

INTRODUCTION

The famous Green Revolution of India became a political issue rather than a scientific issue. The combination of superior seeds, fertilizers, irrigation and a range of protective chemicals to suppress pests and disease, led to the desired results, of superior yields, as would have been expected.

The politicians hijacked the revolution in its infancy, without regard for the consequences, of not following, the natural progression of Science and its necessary infra-structure, in maximizing the full utilization of the increased crop yields. There were huge losses of post-harvest delivered grain and other perishable Agricultural commodities, which is continuing to the present day.

Unfortunately: the Government was not prepared to learn from history. Almost 100 years ago synthetic Ammonium Sulphate (Nitrogen only) was introduced to agriculture with: quick results and impressive plant growth. Highly soluble and strongly acidic, it rapidly impacted soil organisms and essential trace elements. Very quickly farmers abandoned its use.

The Green Revolution repeated history, using urea, a synthetic Nitrogenous fertilizer. The results were as expected, a large initial increase of food grain production, but at enormous cost to the health of Indian soils and the future of Agriculture in the country. Indian soils are now in a crisis and are at the tipping point. It has been reported that 250,000 farmers have committed suicide in India during the past 15 years. Most of these can be shown to be directly due to farmer indebtedness, due to the purchasing of Agro-Chemicals.

The Government without taking note of history is now considering the introduction of GM crops. This introduction of these crops is contrary to all the evidence from Europe. This is NOT the best way forward. For the benefit of the layman, GMO crops are genetically modified to withstand the toxic herbicides that will kill all plants that come in contact with them. The exception being the GMO crops especially designed to survive exposure to these herbicides, most notably: Glyphosate more commonly known as ROUNDUP.. It is extremely expensive and does nothing to improve soil fertility. The next for the big issue is caused by GM seeds, in that they have caused a major reduction of genetic diversity. Patented GM Seeds become reliant on patented Agro-chemicals which consistently increase in cost, this not only puts the farmer at financial risk but also damages his soil. India's ancient repository of seeds will in a short period of time become lost, forever. This must never be allowed to happen. This rich seed bank built

up over thousands of years will become essential to India's future food self-sufficiency, as global warming increasingly impacts India. Indian scientists will be able to select drought resistant cultivars from this enormous inventory of seeds. Any threat to this incredibly valuable resource must be prevented at all costs.

GM crops for India, equals Agricultural suicide and must at all costs be prevented from happening.

How the Mining Companies can play a major role in THE FUTURE Agricultural Development OF INDIA. The principle philosophy is to mobilize the Economic Power of Mining and to use it as a platform to help bring about rural development, with a strong emphasis on soil and water regeneration

Indian soils are severely depleted and require restoration before contemplating harmful GM options, with the country being at a critical stage in Agricultural Development. The Green revolution has caused enormous damage to India's inherently fertile soils by accelerating the depletion of the natural organic matter and carbon reserves. The indiscriminate application of Urea on a massive scale has totally corrupted the balance of the essential minerals required for plant growth, and the altered soil pH, similarly an overlooked aspect which impacts trace element availability, so vital for efficient plant production. The increasing use of high assay NPK FERTILIZERS achieved nothing, while production continued to decline. The Petro-Chemical Industry on top of all this has facilitated and encouraged the uneducated farmers to apply highly toxic and dangerous chemicals to the soils and crops of India, thus causing harm to the environment and their own physical health.

The issues being discussed in the attached paper by: Stuart Newton, cannot be solved by Government. The Government has been responsible for the serious decline in the health of Indian soils over the past 60 years. Through short sighted policies, which they have contributed to the malnutrition of millions of people. The crisis that we have at present, can only be dealt with by the Private-Sector, with the Government acting as facilitators, only. The Mining Industry is a logical partner for Agricultural Development. The common factor is that both industries, the Farmer and the Miner, are relying on the bounty of the same source, and that is "Mother Earth." Both industries operate in the rural sector. There is a need for a partnership between the Miner, and the Farmer. Included should be the fertilizer manufacturer and other related parties that provide such items as seeds and chemicals. Other partners that should be involved are the: State Agricultural Colleges, Universities and Organizations: such as TERI and ICAR. Etc.

The basic proposal is simple, and should involve the Mining Company, establishing and financing an Agricultural Co-Op, that would deliver services to farmers that are close to the mining operations. The Co-Op would be run as a profit-making enterprise, with both the farmer and the miner being the shareholders. The Co-Op would employ a Post-Graduate student to manage and organize a fulltime soil testing program, covering all of the farms that become members of the Co-Op. The Co-Op would supply fertilizers and trace elements according to the soil requirements and crop needs, as determined by research inputs from Government Institutes, familiar with the locality and specific soil assay parameters. Certified seed options for traditional crop species, crop specific Rhizobium species for nominated legumes. Advanced seedling could be an option in vegetable growing areas. Aim to introduce Integrated Pest Management and lessen reliance on traditional long life, broad spectrum chemicals. The Co-Op .may also expand its activities to providing a whole range of other services, such as the hiring of small scale farm equipment, the buying and marketing of crops, storage of crops and the transport of crops. They could eventually look at Insurance and finance and also become land agents, acting for the sale and amalgamation of farm properties. The Co-Op would aim to offer a total range of services to the farmer. There will also be a requirement in the early stages, for establishing a soil testing facility. A word of warning, soil testing only intimates what needs to be applied. Only the plant can define what and how much is actually required. A small tissue culturing lab and a plant nursery should also be established.

India must look away from the G.M.O and Herbicide ONLY SOLUTION, along with the irrational, unbalanced, costly NPK formulations presently supplied. Trace elements need to be applied with the cheapest carrier, depending on soil parameters, gypsum or super Phosphate and not the expensive alternative NPK: proposed

Professor Heinemann: a lead author of the International Assessment of Agricultural Knowledge Science and Technology (IAASTD) concludes:

“ We need more than Agriculture, we need Agricultures – a diversity of practices for growing and making food that GM does not support; We need systems that are useful, not just for profit making biotechnologies – We need systems that provide a resilient supply to feed the world well.”

There are some frightening statistics provided by the FAO. For example, for the 10,000 wheat varieties China had in 1949, only 1000 remained in the 1970's.

In the United States, 95% of cabbages, and 91% maize, 94% of peas and 81% of the tomato varieties cultivated in the last century, have been lost.

GM and the control of seed, through patents, not only: restricts a farmer's choice, it also necessitates his having to purchase next seasons seed crop. No longer will a farmer decide what and how much he will grow by retaining farm seed material for next season's requirements; a fundamental right down through ages. That is how Agriculture progressed. An individual's rights, regarding cultivar yield, soil adaptability, disease tolerance and grain quality, are not the only issues. It is one of, **patent rights and chemical dependency for MONEY ALONE, that threatens the life of: plants, animals and humans, through the destruction of soil fertility.**

India must wake up to her true Agrarian destiny, that the Ancients had envisioned so long ago. India's seed bank built up over thousands of years must at all cost be protected. They represent the true "CROWN JEWELS" of the Nation. Protection can only come through the banning of G.M seed material.

There is a big Opportunity for both the Miners and the Farmers to join hands to help each other. These are two great essential industries that are and have been forever, geologically, Brothers and Sisters. The Mine is a generator of economic activity. The Mines have expertise in water and energy management and they also have heavy earth moving equipment, that can be mobilized at the district level for building check dams etc.

In Conclusion: the activities of the Co-op would be based on the following philosophy and including the list below of various activities.

To help bring together both Nature and the best of Science.

The following key bullet points must be considered.

1. Farm Debt counseling to help reduce suicides.
2. Use natural symbiotic methods as much as possible to help reduce freight and material costs.
3. Employ sound Science to maximize soil/crop productivity.
4. Understand and apply Trace Elements at correct rates.
5. Adjust soil pH levels to maximize nutrient uptake, where advised.
6. Increase farm trash/compost/green leguminous manure crops, as much as possible.

7. Adopt Nitrogen fixing plants into soil rotation schedules.
8. Inoculate seeds before sowing, with active species of specific culture.
9. Revert to proven multi-crop combinations, to minimize pest and disease build up.
10. Adopt active predator/pest control methods with low power, short duration chemicals.
11. Be aware that insecticides are harmful to bees. Only spraying when the bees are at rest in the evening.
12. Encourage bees both for honey and crop setting, even peanuts give at least 7% yield increase before entering the soil.
13. Adopt contour tillage of the soil to retain rainfall and prevent erosion and the loss of essential soil fertility from the fieldso use India's advanced Bio-Technology, to help bring about massive soil improvements, through Nitrogen Fixation, mineral mobilization and crop productivity enhancement schedules.
14. Make full use of the large volume of available research and brain power available at State Agricultural Universities and Colleges.

Capitalize fully on the knowledge base of Teri, ICAR, and organizations like the M.S.Swaminathan Research Foundation at 21.

Combine the science and the symbiotic contribution of nature at both levels of scientific technology, using high and low level input methods, incorporating: Algal Ponds - Aquatic proteins of diverse sources, vermin-culture and bee keeping etc.

Establish soil testing Laboratories.

Establish tissue Culturing Laboratories. Rhizobium inoculums, crop-specific cultures in remote areas.

Quality vegetables seedling nurseries, supplying strong and healthy growing materials, eliminating the most critical phase of plant growth, at a central, controlled environment, to maximize: farm profitability.

Trace element status needs defining, followed by crop NPK balance restoration, adopting rotation sequences to give sustainability; matched with: clean, disease free, seed material.

Supply cattle licks which include: trace elements, salt, urea and molasses.

Supply organic sprays for control of pests and fungi. Focus should be on natural controls, rather than chemicals, where ever possible.

Supply of proven trickle and spray irrigation equipment to match water quality parameters.

Organizing and constructing small water bunds to help charge the ground water reservoirs.

To: discuss with the village Panchyat, the development of the Gomala lands. Removal of all thorny growth and introduce better adapted perennial and annual fast growing species. Water sprinklers to provide new pastures,. To: organize strip grazing of cattle with movable electric fences.

The CO.Op is to be paid a small management fee so as to recover some of the costs.

To: make available regular vet clinics to establish, MILK quality, (no TB or Mastitis problems), and generally engender up-grading of animal health and welfare.

