



For a Workable “Green” Green Revolution: A Framework

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Abstract

FAO/UN claimed that their 2018 draft report on agroecological approach was prepared based on a decade interactions. However this as such has little utility for agriculture development in developing countries; most of them are located in warm tropics, wherein moisture is the limiting factor for crop growth. Moisture is highly variable with natural variability component of climate change in rainfall. Temperature is a limiting factor in middle latitudes where most of the developed countries are located. This primarily relates to the day length or time of ending and starting of winter. FAOs propositions help multinational companies selling their destructive technologies/products in developing countries. One such is genetically modified seed technology and genetically modified infant food. Earlier FAO report says that around 30% of the food produced globally is going as waste. It is 40-50% in India. With this, the natural resources that were used to produce that are going as waste. Therefore, production is not a limiting factor; but distribution and nutritious food production are the key limiting factors. Production through chemical inputs technology is not nutritious food. GM also works under chemical inputs technology. In both these irrigation component is a major input. Chemical inputs and irrigation are huge burden on government and farmers that vary with climate risk and at the same time effecting environment with the pollution. In view of these limitations, the present article discusses a workable green revolution for developing countries, more particularly for India in a Framework of “Green” Green Revolution. This could be achieved with organic farming under cooperative agriculture mode. In this animal husbandry based farming system provides the necessary nutritious food. This was the tradition but disturbed by chemical inputs technology in around 60s. Based on the inputs used, organic farming has been referred by different names. Some of these issues are discussed in light of recent FAO/UN report.

Keywords: Organic Farming; Cooperative Agriculture; Climate Change; Workable Green Revolution; Agroecological Approach; Regenerative Revolution

Introduction

FAO/UN draft report [1] on agroecological approach has been written basically with the objective of: of-by-for multinational companies [MNCs] similar to pushing global warming under the disguise of climate change pushing aside the real climate change that affect agriculture, namely natural variability in rainfall. Most of the developing countries are located in warm tropics, where moisture is the limiting factor but not the temperature with high yearly and seasonal variations crops are being grown around the year. Figure 1 presents the IPCC projection and figure 2 presents the year-wise production (a) India and (b) USA. We must remember the fact that during drought years’ temperature goes up. Temperature is a limiting factor in middle latitudes where the most of the developed

countries are located. This primarily relates to the day length. Here colder temperatures play the critical role in crop production. Figure 3 presents crop season relating to receding and starting of winter that define the growing season length. Floods affect the standing crop. This is common with cyclonic activity.

The report [1] claims that the high level panel of experts for food security and nutrition was created in October 2009 as the science-policy interface of the UN Committee on World Food Security [CFS]. The CFS is the foremost inclusive and evidence-based international and intergovernmental platform for food security and nutrition [FSN] --- towards the elimination of hunger and ensuring FSN for all human beings. However, if we read the report, there is no realistic answer to these stated goals -- too many “adjectives”.

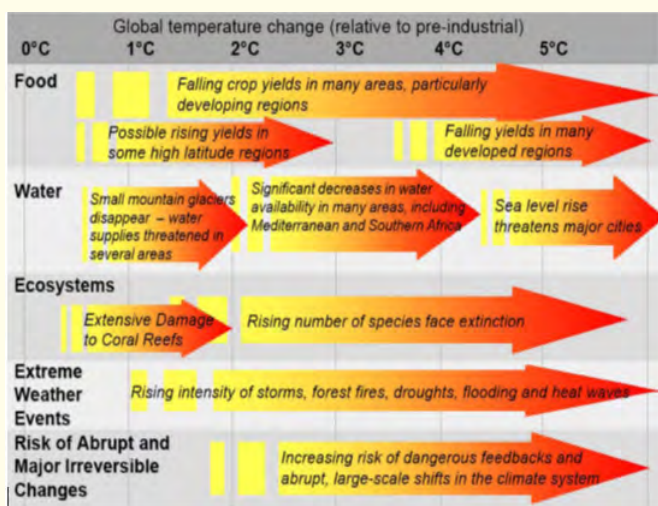


Figure 1: Global temperature change (relative to pre-industrial).

