, Karnataka, West Bengal, Gujarat, Meghalaya, Maharashtra, Assam are some of the important states growing turmeric, of which, Andhra Pradesh alone occupies 35.0% of the area and contributes about 47.0% of the country's production.

Turmeric can be grown in diverse tropical conditions from sea level to 1500 m above sea level, at a temperature range of 20-35°C with an annual rainfall of 1500 mm or more, under rainfed or irrigated conditions. Though it can be grown on different types of soils, it thrives best in well-drained sandy loam or loam soils with a pH range of 4.5-7.5 with good organic matter content.

Turmeric occupies about 6% of the total area under spices and condiments in India. In 2018, India was the top exporter of turmeric (US$ 192 million) followed by Vietnam (US$ 22.6 million), Indonesia (US$ 12.8 million) and Burma (US$ 8.23 million) (via interrnet).

Turmeric powder is about 60–70% carbohydrates, 6–13% water, 6–8% protein, 5–10% fat, 3–7% dietary minerals, 3–7% essential oils, 2–7% dietary fiber, and 1–6% curcuminoids (Rajkumari and Sanatombi, 2017). The active golden yellow chemical in turmeric is curcumin ($C_{21}H_{20}O_6$). The IUPAC name is (1E, 6E)-1,7-Bis(4-hydroxy-3-methoxyphenyl) hepta-1,6-diene-3,5-dione. It could be present in enol or keto form (Manolova et al., 2014).



Some research data on turmeric from Tamil Nadu state is presented in Table 1, but much more of such data are needed from other states. It is essential to provide quality data on packages being marketed. The present international market is very quality conscious.

Turmeric has been used in Asia for thousands of years and is a major part of Ayurveda, siddha, traditional Chinese and Unani medicine (Chattopadhyay et al., 2004). It was first used as a dye, and later in folk medicine. It's a potent anti-inflammatory agent and is generally the first thing to be given (mixed in milk) in accidental injuries in India. It is recommended in arthritis and is taken in several forms (TOI, 2019). It is also an antioxidant and may also help to improve symptoms of depression. Other health benefits include prevention of cardiovascular diseases, Alzheimer's and cancer (Prasad and Agarwal, 2011). Nwankwo (2014) reported that he methanolic extract of the plant exhibited significant inhibitory actions against *Escherichia coli, Streptococcus, Staphylococcus, Bacillus cereus, Micrococcus, Pseudomonas, Aspergillus* and *Penicillium* at a final concentration of 20 mg ml^{-1}.

It is an important ingredient of curry powder used for vegetable and meat curries in India and abroad. In India it is taken in every meal. It is also used for coloring and flavoring several savory dishes and even some sweet dishes.

3. Ginger

Ginger (*Zingiber officinale*) originated from Islands of Southeast Asia. It is a true cultigen and does not exist in its wild state (Singh, 2011; Ravindran and Nirmal Babu, 2016). The most ancient evidence of its domestication is

Table 1: Some of the varieties grown in Tamil Nadu, their crop duration and curcumin, oleoresin and essential oil content

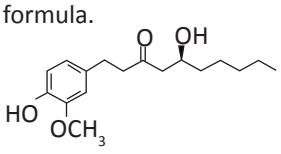
Variety name	Mean yield (fresh, t ha^{-1})	Crop duration (days)	Dry recovery (%)	Curcumin (%)	Oleoresin (%)	Essential Oil (%)
Suvarna	17.4	200	20.0	4.3	13.5	7.0
Suguna	29.3	190	12.0	7.3	13.5	6.0
Sudarsana	28.8	190	12.0	5.3	15.0	7.0
IISR Prabha	37.5	195	19.5	6.5	15.0	6.5
IISR Prathibha	39.1	188	18.5	6.2	16.2	6.2
Co-1	30.0	285	19.5	3.2	6.7	3.2
Krishna	9.2	240	16.4	2.8	3.8	2.0
Sugandham	15.0	210	23.3	3.1	11.0	2.7
BSR-1	30.7	285	20.5	4.2	4.0	3.7
Roma	20.7	250	31.0	9.3	13.2	4.2
Suroma	20.0	255	26.0	9.3	13.1	4.4
Rajendra Sonia	4.8	225	18.0	8.4	–	5.0
Ranga	29.0	250	24.8	6.3	13.5	4.4
Rasmi	31.3	240	23.0	6.4	13.4	4.4