Become involved with bulk storage and transport of crops, both refrigerated and un-refrigerated.

Acting: on behalf of farmers to sell crops at the best available market prices.

Acting: as a broker for crop insurance and crop loans.

Study possible local processing of some crops. Example: Being the processing of dried tomatoes. (The present retail market price in Bangalore of dried tomatoes in oil is R300 per 100 gms)

Set up an advisory crisis service for farmers that may have run into financial difficulties. The service is to be run by retired, educated Business and Professional people.

Urgently assess Iron, Zinc and Iodine deficiency in the local population.

Resolve the issues of safe, clean, fluoride-free, drinking water etc. and initiate remedial action. Technology from Scalene in Bangalore is available that will remove both Nitrates and Fluoride.

Carry out a mineral deficiency audits on school lunches.

To study globally and in India, all available technologies that can help uplift the people living in proximity to the mine. An example: being the Gates Foundation work, on dry toilets and the use of Human waste for fertilizer purposes.

Build public toilets and BIO- GAS plants to take both human and animal waste.

Encourage the factional leaders to become our business partners in local business opportunities that will develop as a direct result of the mine. Explain fully the financial model of the mine and how “killing the Goose that is going to lay many golden eggs,” is not an intelligent thing to do.

Incorporate local NGOs in some of the activities in support of the Co-Op such as: running public toilets and bio-gas plants, the setting up of a blood banks and managing ambulance services.

Computer Training for village children, to be carried out by our Sacred Trust Foundation.

The attached paper below, by Stuart Newton of the Australian Indian Rural Development Foundation (AIRDF) fully explains in technical terms what are the problems facing Indian food production. The Government has failed to fix this problem. The opportunity today for private enterprise to step in and partner with Agriculture is unlimited, but the Government must first of all encourage and facilitate the private sector through sensible taxation incentives.

PUTTING THE TRACE ELEMENT TOPIC INTO PERSPECTIVE

Stuart R.J. Newton B. Sc. Botany

The World Health Organization in 2002 published the human component of just a few the Essential Mineral Elements, long known to maximize plant growth and productivity. Fundamentally **no** crop when grown in deficient soils can do other than continue the process. Only Man is able to turn around these inadequacies; the knowledge and capacity exists. It's only the Will to bring about ***serious change that is lacking.***

Looking at the global situation : - there are some 800 million malnourished individuals with protein and energy deficiency.

3 billion known to suffer from one or more mineral deficiencies.

53% of child mortality within the first 5 years is attributable directly to mineral and Vitamin deficiency.

Globally about 2 billion suffer from Zinc deficiency and another 1 billion suffer from Iron deficiency, with debilitating side effects ranging from mental and learning

problems, to lassitude, physical weakness, low birth weights and poor life expectancy.

India's vast agricultural alkaline clay soils, compound the Iron deficiency problem. The Iron problem has never been seriously resolved. Consequently India has the largest population of Iron anemic inhabitants in the world, some 86 % of her population.

800 million people globally are known to be deficient in IODINE, including 300 million with Goiter and 20 million with **permanent brain damage**. Again W.H.O includes India in these figures. Iodized salt is a **cheap and simple** commodity, to place into mass circulation. (1.5 pounds of Potassium Iodate to 1 ton of common salt.) The worst manifestation of Thyroid mal-function will not occur, if iodized salt is consumed daily.

A Government program, to provide iodized salt in free school lunches and the education in its importance; have met varying success depending on the State.

Iodine acts on the Metabolic Growth Control mechanism of the body and this applies to both humans and livestock. As cattle licks seem to be non-existent in India, one can surmise that this deficiency will be found in Indian cattle and sheep.

Nature is essentially a balanced complexity, from which we must start to take note of and learn from. One needs to have the eyes to critically observe and the mind to question. Sadly the soil beneath most individual's feet is frequently excluded from these observations.

The widely acclaimed Green Revolution with its single focus approach, served the immediate needs of yield increase, but fundamentally, disregarded the collective soil and mineral relationship, both major and minor, and the narrowing of the crop base, and its dietary impact on the vital essential amino acids needed for human life. The consequences are still with us today.

Unfortunately this opened the flood gates, to an uneducated, mass of farmers who were not aware of: the technicalities of modern agricultural chemicals, the mode of action and the long term residual repercussions. This overwhelming impact, on an under developed technical extension service, and a poorly coordinated Public Health department, is still being seen today, "**if a little does good, more must do better**".

The recent banning of India's Table Grape exports from the European markets, is a classical example of the lax supervision of Public Health matters and overuse of pesticides. Incidentally the viticulture industry is universally the single largest user of Agricultural Chemicals, over all branches of crop production, throughout the world.

During the period of the Green Revolution there was the failure to coordinate, implement and modernize grain storage, and other spoilage prone agricultural produce. This wastage has been allowed to continue season after season

The FAO 2005 “Fertilizer use by crops in India” report, although very informative, in quantities applied to differing crops across the various district of India, nevertheless indicated a lack of knowledge and understanding, regarding the soil types and specific crop interactions. Again it was apparent, research had not progressed to defining efficient utilization of the costly major elements, Nitrogen, Phosphorus and Potassium (NPK). Similarly the growth advantages arising from correctly matched trace element supplements, to soil needs, is still to be defined. The report comes across very much as a routine statistical data compilation, with little substance, which appears only at the end of the report, regarding the need, for Indian sourced, quality materials being formulated and marketed in quantities, suited to India’s small plot farmers, who **desperately** need to apply the **correct** combination of Trace Elements for his soil. Similarly there are massive freight demands for additional fertilizer inputs, to meet India’s projected crop demands for sustaining a growing population. Likewise the Report, emphasizes the coordination necessary to achieve storage and handling of both fertilizer and produce, without the present waste factor and delays.

Takkar PN, Sing MV, Ganeshmurthy AN (1997)

Micronutrient deficiency & Fertilizer requirement by 2025.

Proceedings of National Symposium on plant nutrient needs, supply efficiency and policy issues (Ed Kanwar JS, Katyal JC NAAS New Delhi 1:218-224

This article was highlighted in the book Micronutrient Deficiencies in Global Crop Production by Prof B.J.Alloway,University of Reading; Chapter 4 covered the India situation, edited by Mala V Singh pages 93-126.

The introduction claimed, that by the year 2025, India will need to apply 324,000 tons of Zinc, 130,000 tons Iron, 11,000 tons Copper, 3,900 tons of Boron and 22,000 tons of Manganese, as fertilizer supplements annually, for at least 2 years, until studies resolve, soil persistence, plant uptake and yield interaction.

MV Singh as the All India Project coordinator Micro Nutrition India Institute of Soil Science (ICAR) 2008 Bhopal, has published a comprehensive and very informative, series of State, district maps, designating areas of low, moderate, and high levels of some of the diverse minerals which are under review.

Within Academic and Lay circles, the question of plant nutrition is one of intense debate, with some promoting the organic route and others objecting, contending that India cannot afford the luxury of the organic pathway, as production will fall and people still need to be fed.

What is needed, is a bringing together of both options with the best science prevailing.

An excellent example of this, is in the Shimoga District of Karnataka where you had a trial, of a 30 year, continuous cropping of Sugarcane, on a 1 acre plot, that epitomized nature's symbiotic contribution. The farmer in question was awarded an honorary doctorate. The late: Dr. Profulchandra, and all of India's academia, paraded through the field, and failed to see the obvious beneath their feet, or to question, the role of micro-flora and the diverse nutrient inputs from bio-gas waste, and the NPK supplements to speed trash recycling, and the heavy annual lime and earthworm. incorporation. It was the routine doubling of India's nationwide, sugar cane yield figures that caught their attention. They failed to appreciate the magic component, was none other than the high natural plant Silica, acting as NATURE intended. A new trace element, suspected by Japanese researches from early 1930's, contained within the leaf litter and religiously retained in-situ. This meant the minimizing of off farm mineral losses, whereas the soil micro-flora (bacterium) that mobilized the crystalline silica, into a soluble, plant available item, escaped their attention.

The diverse organisms operating in the root zone, that actively mobilize metals, first came to life in an American citrus nursery seedling beds, in the early 1930's. Methyl Bromide gas fumigation (a total sterilant) for fungal control induced a Copper deficiency where none previously had existed. Nature was showing the way, but man had totally ignored the obvious.

Again nature's unseen micro flora, and the humble farm yard compost heap, has shown clearly the important role in speeding up the massive mineral mobilization and uptake needed to transform India's degraded farm lands. The organic, plus mineral fraction is given a rated 50 -75% boost to just mineral supplementation alone, unfortunately its not specified, but one would assume a pH level in the 6.5-6.8 would be the desired balance.

Universally farmers prefer to employ leguminous pasture and crop plants, to restore soil fertility. Nature has supplied this highly specialized and symbiotic interaction of Bacteria and plants root hairs, triggered by Calcium, Molybdenum and Iron. Effectively free atmospheric nitrogen is taken up and converted into plant usable Nitrogen. Whereas: India has a Government and Industry fixation, on UREA, Nature can do it for **free**.

Depending on plant species, climatic limitations, soil types, duration of the growing season and appropriate levels of the above mentioned trace elements, over sea's researchers, report in terms of 1, 2, and 3 hundred Kg/ha/year of **free** Atmospheric Nitrogen being added to the soil fertility equation annually.

UNDERSTANDING FERTILIZERS AND WHAT THEY DO:

India's focus on UREA, is typified by the 2007-08 Fertilizer Distribution in Kurnool District, Andhra Pradesh. This shows an irrational and wasteful use of valuable imported materials.

