Final Summary-Chandre Dharmawardana

When public claims for a product are questioned, such questioning should NOT be regarded as an attempt to "disparage local scientists".

In fact, such questioning is an OPPORTUNITY for those who have products to highlight the capabilities and obtain good publicity by pointing to positive, well substantiated results available in the public domain. Having a commercial Interest should be openly declared.

The public HAS a right to ask questions.

Those who are in Research and Development of products that are to be marketed should indeed make optimistic claims, but NOT EVEN "WHITE LIES" are allowed in science. Such white lies are for politicians. Scientists should present scientific support for such claims in the public domain with sufficient details so that other scientists can REPEAT those pot trials, greenhouse trials and field trials where needed.

The discussion about microbial fertilizers was triggered by claims made by Dr. Chris Dharmakirthi that even the green-algae growing in paddy fields can be adequately used to supply the nitrogen fertilizer needed, and that pre-cropping with Mung can provide 200-300% more nitrogen. It was also claimed that Prof. Mawjood had shown that one can grow paddy for as long as you want, without any fertilizer and recover about 2 tonnes/hectare.

All these extreme claims were couched in statements that suggested or indirectly implied that the scientists of the Dept. of Agriculture, and some kind of "fertilizer mafia" stood in the way of introducing these wonderful techniques invented by local scientists.

As Dr. Dharmakirti had directed the questions to me by name and a couple of other scientists (like Dr. Ranil Senanayake) and since they did not reply I gave my replies, mainly basing my replies on the review article by Kulasooriya and Magana-arachchi. I stated *that these microbial techniques are still NOT ready to be offered to farmers*, and that they are still at the research & development state. This view was also independently endorsed by Professor Nimal Chandresena who provided references to the most recent peer-reviewed literature and to recent books on the subject.

Somewhat the same view had been expressed in an article on Fertilizers published months earlier in the Island Newspaper by Dr. Kirthi Tennakoon who had been a Director of the NIFS where some of the bmicrobial fertilizer work had been done.

It was quite surprising to find that Dr. Kulasooriya rose up in defence of Dr. Dharmakirti, in an email entitled CROP PRODUCTION IN SRI LANKA: CHEMICAL OR ORGANIC ?

https://dh-web.org/green/BBF/Kula-Agri-chem-org-CDW.pdf

where expatriate scientists like myself were unjustly criticized for their alleged ignorance of even Salvinia not being a Nitrogen fixing plant.

I believe that Prof. Kulasooriya had not properly read what I had written in reply to Dharmakirti, or what I have been writing during the last three or four decades. He may have reacted to whatever he had heard from his associates and wrote to demolish a strawman that they themselves had erected, e.g., claiming that his work was linked with Ven Ratana's occult beliefs etc.

In fact, Dr. Kualsooriya had been a pioneer in microbial sciences in Sri Lanka, and indeed my response to Dharmakirti was based on Kulasooriya's scientific publications that I considered to have been trend setting. However, I have to differ with Prof. Kulasooriya in regard to the marketing of microbial inoculants as well as biofilmed-biofertilzers (BFBF). We ourselves and the caring public have to go by what is available in the public domain.

In the "CROP PRODUCTION IN SRI LANKA: CHEMICAL OR ORGANIC ?" Article Prof. Kulasooriya had repeated the common fallacy that the flattening in the harvests found after decades of application of chemical fertilizers was a justification for the need to go to organic agriculture. That soils get impoverished under continuous exploitation, WHAT EVER the system of agriculture is a well known fact. Even with the most strictly organic form of agriculture practiced in the 18th century, with no external inputs to the fields, it was necessary to abandon farms and leave them fallow for them to recover. The need to re-mineralize, and also increase soil organic carbon (but NOT the control of soil) erosion were satisfied by periodic fallow periods followed by burning down the new growth.

The need to remedy soils continually, re-carbonize and control erosion has been ably documented in a recent book on soils by Jo Handelsman:

The Past, Present, and Precarious Future of the Earth Beneath Our Feet *Jo Handelsman* Yale University Press, 2021. 272 pp.