Source: TNAU Portal //www.icexindia.com/profiles/turmeric_profile.pdf

among the Austronesian peoples where it was exploited since ancient times. Today, India is the largest producer of ginger, and in 2018 it produced 893 thousand tonnes (tt) of rhizomes, followed by China (510 tt), Nigeria (369 tt), Nepal (284 tt), Indonesia (207 tt) and Thailand (168 tt), however, China is number one in exporting crushed/ground ginger (US$ 30.5 million; 37.2% of the world total) compared to India's US $ 12 million; 14.6% of the world total. In India, about 70% of the total ginger production is confined to Kerala. Other states that grow ginger are Assam, Andhra Pradesh, Himachal Pradesh, West Bengal and Sikkim.

Ginger grows best in warm and humid climate. It is mainly cultivated in the tropics from sea level to an altitude of 1500 m, both under rainfed and irrigated conditions. Ginger thrives best in well-drained sandy loam or loam red or lateritic soils high in soil fertility. It is planted in March to June and is a 7-8 month crop. It requires high humidity for the first 6 months of growth and dry weather with a temperature of 28° to 35°C for about a month before harvesting. Harvesting is done by digging with a spade or pick-axe.

Dried ginger contains 5.02–5.82% protein, 4.97–5.61% crude fiber, 0.76–0.90 fat, 3.38–3.66% ash, 0.81 mg 100 g^{-1} β-carotene and 3.83 mg 100 g^{-1} ascorbic acid and 69.21 mg 100 g^{-1} polyphenol (Sangwan et al., 2014). The active ingredient in ginger is gingerol ($C_{17}H_{26}O_4$)[(*S*)-5-Hydroxy-1-(4-hydroxy-3-methoxyphenyl)-3-decanone] with the following formula.



Gingerol is a phenol phytochemical compound found in fresh ginger that activates spice receptors on the tongue. It is a relative of alkaloids capscine and piperine .

Ginger rhizomes and the leaves are used to flavor food or eaten directly. Ginger is used in India in making curry paste and dips (*chutney*). Ginger appears to be highly effective against nausea. It has a long history of use as a sea sickness remedy, and there is some evidence that it may be as effective as prescription medication. Ginger can help in overcoming indigestion, has anti-inflammatory effects and can help with osteoarthritis. Ginger may drastically lower blood sugars and improve heart disease risk factors. It can also reduce the risk of cancer and also helps in overcoming depression (D'costa, 2019).

4. Isabgol / Psyllium

Isabgol (*Plantago ovata*) also known as *Aspaghol* (Persian *'asp' meaning horse and 'gul' meaning flower, the word thus means horse flower)* is an annual herb of Iranian origin, but India is now a major producer and exporter. The genus *Plantago* contains over 200 species. *P. ovata* produced in India is *known as* white or blonde psyllium*,* while *P. psyllium* commercially known as black, French, or Spanish psyllium is produced in several European countries. India is the largest producer in the world and has monopoly in its trade.

In India it is grown in North Gujarat and adjoining parts of Western Rajasthan and Madhya Pradesh. However, the crop is spreading in non-traditional parts of the country such as Punjab, Haryana, Uttar Pradesh and Karnataka. It is a cool and dry season (*rabi*) crop. It requires an annual rainfall 500-1250

mm. Since, the papery seed husk can absorb water many times than its own weight and swell and drop off due to increase in weight, hence unseasonal rain or, even high dew deposition during the crop maturity is the major deterrent factor in isabgol cultivation and can cause total loss of the yield. Thus, regions receiving winter rains are not suitable for isabgol cultivation. The temperature requirement for maximum seed germination is 20–25°C, whereas, at the time of maturity it requires a temperature of 30–35°C. Plants flower about 60 days after planting. The seeds are enclosed in capsules that open at maturity. Both seeds and husk are used.