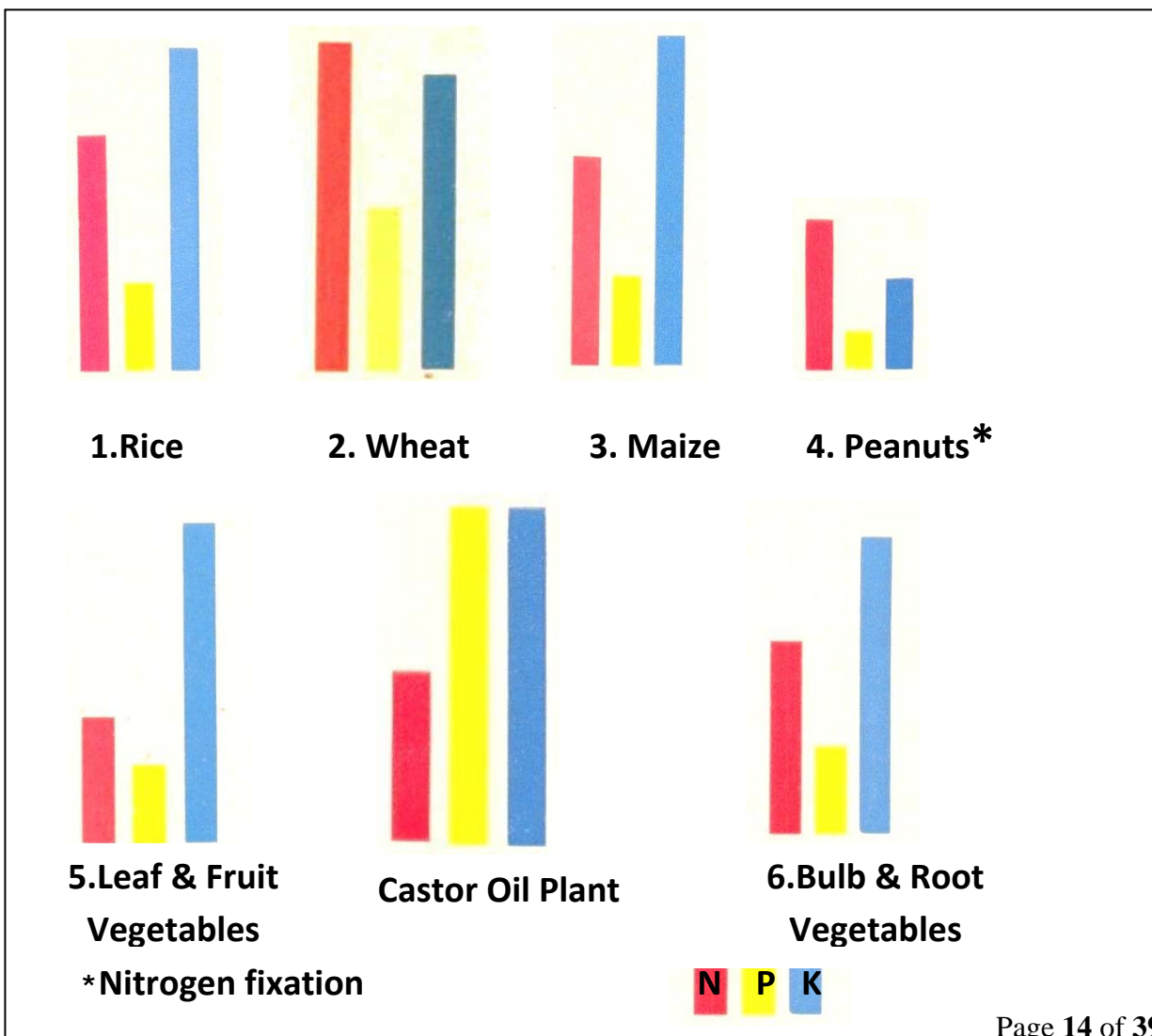
Urea *	99,895 mt*
Di-Ammonium Phosphate	57,918
Ammonium Phosphate 20:20	42,824
10:26:26 (N:P:K)	19,318
14:35:14 (N:P:K)	18,025
Ammonium Phosphate 28:28	17,281
Muriate of Potash	16,949
Ammonium Phosphate 16:20	12,686
19:19:19 (N:P:K)	5,644
Single Super Phosphate ##	4,146
17:17:17 (N:P:K)	1,401
Ammonium Sulphate	1,225
12:32:16 (N:P:K)	881

The Year is 2007-2008 Season **makes no mention** of Trace element incorporation. There is obviously an urgent need for Science and Industry to **talk**. The above usage shows no comparison for what is needed for crop production.

The chart shown below was extracted from Deutscher Kaliwerke gmbh Hanover, Germany 1950. This shows Nutrient Demands by Crops, expressed in Kg/ha. The full List has 32 crops Identified around the world (tropical plantation crops) but limited to 6 in this presentation for ease of comprehension. It clearly shows that the Kurnool figures as shown above have failed to meet the required standards.

	N	P	K
Rice crop yield 2,500 kg/ha	55	20	75 kg/ha
Wheat	40-80	40-80	60-120
Maize	98-120	50-60	125-150
Peanuts 1800 kh/ha	90*	25	120
Tomatoes 40t/ha	110	30	160
Onions 30t/ha	80	40	120

The above data records only the major nutrient levels extracted from the soil, for these specific crops. Unless this destructive process is reversed and minerals actively replenished, after the harvest, the land and farm productivity areas in **negative** balance. The following color chart indicates the N P K requirements



Peanuts is the exception given that the correct Rhizobium for Nitrogen Fixation (p20-21) it will produce this quantity itself. Castor Oil plant is unusual with its high P&K needs.

For the Layman accepting UREA=Nitrogen and **only** Nitrogen; if we use the example of onion growing, a 30t/ha crop will consume, 80 kgs of Nitrogen, 40 kg Phosphorus, and 120 kg of Potassium. The question is, WHERE does the crop obtain the other required elements. **Obviously**, it can only come from the soil reserves, which has to make up the deficit. HOW long can this be maintained?

Simple book keeping of Indian soils, explains the reason behind India's endemic declining yields and non responsive soils. The soils have been **impoverished** by strict adherence to traditional cultivation inputs, attitudes and misguided concepts arising from political and commercial intervention.

The Government supported UREA program automatically puts the land into negative balance, as it supplies no P or K progressively.

The over use of urea is slowly destroying the countryside, with the ill-informed farmers accelerating the process. There is a urgent need to transform technical data into layman's comprehension.

The above 6 listed crop items demonstrate the **actual** differing crop consumption trends. Similar figures have yet to be compiled across India, for the Major Crops by differing soil types. Also it exposes the irrational formulation that has been applied by the manufacturers. If you look at the distribution figures for Kurnool of itemized tonnages, of fertilizer per district, this shows a wasteful use of expensive resources, especially as they are all imported items. High Phosphorus is most definitely not required and the 38:38:38 blends are ill-suited for the districts crops. An aspect covered in the 2005 FAO report.

The example of the Macadamia, an exclusive Australian Nut tree is accorded a pH (short hand expression 0-Acidity, 7-Neutral, 14-Alkaline) range of 5.5-6.5 as its ideal soil environment. But at 5.5 there is a trade off in available Magnesium, Calcium, Potassium, Sulphur, Phosphorus and Molybdenum, that is extractable from the soil, along with a reduction in Nitrogen fixation efficiency. These elements are readily identified by matching Vertical and Horizontal intersection at the 5.5 pH scale. A cropping concept never explained to the Indian farmer who is very much in need of efficient utilization of essential and costly inputs. Refer to TABLE 3 ON PAGE 19 TO VIEW THE DAUBENMIRE SOIL CHEMISTRY REACTION TABLE 3

A soil in the 6.5-6.8 range enables all major and minor plant minerals, to be sufficiently soluble to achieve normal plant growth. Below 6.0 the ***nitrification process is impaired.***

Molybdenum in higher plants, has functions in addition to its role in nitrate reduction. Concentrations of various amino acids are often found to be spectacularly low in molybdenum deficient plants.

The Essential Amino Acids for human development are Threonine; Valine, Leucine, Isoleucine, Methionine, Phenylalanine, Histidine, Tryptophan* and Lysine NB* interconversion to maintain the status quo.

Extracted from E.Baldwin 1959 "Dynamic Aspects of Biochemistry" 3rd Edition Cambridge University Press.

Soil deficiency is one thing, but a narrow spectrum, grain dominated diet is incapable of supplying the full range of essential amino acids, required for normal human growth and development. Nutritional studies report an increase in sub-optimal caloric intake by the rural poor. India is now acknowledged as having the largest population of malnourished Children, in the World.

NATURE AND BALANCE IS VITAL

A) Minerals in the soil

B) Nutrients in the crops and food intake

Sorghum: for example is deficient in Lysine and Methionine, as are most of the millets; wheat and barley are deficient in Lysine and Threonine, and so the story goes on. There needs to be a widening of the food range, which must include legumes, leafy green vegetables, and the coloured elements for enhanced Vitamin intake. Similarly fruit consumption needs to be increased, and only then will nutritional and health status improve. From observing village children invited to finish off the food left over from a gathering, it would appear that correct dietary components needed for human health ***needs, has*** to be taught, as I noticed that the rice was finished off quickly, and the limited vegetable component was ignored. The Deccan Herald Tue 25 th Feb 2014 Prakash Kumar reports mid-day meal schemes are failing in the fight against Malnutrition across many states.

Thus the introduction of any cash earning crop, needs to be reviewed on a superior nutrient status, taking for example the newer developed sweet potatoes for bettering village Mineral and Vitamin requirements, and with any possible surplus being aimed at improving animal nutrition. Many institutes have developed new and better yielding crop elements, but the physical separation of village and research facilities, precludes acceptance of superior items being incorporated, into the village awareness system. Collectively the Dietary needs and knowledge base exists in

India, they just need to be marshaled, so that India's Rural Poor no longer operate in a vacuum.

The world of plants, in-general, occupy a far wider range of soil types than the few species developed by Man for Food purposes. Accordingly the following list was derived from plant tissues were considered as adequate examples of normal growth and nutrient status. The data was extracted from:

"Mineral Nutrition of Plants: Principles and Perspectives" as presented by Epstein E. (1963) after Stout (1961) Copyright 1963 by Academic Press, New York and London

Obviously: different plants species growing in the same soil can differ significantly, according to specific uptake demands and internal chemistry, rendering them the status of being called "Accumulators". Rice and Sugarcane are now known, to be active Silica accumulators, gaining physical advantages in yield elevation and water efficiency etc.

IMPORTANCE OF SILICA. MANY YET TO APPRECIATE THE ROLE OF SILICA

Similarly Ma J F, & Takahashi E "ripening spikelets in rice and barley and pollen fertility in soybean, cucumber, strawberry, and tomato are significantly reduced by the deficiency of Si. These facts indicate that Si may be involved in the process of reproduction, although the mechanism remains unknown" page 189 "Soil, Fertilizer, and Plant Silicon Research in Japan" 2002 Elsevier

TABLE 1.

