India and elsewhere. Indeed famines are induced and used as instruments to control resistive populations by foreign occupiers. For example, between 1875 and 1900, during which period most of the severest famines in the entire Indian history occurred, annual grain exports from India increased from 3 to 10 million tons, a quantity that is equivalent to the annual nutrition of about 20 million people[4]. I should re-emphasize here that this haemorrhage ('As India must be bled . . .') occurred while the best lands were increasingly being used for non-food crops. During the famine of 1899–1900, when around 143,500 Beharis died directly from starvation, the province exported not only tens of thousands of bales of cotton, but an incredible 747,000 bushels of grain[5]. The 1942–45 famine is a direct consequence of the occupation policies in the form of (a) 'boat denial scheme', which resulted in the confiscation of 65,500 boats and as a consequence practically all fishing in the Bay of Bengal ceased and inland water navigation collapsed, (b) confiscation of land for military fortifications, which led to expulsion of 150,000 to 180,000 people from their land, making them homeless, and (c) export of food from the Bengal region in the framework of 'rice denial scheme'[6].

Famines can also occur amidst plenty of food, if people are unable to buy it for the lack of money, which may result from severe unemployment. For example the official report on the 1899–1902 famine in Mumbai states: 'Supplies of food were at all times sufficient and it cannot be too frequently repeated that severe privation was chiefly due to the dearth of employment in agriculture (arising from drought)'[5]. Should we still continue to argue about the cause of the Indian famines during the occupation?

There is no point in recapitulating statistics after statistics to prove the fact that it was the policies of the occupiers – not crop failure – that have been the major, if not the sole cause of famines depicted by Bhatia[3]. Besides, the table is not complete. All these statistics naturally make the assertion by Bhatia[3], 'Famines in India (listed in table 1 of ref. 3) were due to crop failure for several consecutive years' patently false.

Indeed it would be rather foolish to expect from a foreign occupation force to behave otherwise. Countries invade other countries in order to rob. This is a universal fact.

So-called traditional methods are certainly not rigid in the sense that they have not evolved or have not been adopted to suit varying circumstances over time. Often these methods have high efficiency and minimum or no adverse environmental impact. They are called traditional because they are intrinsic to our societies and products of our civilizations. As anyone who has a rudimentary knowledge of history knows, science is not a prerogative of Europe or America alone. It is absurd to declare our methods as primitive and those of others as scientific. Do we have the scientific capability to create transgenic life forms? The answer is a clear yes. Whether we desire to release such life forms into the environment is a question of social responsibility.

Famines have little to do with traditional agricultural methods. I do not believe that the so-called Green Revolution should be regarded as a consequence of something different from traditional agricultural methods. After all, it is the introduction of new crop varieties bred by traditional methods on a large scale. Such 'revolutions' have been occurring all over the world throughout history. Is the introduction of potatoes and maize from the Americas to other parts of the world a 'modern' process? The reader is invited to learn how the traditional methods were coping with famines in a far more efficient way than the 'modern' occupation force of England[5].

Besides, if crop failure is the cause of famines and transgenic crops are the way to prevent famines as Bhatia implies, are we to conclude that transgenic crops will never fail?

Transgenic crops contain foreign genes which make them either resistant to herbicides or enable them to produce toxins which are fatal to certain insects attacking these crops. Usually these toxins are also fatal to a class of 'harmless' insects as well. Targetting members of distinct classes will inevitably lead to targetting a broad spectrum of insects. This is what is called environmental poisoning. Coupled with gene flow, this would mean that we will have plants and animals in the environment which continue to manufacture toxins. Worse still, the population of such plants and animals may gradually increase. Indeed, naturally occurring plants and animals also produce such toxins. This does not mean that we need to add more, both qualitatively and quantitatively. I am not claiming that this will certainly occur. I am only claiming that this is a possible and a likely scenario, because no law of physics or for that matter, no law of biology categorically prevents it. There is nothing unscientific about it.

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M. KRISHNAPILLAI

Dadheru Khurd,
Dadheru Kalam,
Muzaffar Nagar
e-mail: ra_krish2002@yahoo.com

Response

As mentioned earlier[1], 'the purpose of communicating my comments to Tiwari's[2] call for reverting to 'Vedic' farming technology was that India cannot feed a population of billion plus without further modernizing its agriculture based on contemporary scientific knowledge and techniques'. I opposed his condemnation of the Green Revolution technology, and propagation of irrational belief that the traditional methods can feed the present population'. The word 'transgenic' was not mentioned anywhere in my comments[3]. In his response, Krishnapillai[4] made a statement: 'Transgenic life forms have potential to poison the entire planet', which has no scientific basis, and hence, asked to provide evidence for the same[1]. These are two unrelated issues: (1) the cause of famines in India listed in table 1 of my note[3] and (2) transgenics. The causes of famines were stated in the previous correspondence[1]. The mean foodgrains production in 1950–51 was 51 million tons from 97.3 million ha of cultivated area[5]. Per hectare productivity of traditional agriculture was 525 kg/ha (51/97.3 expressed in kg) that did not create adequate surpluses to sustain food availability during the periods of successive crop failures. The impact of the Green Revolution technology is well illustrated by enhanced wheat productivity in the country. In 1950–51, 12 million tons were produced from 14 million ha area under cultivation[6] (mean yield = 857 kg/ha). In 1994–95, following the spread of new technology, 60