It was Bodhi Dhanapala, an Emeritus Senior Faculty member of the Ecole Polutechnique in Quebec who looked at what is in the public domain and called a strong critique on some of the entries in the *Commonwealth Agriculture Bulletin Journal* (CABJ). Then I myself, and Dr. Waidyanatha (who had already commented on the CABJ article in an Island Newspaper article by saman indrajith in 2017) wrote to point out *that all the entries in the CABJ Table (that compared harvests with and without BFBF) were untenable, and cannot be used to substantiate the claim that BFBF could replace 50% of the needed chemical fertilizers* (for a large variety of common vegetables, maize, tea, paddy etc).

The incorrect material in the CABJ article, the ONLY data available in the public domain up to 2020 was excused of by Dr. Gamini Seneviratne as material published in a "book chapter". Surely, book chapters written by 16 authors, one of them an Australian,

+need even more care than a journal article that can be corrected by an erratum or a retraction. Even for book chapters, a correction could have been published in a subsequent issue of the CABJ and this would have been in the public domain.

As for the newspaper article by Saman Chandrajith where the BFBF was claimed to replace up to 50% of chemical fertilizers and yield harvests in excess of 20-30% BEYOND that from chemical fertilizer, are we to write it off and excuse it as "A WHITE LIE" to gain market access in a country like Sri Lanka where market access is difficult, (as claimed by Dr. Vijaya Kumar in a different context)?

I think going down that path is a slippery slope that will discredit those who resort to such tactics, and even discredit all the scientists who follow the honourable path of evidence-based science.

Meanwhile Prof. Kulasooriya drew attention to their "post-Covid" publication:

https://dh-web.org/green/BBF/Kula-2021- NSF-COVID-19BOOK.pdf

where a new (but very limited) set of data supporting the efficacy of microbial fertilizers has been presented in the public domain. The best practice is that such data need to be confirmed by independent investigators who are not linked to institutions or individuals who have a commercial interest in the products studies. However, it must be granted that this does not always happen even in rich countries where consumer-protection oversights are very strong. However, it does happen in matters of great public interest (e.g., the Covid-19 vaccines).

At this point Dr. Ben Basnayake came forward to express his support to the microbial fertilizer people at NIFS but did not specify or direct us to the data sets that are available in the public domain that instilled his confidence.

Dr. Basnayake himself expressed surprisingly high confidence in what can be achieved using biochar**. He claimed that one kilo of biochar added to the soil can in effect replace one kilo of urea because the biochar will induce microbial growth in the soil that will increase bioavailable nitrogen, thus fertilizing the soil, as clarified by him in response to Prof. Methika Vitahnage.** Dr. Basnayake's optimism is not based on results that are already available in the public domain, but on the basis of tests that he is carrying out in collaboration with various research institutes.

In 2019 Sri Lanka imported some 250,000 tonnes of urea. Even with Dr. Basnayake's claim of 1kg of biochar "equals" one kg of urea, we needs to produce some 250,000 tonnes of biochar, using coconut-shell charcoal. Carbonization of one tonne of coconut shells produces of the order 300 kg of charcoal, which can be converted into 120 kg of activated carbon or presumably 200 kg of biochar? So biochar, if based on coconut shell carbon may turn out to be more expensive than urea, environmentally not all that clean, and certainly well beyond the output of coconut shells that may be available in the country for the biochar people.

In our view, in the long run, nanoparticulate urea and nano-particulate phosphates and potassium would be cheaper and more efficient anything based on microbes. The reason is very simple. It is very easy to accurately engineer and nanofabricate inorganic materials with high precision, as today we have atomic-monolayer control over nanofabrication. Time-release according to a calendar that fits in with the fertilizer demands of a plant as the plant grows can be constructed using multi-layers nano-fertilizers that are currently on our laboratory benches.

In this context, one may look at Prof. RMG Rajapaksa's contribution from Peradeniya:

https://dh-web.org/green/BBF/RajapaksaRMGInnovations18Dec21.pdf

However, in my view microbial techniques will play a large role, especially in the treatment of waste materials and in processing garbage.

In fact, the earliest uses of biochar in the West and in China were to clean-up badly polluted industrial soils and render them available for human use. In any case, in my view, those who develop products, be they microbial or inorganic, should NOT make extravagant claims.

When public claims for a product are questioned, such questioning should NOT be regarded as an attempt to “disparage local scientists”. In fact, such questioning is an OPPORTUNITY for those who have products to highlight the capabilities and obtain good publicity by pointing to positive well substantiated results available in the public domain. The public HAS a right to ask questions.

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