Element	Dry Matter		Relative No of Atoms with respect to Molybdenum
Molybdenum	Mo	0.1 ppm	1
Copper	Cu	6 "	100
Zinc	Zn	20 "	300
Manganese	Mn	50 "	1,000
Iron	Fe	100 "	2,000
Boron	B	20 "	2,000
Chlorine	Cl	100 "	3,000
Sulphur	S	0.1 %	30,000
Phosphorus	P	0.2 "	60,000

Magnesium	Mg	0.2 "	80,000
Calcium	Ca	0.5 "	125,000
Potassium	K	1.0 "	250,000
Nitrogen	N	1.5 "	1,000,000

It must be emphasized that Table I has been tabulated to show, the general sequential magnitude of plant growth elements, matched against Molybdenum, obviously an item in least demand, but nevertheless vitally important for efficient Nitrogen fixation. Ideally farmers should be encouraged to efficiently restore soil fertility by using bulky local Leguminous plants, such as green manures, pH adjustment and appropriate trace element supplements should be matched to local soil needs, along with crop specific inoculum.

Substantial investigations have been conducted by American researchers, where Boron is the single most widespread deficiency across the country. Geologically, tropical South East Asian soils are prone to widespread Boron deficiency. India is reported to be importing limited quantities of commercial packaged SoluBor from England. Unfortunately on the local scene Boron is encountered as a complex of silicates and aluminates, in rocks such as Tourmaline, and as such presents future availability and supply problems.

Agricultural chemistry emerged on the scene in the 19th century, along with the advent of artificial fertilizers. The Trace element contribution commenced with Boron being identified in 1910, Zinc 1914 and Manganese in 1922 etc

TRACE ELEMENTS – items are listed in the ppm section of Table1

As the name implies Trace elements are essential at the appropriate levels, determined for general use. Excess levels can be toxic. As an example, Copper Sulphate is an effective algaecide in eliminating algae from small dams, employed for trickle irrigation, where excessive filter blockage is occurring. (Remember to double check, as anything soluble added to water, cannot be retrieved.)

The same applies when adding small quantities of minerals uniformly to the soil. The Australian experience used single strength Superphosphate as the carrier. This is a far better and cost effective mode of application, rather than an Indian suggestion, of incorporating them in expensive NPK formulations. Given the preponderance of small plot farmers, with limited means, the cheapest carrier should be adopted along with small scale packaging of the fertilizer to suit the size of the small scale farms. India has a booming liquid formulated Bio Fertilizer Crop Booster trade, promising a host of plant benefits, but many of which are dubious nature.

ICI commenced its financial evolution by supplying synthetic Ammonium Sulphate to the farmers globally. The yield increases had everyone pleased, which was similar to the Indian Urea experience. Again it was only after prolonged use, that farmers observed nutrient imbalances and deficiencies, caused by excessive soil acidity. I personally had the experience of turning around a citrus orchard with a 30 years plus, continuous history of Ammonium Sulphate application. This induced a progressive deterioration in the soil and its microorganism content, until finally the soil reached practically sub-growing levels of pH 4.5.

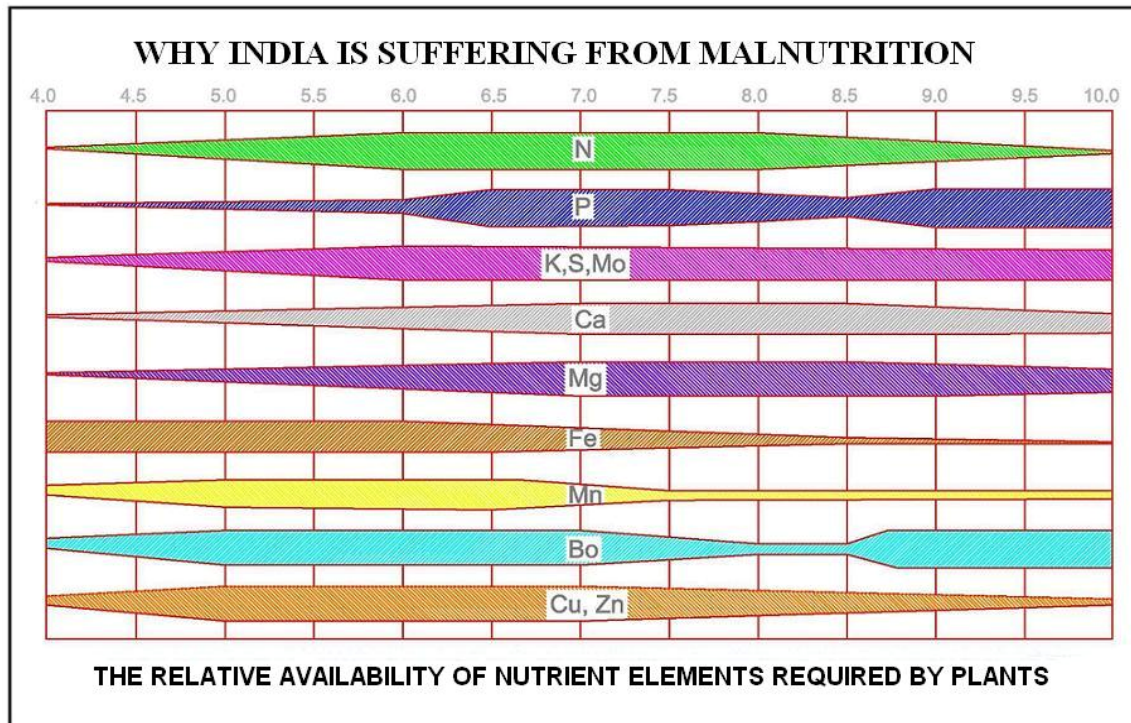
Soils are derived from the weathering of parent rock by a combination of chemical, rain, solar, and mechanical influences, together with the evolving micro-flora, be they bacteria, algae, protozoa, fungi and lichens etc. Then there are the more violent forces of nature that metamorphose, transport and rearrange the previously orderly topography into what now exists.

This is where Geology comes into play with all the combinations and permutations, impacting rocks, and their mineral composition, in turn influencing the type of flora, and the resulting cumulative organic matter, along with the contained biotic species and the ever present fundamental chemical reactions of life, Acid – Neutral - Alkaline.

The Inorganic world of rocks and complex soil elements, required to sustain plant growth have been presented earlier in this article. One needs to now appreciate the differing reactions of specific elements, in a soil's soluble environment, necessary for plant utilization, and the ongoing transition from basically an Inorganic habitat, into an Organic entity. Here, the constancy of environment and "growth", becomes a series of chemical reactions, including step-wise conversions of intermediary products, derived from Photosynthesis, where energy and enzyme powered reactions are largely the domain of trace element metals, accelerating reaction rates.

Table 3 below is extracted from Daubenmire RF 'Plants and environment' modified from Truog, Copyright 1947 John Wiley and sons, which clearly shows the relationship between the soil pH and the mobilization of the trace elements.

Table 3 Soil pH



The above diagram simplifies the mineral availability response of both Major and Minor plant growth elements, as impacted by fundamental chemical reaction responses in ACID SOIL on the extreme left, through to NEUTRAL (pH 7) in the centre and on to increasingly ALKALINE on the far right.

From Table 3 it is apparent that maximum availability for ALL ELEMENTS occurs around pH 6.5-6.8. What needs to be emphasized, is that NITRIFICATION is impaired below 6.0 and above 7.7. Within the nursery trade adjustments are made to the basic 6.5 – 6.8 levels for known acid or lime loving plants possessing distinctive bloom production, and color, linked to specific soil pH.

A farmer in the West, confronting an excessively acid soils and declining productivity, needs lime, or crushed limestone to bring the soil back towards neutral. There, test plots of using differing rates of application are used to evaluate soil/pasture response.

Around the world the problem of intensively cropped soils, under indifferent management, has produced a progressive decline from the ideal level of 6.8 into the sub 5.0 levels of impaired nutrient efficiency. The Calcium derived material is

the foundation upon which all plant cell walls are constructed, and it is the stimulus in the pH regulated, curling of root hairs in the encapsulating, nitrifying Rhizobium. This is but a small part of the intimate relationship between soil micro-flora and efficient plant growth.

SOIL TESTING pH IS THE START OF SOIL IMPROVEMENT

India with its mis-guided reliance on Urea and abandonment of traditional Nitrifying Crop rotation systems has compounded the problem of her abused, organically depleted soils, frequently exhibiting 2-3 deficiencies of the Intermediate and Major class elements. This emphasizes the importance of employing Chemical Testing of India's diverse soil types and matching them to the major crop needs, over all major production areas.

Quality seed appears to be a real problem in some areas. We have observed excellent healthy Peanut plants developing, while only a few kilometers away, the peanuts had a heavy virus load. The Soybean 40,000ha scam the Deccan Herald records, about Oct 2013, is an example of bad seed distribution.

The FAO 2005 "Fertilizer use by crops in India" identifies an unusual farmer's response that has Northern Districts being more heavily fertilized than the South. Another aspect, that highlights the possible limitations in the use of Rhizobium, is due to poor carry-over and survival within Indian soils. The basic flawed recommendation is to employ more Urea with pulse crops.

Similarly the main oil seed crops are given as Rapeseed and Mustard with an area of 6.0 million ha and using 3.4% of India's fertilizer consumption for the 2003/04 season. This gives a computed average, of 69.kg/ha N, 25.0 kg/ha P₂₀₅ and 2.9 kg/ha of Potassium?

Further into the report, Groundnuts are noted as being third in ranking of India's oil crops, yet it is recorded as occupying 6.6 million ha and consuming 2.9% of the same season fertilizer production. There is an interesting and subtle distinction for Irrigated and Rainfed crops, receiving differing rates of fertilizer, respective 118 kg/ha and 67.2 kg/ha. Again this is an expensive over use of artificial Nitrogen, with absolutely no mention of Calcium, Sulphur or Rhizobium contribution, on impacting yield and oil content.