Isabgol/Psyllium is a proven bowel regulator (Cheng et al., 2019). It is mainly used as a viscous, soluble dietary fiber that is not absorbed by the small intestine. The purely mechanical action of psyllium mucilage is to absorb excess water while stimulating normal bowel elimination. It also lowers blood cholesterol (Olson et al., 1997) and thus is useful in reducing the risk of coronary heart disease. Psyllium husk may also reduce the risk of type 2 diabetes.

5. Senna

Senna (*Cassia)* is native to Africa and is grown several countries with semi-dry climate. It has been grown in the Egypt since long and is now grown throughout semi-arid tropics and even in some temperate region countries. There are about 300 species of which about 50 species of *Senna* are in cultivation. The most common cultivated species are: *Cassia aculeata, C. augustifolia and C. alexandrina* (in Egypt). India has the largest area (about 0.1 million hectares) under senna cultivation mostly in the states of Tamil Nadu, Gujarat and Rajasthan. India is the largest exporter of senna. Both leaves and seeds are exported and used after grinding and forming tablets. The total annual production of senna herbage in India is estimated to be around 8600 tonnes. The international market receives leaves and pods of *Alexandrian senna* obtained from the North African countries in substantial quantities, accounting for about 25% of the international trade

Senna grows well in medium to high rainfall (700-1500 mm) areas with 25-30°C temperatures. It grows well on loam soils of pH 5-7.5. It is a *kharif* season crop.

Indian senna (*Cassia angustifolia)* contains flavonoids, pinnitolos (polyols), acidic polysaccharides, and mineral substances. It also contains two types of glucosides known as sennoside A and B, and other compounds including myricyl alcohol, anthraquinone derivatives, galactose, arabinose, rhamnose, and galacturonic acid, chrysophanic acid, salicylic acid, resin, mannitol, and trace amounts of volatile oil (Naz et al., 2019). Senna is mostly used as a laxative for the treatment of constipation (Wald, 2016; Izzy et al., 2016), but is also used in diarrhea and dysentery.

6. Discussion and Agenda for Action

Since most agricultural research has been with cereals, where the main quality traits were boldness and lustre in grains other than rice, while in rice it was fineness and length of grain, which are only the physical characters. There has been no attempt on determining the protein content even in wheat, a major consideration in US and Canadian wheat markets. The crops mentioned in this paper are marketed for their active chemical constituents, which are responsible for their health and culinary benefits. Therefore, declaration of the content of these chemicals is a prerequisite for each lot sold in the international market. A beginning of this has to be made at the farm gate and there is a need for such analyses at that very point.

Therefore, breeding of better quality varieties of such crops requires strong science (chemistry) base and the agricultural scientists need to work in unison with chemists. At present there are two institutes in India responsible for this. One is the Indian Institute of Spices Research (IISR) at Kozhikode, Kerala under the control of the Indian Council of Agricultural Research (ICAR), New Delhi of the Ministry of Agriculture & Farmers Welfare, while the other is Central Institute of Medicinal and Aromatic Plants, Lucknow under the control of Council of Scientific & Industrial Research of the Ministry of Science and Industry. Since two ministries are involved, coordination is a difficult job. ICAR has a separate institute/ directorate for each cereal crop and traditional crop, such as, cotton, sugarcane and potato. There is a need for a separate institute for herbal crops also with well-equipped analytical chemistry laboratories having well trained staff, where a farmer or a businessman can get his samples analyzed for a small reasonably fee at a short interval of time. Such laboratories will also create many jobs for analytical organic chemists.

In agriculture research, the only time the need for labs was felt with the introduction of soil testing laboratories all over the country and there was a flurry of lab to land. It is time to talk also of land to lab, required in the context of the crops discussed in this paper.

7. Conclusion

For the crops under reference there is an immediate need for marketing research to familiarize people of the health and culinary advantages of these crops. At the moment this job is being done by importing agencies of a country. We as an exporting country also owe some responsibility in this direction. Needless to mention that people in advanced countries have just become aware of the health benefits of these crops and would like to have more information. As regards health benefits, there is an urgent need of conducting randomized trials for bringing out the evidence of health benefits of these medicines and Ministry of AYUSH has the major responsibility. Sooner it is done better it is.

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