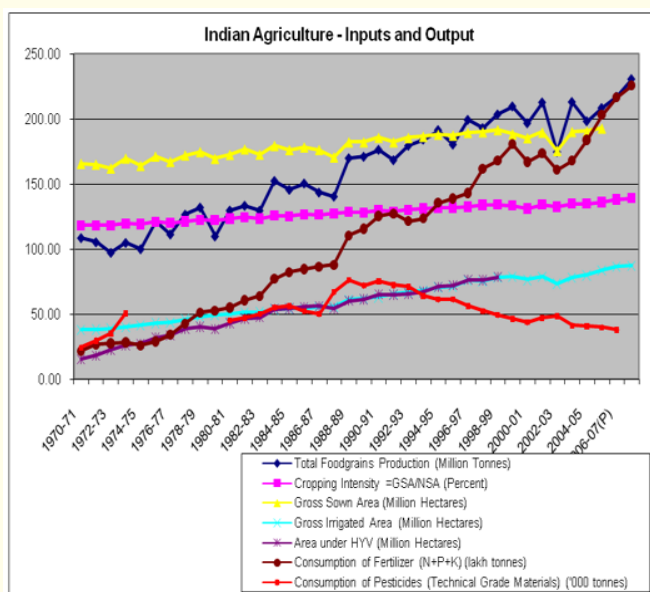


Figure 2a: Indian Agriculture – Inputs and Outputs.

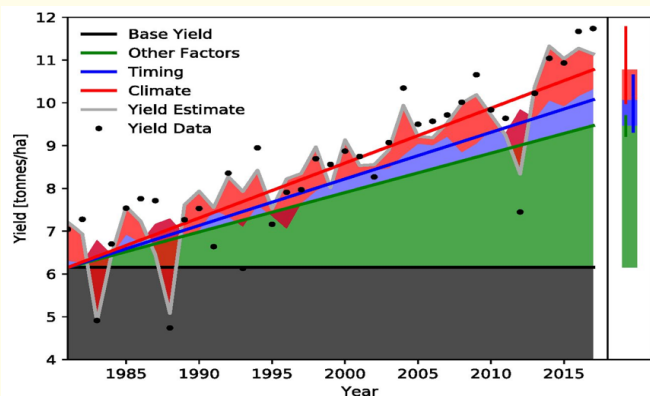


Figure 2b: USA Corn – Inputs and Outputs.

Also, there is wide discussion on a recent report relating to “Regenerative Revolution”: The Climate Change term for Chinese Inspired Social Re-engineering of Western Agriculture. Question

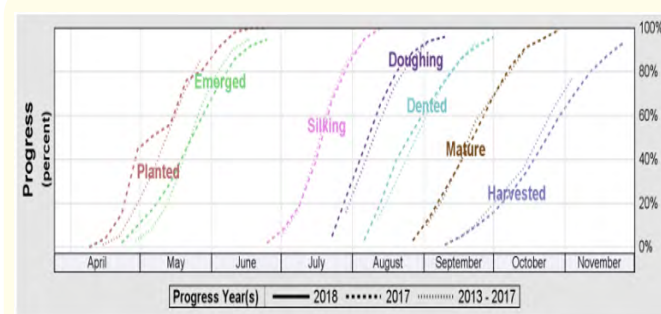


Figure 3: Crop progress and condition for corn in Indiana.

is asked “How a Regenerative Revolution could Reverse Climate Change”. Here they mean climate change as global warming. This is false propaganda, though this technology is organic farming based used to bypass carbon credits.

Climate Smart Agriculture

Climate Smart Agriculture [1] is not a system of agriculture but it is a misnomer. They did not ensure Food Security and Nutrition [FSN]. This has been discussed in my book as back as 2011 [2].