NITROGEN Deficiency is the most dramatic deficiency of all, causing stunted growth, and chlorosis, with the internal mobilization of stressed nitrogen from the older leaves into the newly emergent active growing tissue. In simplistic terms, leaves, their normal development and pigmentation arising from Iron and Magnesium association are fundamental to plant growth. Sunlight, leaf chlorophyll and Carbon dioxide and the resulting metabolic transformation, into protein, amino acids and carbohydrates etc, is but a more advanced level, of the spark of life.

The fixation of Nitrogen by micro-organisms, therefore ranks with the assimilation of CO₂ by green plants and their accumulation of Potassium from micro-molar solutions, as one the most remarkable instance of chemical acquisitiveness of the biosphere. Nitrogen fixation in Nature, completes the exercise at temperatures of 30– 35 C and 0.2 -1.0 atmosphere (ambient pressure), while Man on the other hand has to employ temperatures of 450 C and pressures of 250 -1000 atmospheres to achieve the same end. The costs involved in Urea synthesis and the other slow release urea-formaldehyde formulations variants can be significantly reduced if Indian farmers were educated as to how Nitrogen fixation works in nature?

Understanding of the Legume-Rhizobium system, was the breakthrough with Ammonia, the first recoverable product of nitrogen fixation, and attendant enzyme nitrogenase. This subsequently proved to be a complex of at least two enzymes one a Molybdenum–Iron protein and the other an Iron protein and a hemoglobin component now called leghemoglobin. This is to help science come to understand the Nitrogen fixing process and the time frame not concern with layman's understanding

Ref: Carnahan J.E. et al 1960 "Nitrogen fixation in cell free extracts, of *Costridium pasteurianum*". *Biochim Biophys Acta* 38; 188-189 And the Evans group 1968 Klucas R.V. et al "Purification and some properties of the nitrogenase from soybean (*Glycine max*) Nodules" *Plant Physiol* 43:1458-1460.

Cobalt is a known as a requirement of free living nitrogen fixing organisms, hence its inclusion as a trace element. Also it's a vital nutritional precursor in rumen flora, especially cattle, facilitating Vitamin B12 synthesis and animal well being. Pasture top dressing is an annual schedule in New Zealand's deficient soils for weaned livestock acquisition of the vital element. Alternatively: a solid Cobalt supplement slug and bulking component are inserted orally, into the gut of each animal.

Organic compound of nitrogen are transferred to the plants vascular system, are mainly amino acids and amides predominantly ASPARAGINE and GLUTAMINE. Pate J.S. et al 1965. "Nitrogen containing compounds in the shoot system of *Pisum arvense*. The significance of amino acids and amides released from nodulated roots" **Ann. Bot N.S. 29:475-493.**

The sequence of Compatible plant inoculation (1) Development of root hairs (2) Build up of appropriate bacterium in proximity to root hairs (3) Curling of root hairs (4) Development of infective threads (5) Nodule formation. Break the sequence and all fails in the time growth reaction.

Root curling is pH dependent and for example Alfalfa sativa would not curl at 4.4 but curled at 5.4 which is an acid sensitive step. It is very important to keep this chemical reaction in mind, when reviewing the Indian research findings, reporting sub-optimal Nitrogen fixation rates, as per below figures. The latest 19 page Organic Farming, TNAU Agritech Portal has an informative table shown below.

Host Group	Rhizobium sp	Crops	N fix kg/ha
Peas	R.leguminosarun	Green pea, lentils	62-132
Soybean	R. japonicum	Soybean	57-105
Lupinus	R.lupine orinth'.	Lupine	70-90
Alfafa	R. mellitoti	Lucerne	100-150
Beans	R.phaseoli	Bean	80-110
Clover	R.trifoli		130
Cowpea	R.species	Groundnuts	57-105
Cicer	"	Bengal gram	75-117

Studies on Nitrogen Fixation by Groundnuts at ICRISAT by P.T.C.Nambiar and P.J. Dart

NODULATION

"Surveys in farms in the southern states of India showed considerable variation in nodulation with 52 out of 96 fields surveyed having poor nodulation". The conclusion is that yields can be increased by better Rhizobium and higher cell counts per seed, and the avoidance of shading by tall millet, maize or sorghum, reducing photosynthesis. Nodule numbers were given as 247-628 per plant but there was no farmer friendly information being given regarding the internal colour of the effective working nodules, which need to be a Red-orange in colour, while ineffective ones are white or green. I believe Molybdenum deficiency, which is widely encountered in many Indian soils is more likely responsible. Especially as a major research centre is unaware of this aspect, and the specific role of Calcium and pH in the nodulation process. By comparison in the West "Trifolium alexandrinum" is credited with 270-400 lbs of Nitrogen Fixation /Acre/Year.

The popular view of Urea as the farmer's friend, in supplying cheap Nitrogen for crops, proves false in the face of such natural symbiotic matching of the correct strain of Rhizobium, to the most efficient Leguminous plant, for Nitrogen Fixation and Green manure, considering the prevailing climatic conditions.

Change must occur, as the present attitudes need updating, and the simplistic concept that the Organic way is the only way forward, which is wrong. A sudden switch to certified organic agriculture would have yields declining significantly for at least seven years. What is their stance on Trace Elements etc as they cannot be conjured out of thin air? Rather it must be combination of Nature's Symbiotic, and restorative contributions, matched with sound Science, that is not in conflict with NATURE AND THE ENVIRONMENT. Given the frequency of climate changes and altered rainfall patterns, along with crop genetics and stress, disease tolerances are becoming a far more important local concern.

MAXIMUM UTILIZATION OF NATURE'S SYMBIOTIC ASSOCIATION

The answers to India's agricultural productivity, is not that: of embracing the International, Monopolistic, Corporate, Conglomerate, promotion of chemically dependent GM crops. These crops, if planted in nutrient deficient soils, would become even more expensive failures. India has to restore and nurture her depleted, abused soils and not harm them any further, with dubious chemical overload, which are endangering human and animal health.

The Trace Element issue is now starting to gain momentum. A series of wide spread soil sampling and chemical assaying, in a low rainfall area across Madhya Pradesh and Rajasthan, clearly demonstrated it was not only the shortage of rain that had crops giving disappointing yields. Once the soil deficiencies were defined and addressed the results became positive.

Ref. Ch.Srinivasarao. S.P.Wani et al "Enhanced Productivity and Income through Balanced Nutrition in Madhya Pradesh and Rajasthan Watershed" in Indian J, Dryland Agric Res & Dev 2008 23(2):1-5.

A highly effective trial had farmers apply their regular crop and planting schedules to the land. Superimposed on these sites were the indentified deficient elements as follows: Zinc being applied as Zinc sulphate at 50 kgs/ha, Sulphur as Gypsum at 200 kgs/ha, Boron as Borax at 5 kgs/ha. While the unenlightened farmer operated with their regular soil dressing (FP= farmers practice) of Nitrogen 30 kgs/ha and Phosphorus at 60 kgs/ha Most significantly all, the soils were ALKALINE. Checking the Daubenmire table would have had one questioning the status of Fe(Iron), Mn(Manganese) and Cu(Copper), especially as Zinc and Copper share the same availability pattern, YET Zinc was accorded 50kg/ha application rate. And the alkalinity would suggest Mn would be even more suspect than Fe in these soils?

RESULTS

Site	FP (N/P)	Plus Trace elements	Yield increase	Crop
(A)	2100 kg/ha	3360 kg/ha	60 %	Sorghum
(B)	400 kg/ha	700 kg/ha	75 %	Soybean
(C)	1120 kg/ha	2000 kg/ha	79 %	Soybean

The message emerging is that Farmers need to be much better informed about their soils and their needs, to improve crop yields. Poor knowledge transfer, to illiterate farmers requires a SEEING is BELIEVING, approach, along with direct participation. There is a need for a comprehensive change in the established mind set, if rapid changes are to occur in crop productivity, across the country.

The advantages of micro-flora impacting the rhizosphere and mineral mobilization, is a very important aspect of long term soil fertility. When reviewing the above data and the foregoing discussions of Nitrogen fixation, and the role of Nodule formation, and given that Soybean is the foremost Legume in agricultural production. How much more productive would it would have been, if they had given due attention to the known specific requirements of Soybean? Note that there is no mention of Legume inoculums being used and no mention is made of the: Iron, Molybdenum. Manganese and Copper elements. Molybdenum and Iron are fundamental to the whole nitrogen-fixating issue. If you refer to the Daubenmire chart, Table 3, the trace elements in short supply are clearly shown. This trial could have been far more dramatic and productive, if basic scientific research results had been used.

Maize genetics and GM cropping schedules are no longer sustainable agricultural options. Especially: as European plant breeders have improved Maize yields, without the massive reliance on crop protection chemicals or herbicides. These chemicals and seeds underwrite the entire USA Maize Industry, in a mutually inclusive monopoly, that is being promoted as best serving the world's need for increased grain yields. Truth is an early victim.

The Europeans have demonstrated their approach is more nature friendly, by reducing the chemical overload on the environment, especially the Herbicide impacting the soil and its beneficial organisms. The Deccan Herald Wed Jan 29th 2014 had a very pertinent article written by Colin Todhunter "Health dangers of glyphosate and implications for India".

Man has made enough stupid mistakes with persistent chemicals, considered harmless, without ever considering the illiterate end user's contribution. The manufacturers cover their liability on every package, with the disclaimer, "if not used as directed etc" e.g., Consider the consequences of Dieldrin and now Endosulfan. One cannot even contemplate, such high tech methodology being applied by the bare legged and back pack farmer, with scant idea of the application rates ever being seriously considered.

India's: diverse, unique habitat, and stress surviving, genetic options, for Maize improvement, is being overlooked, in a rush to embrace US PATENTED varieties. These in the long run are of dubious utility, needing expensive high rates of fertilizers, to achieve the promised yields, when at this time, antiquated grain storage and excessive waste has yet to be resolved.

"Sustainability and innovation in staple crop production in US Mid-West" by Jack A. Heineman et al, International Journal Agriculture Sustainability.

INDIA with her past civilizations, and her historical records are now being deciphered, and they reveal, a superior degree of agricultural development than that, previously believed. Fruiting trees, being highly prized, were developed for annual production and longevity. Large planting pits took care of waste disposal, both by fire and composting, including animal carcass and bones etc. The calcium, phosphate, and offal elements of animal waste, with their SIGNIFICANT input of Trace Elements provided for enhanced growth, and folklore did the rest. Back filling and planting with a long living productive fruit trees, emulates Nature, in-filling voids and maintaining equilibrium. This combined with the vast tracts of virgin forest ensured constancy of unpolluted spring and river waters. The present day Ganges is India's shame and a testament to Man's total disregard of basic personal and industrial disposal technology.