million tons were produced from 23 million ha[6] (mean yield = 2608 kg/ha). Mean yield in several districts is over 3 tons. Rice productivity also increased, though not to the same extent as that of wheat.

In his present correspondence, Krishnapillai quotes Romesh Dutt, '... there has never been a single year when food supply of the country was insufficient for the people ... '. The book was published in 1950. I am not aware of the period on which his statement is based. If the pre-Green Revolution farming practices were adequate to feed the population, why were foodgrains imported in independent India from 1951 to 76? During 1965–66, 10.34 million tons of grains were imported[5]. The older generation would recall the days in the mid-1960s when wheat, rice and sugar were available only from the ration shops. Boiled, broken wheat was served, replacing rice. Shopkeepers would sell bread only when customers also purchased eggs. The Railway Catering Service would not serve normal 'thali' for dinner on 'no cereal' days imposed by the Government.

After Tiwari's pleading for 'Vedic' farming[2], Krishnapillai wants to take us further back into the era of 'food gatherers' by suggesting that the country has a long coastline bordering the Indian Ocean, which in turn is a vast resource of food. It is pertinent to state that in terms of tonnage, globally only 2% of food is obtained from aquatic sources, while 98% is produced on land[7].

Regarding transgenics, Krishnapillai, in this rejoinder, fails to provide evidence to support his earlier statement – as none exists. There are inconsistencies in the statements made, and evidence-based answers may not change his views. I reiterate sustainable increased productivity per hectare is the only option to feed the growing population, generate exportable surplus at globally competitive cost and higher income for the farmers. Reverting to agrarian traditions based on the wisdom of the past cannot feed the billion plus.

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C. R. BHATIA

17 ROHINI, Plot 29-30,
Sector 9-A, Vashi,
New Mumbai 400 703, India
e-mail: neil@bom7.vsnl.net.in

Turmeric and curcumin

There are certain omissions and commissions in the comprehensive review article on turmeric and curcumin by Chattopadhyay *et al.*[1]. A general article on turmeric by Khanna[2] in the same journal, mentioning a wide range of biological activities for turmeric and its constituents was not referred to. Also omitted was tumerin, a water-soluble antioxidant peptide, reported from turmeric by Srinivas *et al.*[3], which was found to be an efficient antioxidant/DNA protectant/anti-mutagen.

Curcumin is not a mixture of curcumin I, curcumin II and curcumin III, as made out in the article. Curcumin (diferuloylmethane) is the same as curcumin I. Curcumin II is desmethoxycurcumin and curcumin III is bis-desmethoxycurcumin. The structures written in the article for desmethoxycurcumin and bis-desmethoxycurcumin are in no way different from those of curcumin II and curcumin III. The structure of curcumin was elucidated as early as 1910 by Lampe *et al.*[4], as stated by Roughley and Whiting[5], which the authors cited.

By way of additional information on the clinical aspects, I wish to add that although turmeric and its constituents have been extensively studied, no clinically active commercial product has emerged in modern medicine. Central Drug Research Institute, Lucknow had tried to develop curcumin as an anti-inflammatory agent, but their efforts were not successful (N. M. Khanna, pers. commun.). The antiseptic activity of an aqueous extract of turmeric was exploited by Johnson and Johnson in Band-Aid®, a turmeric-based bandage (patents), available in the market over the last few years. P54, an oral product patented and developed by Phytopharm[6], the UK drug delivery company, consists of curcumin together with the essential oils of both *Curcuma domestica* (= *C. longa*) and *Curcuma xanthorrhiza*, suspended in a soft gelatine capsule. Phase II clinical study of P54 for inflammatory bowel disease was conducted in 2001 for possible commercial use.

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E. VENKATA RAO

No. 50-121-49/1/2, B. S. Layout,
Seethammadhara,
Visakhapatnam 530 013, India
e-mail: erraguntlavrao@yahoo.co.uk

I observed some anomalies in the article by Chattopadhyay *et al.*[1]. As per the review, the composition of turmeric powder exceeds 100%, that is around 106%. Some structures given in the figures are repetitions. Moreover they are discussed as separate compounds. Curcumin II and demethoxy curcumin are same; Curcumin III and bis-demethoxycurcumin are same;