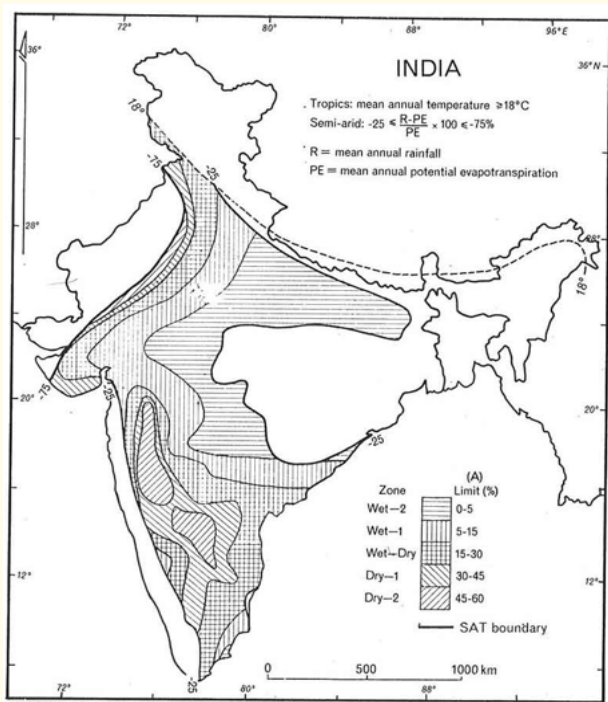
[Components of the yield trend. Observed yields averaged over the US Midwest between 1981 and 2017 (black dots) along with our temperature-driven model estimate (gray line). The yield trend is broken into components attributable to an improvement in climate [red, 0.2 (0–0.5) t/ha, best estimate and 95% CIs, timing adjustments [blue, 0.2 (0–0.3) t/ha per decade], and other factors improving yields [green, 0.9 (0.9–1.0) t/ha per decade]. Also shown is the baseline yield referenced to 1981 (6.2 t/ha). The stacked bar on the far right side shows the total contribution, as of 2017, from each of these components and the associated 95% CIs.]

To achieve good practices, there is a need to study agro-climate at local and regional levels. This addresses the weather based risks. Agriculture has three basic components, namely (a) soil and climate-weather (b) crops/cropping systems, and (c) inputs, animal husbandry and management practices that include crop rotation. Agro-climatic analysis takes in to account the former two aspects. Thus it involves estimation of effective available growing period and its variability, planting time and its variability, wet and dry periods in the available effective growing period and drought risk; also, their variability with natural cycle in precipitation. The concepts of these are presented in my book and latest article [3,4]. Using the technique enunciated in this book [3], scientists from Pune University [5] analysed the data of 45 stations in Maharashtra state in India and agro-climatic variables were presented – earlier a student worked with me on Bhima Basin and got his Ph.D. from the samene University. Figures 4a and b present the aridity Index – drought proneness Index – for India [3] and Maharashtra [5].

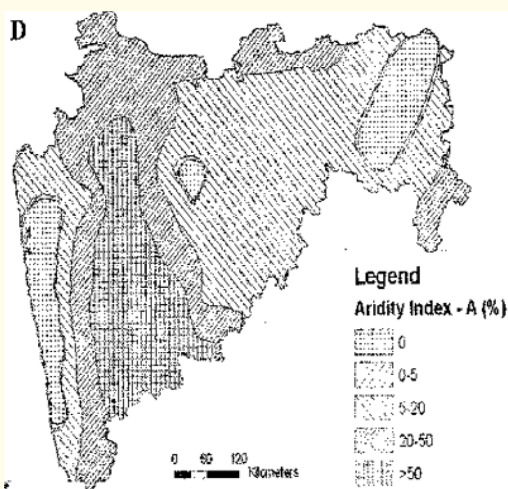
Figures 1 to 4 in the article [4] present glimpses of the parameters: drought risk, temperature versus rainfall, cyclic variation in precipitation in undivided Andhra Pradesh in India and water availability in Krishna River and time series of starting of planting time and available effective rainy period for Kurnool in Andhra Pradesh in India.

Climate change

Climate change is not global warming. Paris 2015 agreement is for sharing \$500 billion in five years under the pretext of limiting global warming of 1.5 – 2.0°C in association with anthropogenic greenhouse gases released in to the atmosphere.



(a) India



(b) Maharashtra State

Figure 4: Aridity Index [drought proneness index] (a) India and (b) Maharashtra State.

The fact is that the observed [adjusted-mutilated data series] global average temperature anomaly of 1880 to 2010 (Figure 5) presented a trend of 1.30°C for 1880 to 2100. IPCC report fixed 1951 as the starting year of global warming and thus for 1951 to 2100 -- 150 years -- the raise in temperature is, $[1.30/220] \times 150 = 0.90^\circ\text{C}$ – if the data series are from 1850 to 2010, then it is $[1.34/250] \times 150 = 0.81$ only.