Nature has functioned and persisted in a constantly evolving environment over the millennium, and functions through an association of balances. Only Man, topping the Animal Kingdom, has yet to appreciate: the subtlety of her curative powers or the backlash to his own survival, when pushed too far.

Modern era accounts of districts Forest and Jungle cover, dating from 1820's to the present day, had NATURE progressively raped, with the forests, first being selectively cut for revenue. Then at an accelerated rate for wartime needs, followed by contractor greed and collusion, and finally land for an ever expanding population needing food and fuel, in conflict with a Forestry Department and their degraded and eroded wasteland.

All well documented in “Green beginnings – joint forest management in Jhabua” a Sida and teri publication ISBN 81-85410-67-1 in the year 2000.

The above article covers the multiple causes of soil degradation and low key village restoration, commencing with stopping the free run off, of water, and its erosion effects. This is very much a matter of normal soil conservation fundamentals, of retaining the water where it falls. Restore the plant cover and soil binding roots mass etc, etc, follow nature’s example, with rapid growing annuals and colonizing species, and specially legumes with judicious restoration of top soil etc.

Farm lands in areas given altered cropping schedules with an application of Gypsum and Zn supplements reported that 25-30% of the 800mm rainfall was lost in run off. Simple as it may seem, contour working of the land to retain water, soil and applied nutrients is universally a frequently ignored fundamental in vegetable plots and larger area workings around the world. Indian experience is the same, you can demonstrate better methods for several years, but once you go, the village resort’s to the old ways. Basically they have to approve a consensus adoption, and contribute to their own physical and financial input before progress can be assured.

Unless farm land is flat, and can be easily worked to trap top dressed trace elements prior to rain, the benefits will be lost. A pelletized formulation broadcast onto a contoured rough textured surface is necessary when introducing Trace Elements into general circulation. Alternatively, drilling into the soil, some 10 cms deep, similar to the Australian approach of incorporating the elements into the soil as a pelleted, formulated Super Phosphate (Single strength).

TIMBER

Imported logs supply 60% of the sawn timber and plywood for India, yet plywood plantations are not encouraged. India’s natural forests are regarded as being exceptionally low producers, with annual cubic per hectare growth rates in the 5-7 cm/ha/y range. Due to cattle grazing and human fuel and wood gathering, this precludes litter recycling. While China’s Timber imports are going down, due to a concerted soil fertilizer and trace element, bio/culture backed, lower density, more highly productive planting programs which are something India has yet to adopt. Tree and cultivar hybrids are utilized in trials to demonstrate growth rates, showing figures of 25 +cm/ha/y. What is India’s answer to the stagnation in her Forest Industries? Now the courts have backed removal of foreign species e.g. Eucalyptus and “Acacia mearnsii” by cutting down the trees and digging up the roots, in India’s irrational policy to embrace GM AGRICULTURE, applying herbicides to thorny waste lands as the alternative to promoting CATTLE FODDER green feed plots.

India is now proposing to use her forests and various types of waste lands to rectify the drastic short fall in Animal green feed. The proposal, envisages annual grasses, herbs and leguminous shrubs, trees and vine species, to both fortify the soil and occupy the under-story of the tree canopy. Ideally the shrub and tree species are capable of multiple harvests per season. Unfortunately, being legumes, most contain toxic elements and can only be used in controlled feeding. A frequently overlooked item is the thorny nature of the material and where the forest and waste land occurs in relation to animal numbers. Considering that the forests are not exceptionally productive, and the wastelands are in need of restoration, recommending biological mining, of what is a depleted resource and then the produced fodder being carried to another location, is Very Much Against Natures Recycling principles.

Technically, comparing countries, with similar climatic and cropping technologies is the best comparison, to resolve the vexing and emotional question of the GM hype and promotion. India with years of declining crop yields is ideally positioned to appreciate, what the Canadian and US farmers are now experiencing, which is declining productivity in their highly specialized, CHEMICALLY focused, Maize production. While non-GM Europe, is improving crop yields by natural breeding programs, integrated pest control, and a significant reduction in agricultural chemicals, they now out-yield North America.

A more Nature Friendly, sensible and sustainable approach is the way to go. Focusing on plant improvement to handle changing circumstance of Global warming, altered rainfall, stress factors and disease, while the Americans are locked into a genetically manipulated herbicide TOLERANCE, and not the vital crop parameters.

Nature will not be dominated by man for long. There are now Herbicide resistant Super Weeds on the loose and the biosphere is endangered in ways not previously considered. Look what the abuse of the life saving Anti-Biotic drugs have evolved into, over-time. New Super-Bugs, have developed an immunity to existing drugs. Man's ego out-runs concern for his only abode. The Shimoga "farmer" had a real concern, as a true steward of the lands that came into his hands. He rendered it more productive, ensuring a timber resource and income, while maintaining a sustainable cropping environment, which is passed along to the next generation by following Nature's lead. How many farmers can equal, this proud achievement in present day India?

Lessons learnt from the past, are deliberately ignored by the corporate controlled U.S Agro and Seed Industry. The southern corn leaf blight epidemic of 1971 (NRCC gave warning on genetic vulnerability of Major Crops 1972) showed clearly how dangerous it is, when money, is making the decisions, as a direct result of the 600,000 tons in patented herbicides that the Company is now selling globally. They

have no concern that the seeds are susceptible to disease, even though this debilitating factor was advised back in 1948 as a dangerous line to pursue. Coincidentally: one hundred years early the “Irish Famine” and its consequences were again a natural disaster of a simple Fungal disease decimating another staple FOOD crop, the Potato. India is well advised to reject the USA OVERTURES, and persist with upgrading her genetically hardy Maize cultivars with possibly some European introductions for grain attributes and yield qualities.

Notwithstanding claims to the contrary, there is NO EVIDENCE that GM biotechnology is superior to other bio-technologies. The US has particular ambitions for Maize, where it expects to maintain its global command of the supply, with 55% of world trade. Wheat has lower status at 16% and hence none of the Hype.

Mining with its new ***ethos of social responsibility***, operating as is does in remote or poorly serviced agricultural regions, offers ***A new conduit*** for the local dissemination and introduction of ***fundamental*** changes, that could help reverse India’s present wide spread crop decline and soil fertility problems.

“Micronutrient Deficiencies in Global Crop Production” ed by Prof BL Alloway, University of Reading

Ref: Takkar, P.N., Sing, M.V., Gaheshmurthy, A.N. (1997) “Micronutrient deficiency & Fertilizer requirement” by 2025. Proceedings of National Symposium on plant nutrition needs, supply efficiency and policy issues (ER. Kanwar JS, Katyal JC NAAS New Delhi 1: 218-224).

Ref: FAO “Fertilizer use by crops in India” 2005 World Health Organization 2002.

Ref: “Green beginnings-joint forest management in Jhabua” a Sida teri publication ISBN 81-85410-67-1 in the year 2000

Ref: “Sustainability and innovation in staple crop production in US Midwest” by Jack A. Heineman et al – International Journal Agriculture Sustainability.

Point for Inclusion

WHO 2002 Mineral vit deficiency Iron, Iodine & Zinc

Zinc first identified 1914 as a plant essential, Talk of 1980 as a possible requirement in Indian soil amendment schedules 1996 trial, 2008 farmer plot trials Graphic results

Mental HEALTH PROBLEMS,

Sanstead H H 1991 Zinc as a Public Health Problem Am J Dis Child 145 (8)853-9

“ “ 2000

Black 2003

Prasad A.S 2003 Zinc deficiency has been known for 40 years but ignored by Global Health Organisation BMJ 326 (7386) 40-1.

Zinc is considered the major element responsible for India's adverse crop yields impacting close to 50% of her farm lands. It first came to the attention of European agriculturists in 1914, while in India it was considered a academic research topic, in the 1980's, and only becoming an area of substantial investigation. The new century 2002/3 was the start of Zinc becoming a realized research item. The 2005 FAO report suggested that Trace element need to be reviewed and reliable Quality and Quantities are assured for ongoing farm use., On the human health aspect IT'S EQUALLY ALARMING, Prasad AS 2003 produced the following comment that "Zinc deficiency has been known for 40 years but has been ignored by Global Heath Organisations" BMJ 326 (7386) 40-1. Especially considering its impact on Cognitive and Motor Function impairment in young children. - Sanstead H H(1991, 2000) and Black M M (20

The culture of India extends back many thousands of years, it's a proud record, not only of survival, but one of advancement and sustainability, conducted within Natures symbiotic support systems. It also has its many intellectual and technical firsts to its credit. The smelting of Zinc and the evolution of the Ayurvedic medical system that pre-dates, the Chinese acquisition of essentially many of the same plant species or local equivalents.

Human illness and physical disorders had been clinically described and routinely treated with specific herbal formulations, empirically improved over time. Even today the system constitutes a cost effective alternative within the Indian Government's medical system. Before dismissing the role of medicinal plants, notice that there are many examples, that, they are the precursors of many of today's synthesized Western drugs. E.g. Bayer or Aspirin is an extract of Willow bark.

GLYPHOSATE = ROUNDUP (Herbicide)

Items of News have a short attention span on the world stage, Agent Orange and the defoliation of S.E Asian Jungles, Bhopal and the toxic chemical release, Thalidomide and dramatic birth defects, widening decline in Frog populations, Bees have entered the Equation of mysterious decimation, around the world. The first three examples are all dramatically and instantaneously recognizable by the layman. The other two examples are only manifestation of the long term disruption by low level chemical disturbances of biological systems. These subjects have aroused scant interest among world viewers, only interested in visually dramatic entertainment.

History has a lot to teach subsequent generations especially in regards to interfering with natural processes, where Man has assumed the role of god; in seeking world commercial product domination. Actively hiding behind secrecy disclosure clauses, to prevent full-product chemical disclosure, while at the same time implying that objective peer group reviews, have been undertaken. Avoiding the disclosure of evidence contrary to their claims, they stall while disputing, possible harmful consequences, meanwhile they let the world assume all is well. The Government regulators and Academic collaborators give tacit approval to the disclosed components, stated in studies as being in compliance with testing guidelines.

This Manipulation of the system is an exact rerun of the TOBACCO CORPORATE MANOUVERS in shifting the blame and involving manipulated research funding, to gain the backing of science. While retaining a massive public relations programme to maintain product acceptance, and gain new markets.

Only now with the passage of time is the glyphosate evidence emerging, of wide ranging complex issues, in the field of Human health there some 30 odd alarming disorders many never before encountered in such numbers: gluten intolerance, leaky gut, Crohn's Disease, Alzheimer's Disease, autism, etc., now epidemic in our society. Crossing the boundary between species to include plants, domestic animals, their health and more importantly fertility considerations, as well as impaired soil minerals and micro organisms not responding to scheduled routines of farm production.

India has an active and successful reputation against those seeking to gain commercial patenting of traditional products derived from thousands of years of cultural heritage and village use. Neem and turmeric being a couple of items that opportunistic individuals, sought to patent for their own gains. Now it's time to ask India, what is her stance on Nitrogen derived from the Atmosphere and incorporated by soil organisms and specific minerals, both long established in

Natures symbiotic regimes? Fortified by centuries of tradition involving the cow and her contribution in sustaining, rural life of the nation and soil fertility nationwide, at a time when the population was less numerous. Cow manure, the four-part stomach, and the diverse micro- flora employed to complete the digestion and absorption of nutrients. This is a complex system where soil minerals ex-fodder and the supportive, natural micro organisms assist in Vitamin synthesis and animal well being. Soaking the dung in water for given number of days, is an effective natural worm killing method. The inclusion of ritual proportions of Urine. Milk, Ghee, Jaggery etc. is an alternative source of nutrition for the diverse micro organisms found both within the mix and supplementation of soil components, such as the vital free living nitrogen fixing bacteria. None of these systems could function if India allows Glyphosate loose in the country, as it is both a powerful mineral Chelator and broad spectrum Antibiotic. It was first patented as a chelator in 1964 by Stauffer Chemical Co, and it was patented by Monsanto and introduced as a herbicide in 1974. However the story start's to unravel in the patent office, starting in 2010 where it was registered as an **antimicrobial**, followed in 2011 as an **Antibiotic**. So it would APPEAR it was being used without full appreciation of its broad spectrum impact on the environment for at least 37 years. So much for full disclosure and peer review. The mechanism by which glyphosate disrupts the EPSPS enzyme (5 enolpuruvylshikimate-3-phosphate enzyme) in plants and microorganisms is by chelating the manganese metal co-factor of this enzyme. **The significance of this** is that glyphosate, a chelator targets nutritive cations (manganese, zinc, copper, iron, calcium, magnesium, cobalt etc) in plants, microorganisms, animals, and humans.

Hence our food is less nutritious and the vital mineral component compromised, not to mention all the documented reports of impaired human and animal health resulting from this insane promotion of: TOTAL RELIANCE on a FAILED HERBICIDE and the HIGHLY IRRATIONAL PROCESS OF MAN CONTAMINATING HIS OWN FOOD

Leads us to conclude: In the words of John McHall " The human being has become the most dangerous organism that the planet has ever hosted.

"Plants grown in sterile soil sprayed with glyphosate do not die; **the herbicidal effect of glyphosate is ultimately due to soil pathogens**, gaining access to the weed thanks to glyphosate weakening of the plants by killing of the beneficial microbes by chelation of manganese and other trace elements. This is a very uncomfortable fact for industry and academics beholden to the industry; because glyphosate kills **beneficial microorganisms** and promotes pathogens that lead to **greater disease pressure**". SEE THE SECOND APPENDED ATTACHMENT

- False advertising US 1996 taken to court

- False advertising France 2007 lost case in Supreme court
- Scientific Fraud Two Labs Closed Down 1978 & 2005
- Advancing in South India Kerala tea and coffee plantations, runoff major concern, waterways and biotic diversity
- Glyphosate, use increasing 3-4 passages per growing season, including the artificial ripening of crops.
- Dubious research on toxicity working with pure glyphosate when it is well known that it is the POEA THAT IMPARTS the toxicity
- Phosphorus needed as feed stock around 250,000 tons of phosphorus trichloride. Since 2002, Monsanto's mine in Idaho has been releasing selenium and other heavy metals into the region water ways, hardly a RESPONSIBLE corporate attitude.
- If it ignores its own US laws, what respect would it show to another countries law?
- Very much a case of monolithic global company with power and wealth exceeding that of governments and flaunting that power when it see fit.

Dr Joseph Mercola –INTERVIEW—‘We know that all herbicides are chelators, mineral chelators. That’s how they compromise the plant’s physiology; they tie up a particular nutrient and shut down a physiological pathway. This wasn’t new from that standpoint. But the thing that was different was its **biocidal** effect. It’s not only a chelator, but it’s also a strong antibiotic to these beneficial organisms”

Adoption of the proffered Magic herbicide would KILL NATURE and her restorative symbiotic benefits, vermiculture, cow manure, bacterial activated Free Nitrogen fixation to enhance soil and crop fertility would be **no longer possible. YOU HAVE TO BUY THE FERTILISER from guess who?** Is this the option you want to embrace?

As a consequence of over harvesting from the wild, many species of Ayurvedic Medicinal plants have been proposed for routine cultivation to meet the expanding demands. Thus it becomes a row cropping, vegetable plot concept modified according to plant needs and how much of the plant tissue and what stage of maturation is required to gain the maximum concentration of the desired chemicals components, that impart the desired medical properties? How many of these compounds are trace element facilitated, likewise impacted by soil pH, and what

draw-down is occurring in specific elements? KEEP WELL clear of any run off, of drainage water that could have been contaminated by Glyphosate?

If India adopts GMO and the attendant Glyphosate; the two are not compatible with traditional ways. This is very much a failed and exceptionally dangerous system, being unloaded on the world, as the only way forward to feed the growing population. But the facts suggest otherwise. Who in their right mind would want this DANGEROUS AND DECEITFUL, APOLOGY OF MANIPULATED SCIENCE?

Realistically herbicides are spot sprayed to kill targeted Weeds. **Whereas** the GMO ethos has evolved into 3-4 applications of the herbicide on a broad acre basis, with the final application deliberately targeting the crop to hasten ripening and ease of harvesting.

Thus the actively growing grain directly acquires adverse chemical contaminants, which enter the animal and human food chain.

Food calories are one thing, but contained mineral elements within the human diet, are another; from 1941 -1991 there has been a steady decline of 15-76% (British Ministry of Agriculture)

"The mechanism by which glyphosate disrupts the EPSPS enzyme in plants and microorganisms is by chelating the manganese metal co-factor of this enzyme. The **significance of this** is the fact that glyphosate, the chelator, targets nutritive cations (manganese, zinc, copper, iron , calcium ,magnesium, cobalt etc) in: plants , microorganisms ,animals and humans.

THIS IS A VERY UNCOMFORTABLE FACT FOR Industry and Academics beholden to the Industry , Because glyphosate kills **beneficial micro organism** and promotes PATHOGENS, THAT LEAD TO GREATER DISEASE PRESSURE, --- Industry denies this mode of action but, US PATENT 7,771,736 Issued August 10 ,2010 was for glyphosate as an **antimicrobial—**

One group of beneficial microbes named in the patent directly killed by glyphosate is the pseudomonas microbes. These are soil bacteria: important phosphate **mobilizers and suppressors of pathogenic Fusarium fungi**

Pseudomonas and most beneficial soil microbes have an important function in making soil minerals available for plant use

Summarizing, there is a two pronged mechanism occurring with: glyphosate, trace mineral chelation and pathogen proliferation. These mechanisms have extended consequence. Not only are nutritive minerals directly chelated out of the system, but the proliferation of pathogens effectively converts additional nutritive mineral to unusable form leading to further nutrient deficiencies in growing crops. This process

is occurring throughout the entire food chain as glyphosate residue in food is becoming common. Glyphosate is essentially “rusting away” the fabric of our soils leading to the proliferation of disease pathogens and nutrient deficiencies throughout the food chain.

The widespread weed resistance developing to glyphosate, worldwide is actually resistance development to the pathogens proliferated due to the glyphosate. Higher and higher rates of glyphosate have to be used to produce the desired effect. Blends with other herbicides are commonplace, and in some areas, due to weed resistance, glyphosate has fallen out of favor as a herbicide. *No-Till Farmer*, May 2012 reported, “..at least 21 varieties of glyphosate-resistant weeds have been identified in the U.S.” and “Between 2005 and 2010, the resistance problem mushroomed, with some Midwestern states reporting millions of acres of glyphosate-resistant weeds, mostly marestail and waterhemp.” Worldwide the concern is greater with 357 biotypes and 197 species of weeds now reported resistant to glyphosate. (<http://www.weedscience.org/In.asp>) This in spite of glyphosate application rates increasing from 2 liters per hectare to as much as 20 liters per hectare (roughly 8 quarts per acre) in some areas of South America .

So an actively promoted derivative, by a company producing a war time herbicide, and still retaining a the war time mindset, was manipulated onto the market place, along with the non-disclosed surfactant component, this entering the worlds farming system as a safe, harmless highly-efficient Weed Killer.

Then the concept was conceived, of promoting Genetic Modification to endow Agricultural crops with a whole spectrum of desired attributes.(that never were realized.). Emotive promotion, sold it to the world as being the only realistic solution for saving the world’s agricultural imbalance. It glibly advertised fashionable, radical new technology, in a patented one-stop total package, that just happened to have some basic flaws that were conveniently overlooked.

I have seen rose growers operating close to a lake in Bangalore spraying highly toxic weed killers without any consideration of the drainage ditches connecting to the lake. This is a major danger for India, of allowing often uneducated people to use indiscriminately, highly toxic chemicals. These herbicides are meant to be restricted to a distance 3km away from waterways, because of the harm to aquatic life and the risk to floods extending the contamination into other areas.

Australia in 2011 had first-hand experience of wide spread Flooding in her Bt Cotton and Sugarcane areas routinely treated with glyphosate. Fish kills and wide spread aquatic plant systems collapsed within the effected the river and marine environment, embracing the sensitive marine grasses and the endangered Dugongs and turtles off the Queensland coast, as well as Corals in the Great Barrier Reef. (A World Heritage Site.)

CONCLUSION

The primitive form of slash and burn farming as practiced in the North East is an excellent example of the farming of soil nutrients which quickly exhausts soil fertility and exposes the ground to erosion.

A similar technique has now been adopted by millions of small scale illiterate farmers who have become reliant on one dominant fertilizer, UREA, rather than a balanced approach. This irrational behavior is of false economic thinking and an abandonment of nature's curative ways. Crops will not deliver the expected returns, unless the required nutrients are made available.

An example, a cattle feed called Pangora Grass on average will deliver 23 tons per Ha but it requires the following nutrient inputs, Nitrogen (N) 300 Kg/ Ha, Phosphate (P_2O_5) 110 Kg/Ha and Potassium (K_2O) 430 Kg/Ha.

Without these inputs production of this feed crop and its nutritional value will suffer.

India has to critically appraise what she wants. Data has been accumulating for years and there has been no serious action initiated and the farmer is going backwards. India is at least 40 years behind China and it is no good pointing the blame to others.

The United Nations through the FAO in 1982 took on the task of introducing to the Third World, the use of NPK fertilizers, and as part of this exercise they provided an all important reference to the already known of NPK minerals uptake of nutrients extracted from the soil by the various crops.

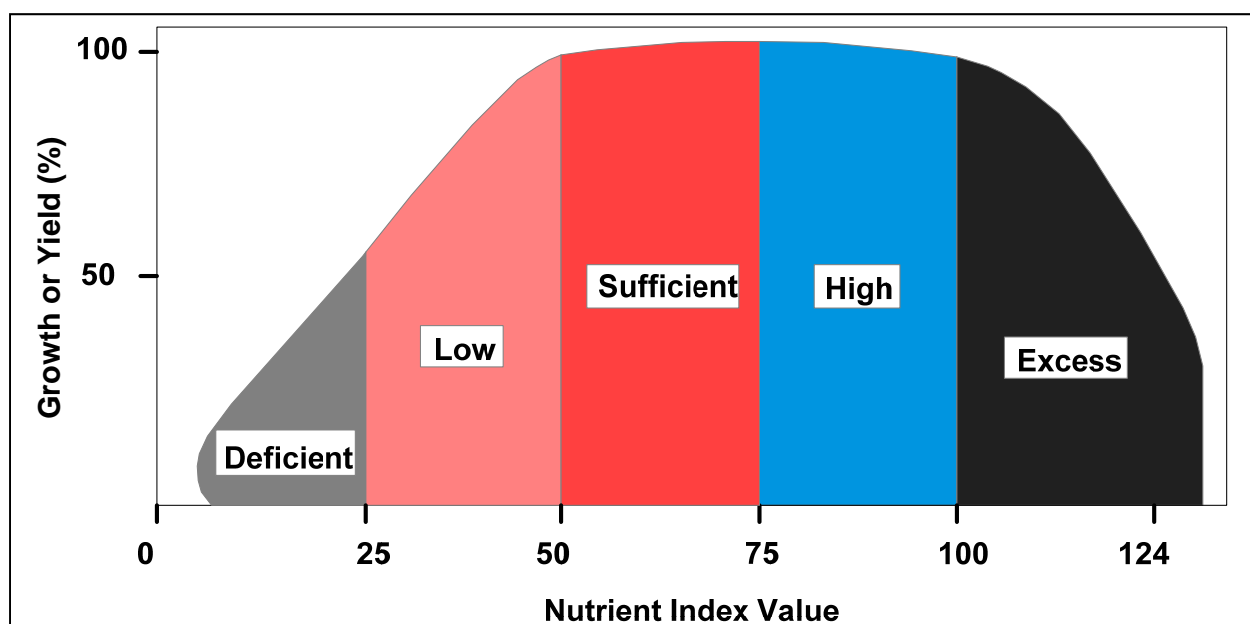
The Indian Government has failed to take note of what science has been saying over the past 100 years and instead has followed an irrational approach of maintaining a policy based on vested interests and the widespread over use of urea rather than a balanced use of NPK. Agriculture works often on trial and error, so it is essential that trial plots are initiated at the district levels to fully evaluate crop nutrient and trace element requirements, so as to convince the local uneducated farmers visually.

The science behind Indian Agriculture has to a great extent been ignored or overlooked by policy makers. Agricultural Science must lead from the front. The 1982 FAO report clearly shows the requirement of the correct levels of NPK uptake for the most widely used crops.

In concluding, the perfect example is of India lagging behind the rest of South East Asia in Agricultural production. The statistics for just two commodities, rice and onion production speaks for itself.

	RICE	ONIONS
India	3.3 tons / Ha	14.21 tons / Ha
China	6.5 tons / Ha	23.07 tons / Ha
Indonesia	5.6 tons / Ha	
Australia	9.0 tons / Ha	

Let us also not forget that long-lived plant, which is described as the staff of life, which towers above one's head, which is the "Coconut". The Coconut is probably the most extracting, soil mining plant of India. The coconut harvest plus all the palm fronds are normally removed off the perimeter of the farm, resulting in a maximum farm mineral depletion. Healthy Coconuts deserve greater input as they are most definitely Silica accumulators. They deserve close attention in nut nutrition and crop setting (3 times a year). Each palm is accorded the national average production of 143 Nuts per palm, in its most productive growth phase. Silica application (in a plant soluble form) at nut setting could result in significant improvements, exceeding existing standards, And especially with older and more mature trees, that may have been mining the soil for at least 40 or 50 years.



India plant nutrition is still in its infancy, in getting across the concept of N,P, K and the complex interaction of macro and Trace Elements that have yet to be run, out Nationwide. The enclosed schematic Crop Yield by Nutrient Concentration Designating Deficiency-Sufficiency Ranges ex Chapman 1967 And the coloured illustration, showing trends arising from supplying sub optimal, through to Sufficient, with the Critical 90 % of CROP genetic Expression Point, to High, to irrational costly Excess

These transition points have been given 0, 25, 50-75 occupying the SUFFICIENT NUTRITION RANGE, the 75-100 Illustrates downward Negative Trend. This is what Indian Research, of Soil and Tissue Nutrients levels has to ESTABLISH, and adopt as a working standard, post haste.

The following Table of NUTRIENT SUFFICIENCY RANGES, by vegetables, is drawn from American Standard just to illustrate the demands made by individual crops.

Especially as India, though producing in Worlds Largest Tonnage of ONIONS, is nevertheless a very insignificant producer on the Tons/ha basis, sadly this a common occurrence right across in Indian Agricultural Crop Statistics. At least the appended list identifies Macro and Micro Elements for Maximum Crop production in both % terms and ppm . For example the specific Sufficiency Range for Capsicum .Broccoli and Cauliflowers are given in COST Effective elements, not something guessed at trial and error assumptions.

The fine detail contained in the following Table of Nutrient Sufficiency Ranges, tabulated below reveal that Sulphur demands as specified in quantities given in Percentage Values for Capsicums, Broccoli , Cauliflowers, Onions, Corn(Maize) , Peanuts and that other oil plant, the Soybean is not being satisfied by traditional Indian growing inputs.

The massive browning and dark spotting of Cauliflower curds, the cause of so much trimming, as a look good hide the reality is very much a Sulphur deficiency /bacterial field infection due to sub optimal cultural inputs in both growing of the crop and less than perfect post harvest handling techniques.

The importance of Calcium to Tomatoes only becomes obvious when blossom end rot appears on the fruit, likewise India tomatoes are FLAVOURLESS due to ill matching N:K Ratios , ideally 1.8 value.

NUTRIENT SUFFICIENCY RANGES

	MACRONUTRIENTS (%)						MICRONUTRIENTS (ppm)					
	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu	B	Mo
Capsicum	4.0-5.0	0.3-0.5	5.0-6.0	0.9-1.5	0.35-0.6	0.3-0.6*	20-150	30-100	25-80	05-10	20-50	
Broccoli	3.0-4.5	0.3-0.5	1.5-4.0	1.2-2.5	0.23-0.40	0.2	40-300*	25-150	45-90	05-10	30-50	
Cauli flower	3.0-5.0	0.4-0.7	2.0-4.0	0.8-2.0	0.25-0.6	0.6-1.0*	30-60	30-80	30-50	05-10	30-50	
Carrot	1.8-2.5	0.2-0.4	2.0-4.0*	2.0-3.5*	0.2-0.5		30-60	30-60	20-60	4-10	20-40	
Onion	3.1-4.27*	0.26-0.48	1.98-4.22*	0.90-1.84	0.16-0.32	0.15-0.57*		51-149	16-45	5-28	6-15	
Tomato	3.5-5.0	0.30-0.7	3.0-4.5	1.0-2.0	0.3-0.8	0.2-0.8	45-300	30-300	18-75	5-30	30-75	
Corn	2.8-4.0	0.25-0.5	1.8-3.0	0.25-.8	0.15-0.6	0.15-0.6	30-250	15-150	20-70	5-25	0.1-2.0	
Rice m.t	2.8-3.6	0.14-0.27	1.5-2.7	0.16-0.39	0.12-0.21	0.17+	90-190	40-740	20-160	6-25	5-25	
Peanut	3.5-4.5	0.2-0.5	1.7-3.0	0.5-2.0	0.3-0.8	0.2-0.35	50-250	20-350	20-60	5-20	20-60	0.1-5.0
Soybean	3.5-5.5	0.3-0.6	1.7-2.5	1.1-2.2	0.3-0.6	0.25-0.6	25-300	17-100	21-80	4-30	20-60	

The above table contains a mass of critical information, if approached with a receptive mind. Equally it is short on details regarding Nitrogen Rhizobium fixation, quantities contributed, and trace elements for Peanuts and Soybean, note only one entry for Molybdenum. Likewise the beneficial role of Rice hulls applied as char at high rates for new rice planting, re disease reduction, crop efficiency /yield advantages. Use of high Silica rice hulls must not be burnt to ash or applied to the soil from large heap as it constitutes a Lung hazard of harmful Silica crystals released into the air. Whereas an imperfect combustion producing a charcoal serves to maximise nutrient absorption and ion exchange capacity of the soil, and render a more soluble form of plant available silica.

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