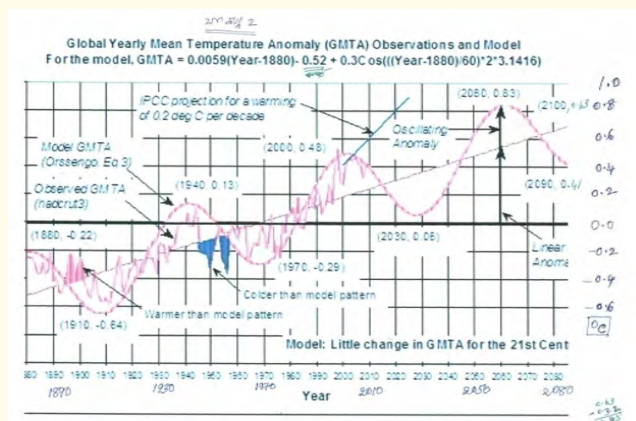


Figure 5: Global average temperature anomaly: trend & cyclic pattern [1880-2010].

Also, IPCC report state that more than half of the trend is due to greenhouse effect [global phenomenon] and less than half is due to non-greenhouse effect [local/regional phenomenon]. Greenhouse effect includes global warming caused by anthropogenic greenhouse gases and volcanic aerosols, etc. Even if we assume global warming component alone is contributing by 50%, then the global warming is $0.90 \times .50 = 0.45^\circ\text{C}$. Figure 6 presents the USA temperature pattern [Raw and adjusted]. When we study jointly these, it shows global warming is practically negligible.

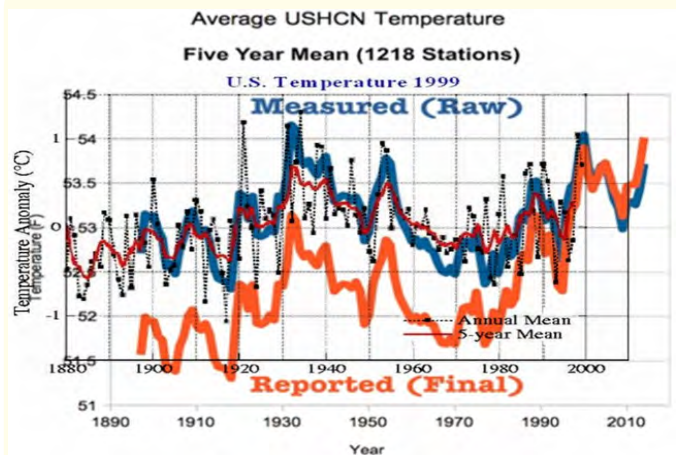


Figure 6: Annual march of USA temperature [Raw and Adjusted data series].

This trend is superposed by a natural cycle of 60-years wherein the Sine Curve varied between -0.3°C and $+0.3^{\circ}\text{C}$. However, annual and seasonal variations in temperature are far higher than 5.0°C . Non-greenhouse effects are presented by changes in ecology, namely land use and land cover changes and are represented by urban-heat-island and rural-cold-island effects. They are not associated with anthropogenic greenhouse gases. See my recent publication [6]:

The main component of climate change is natural systematic variations. In rainfall we term them as cyclic variation. Droughts and floods are part of the cycles. WMO DG attributed Brazil and Africa recent droughts to global warming. I brought to his notice the fact they are not associated with global warming but are associated with natural variations in rainfall in those regions – these are presented in my above referred book of 1993 [3].

Conceptualization of “Green” Green Revolution

Introduction

UN World Economic Social Survey chapter on sustainable agriculture under small farm holders present: “Evidence has shown that, for most crops, the optimal farm is small in scale and it is at this level that most gains in terms of both sustainable productivity increases and rural poverty reduction can be achieved. It also agrees that water quality has been degraded partly owing to intensive agriculture, which has become the main source of water pollution in many developed and developing countries, rendering it unsustainable and a source of risks to human health. Intensive livestock production is probably the largest sector-specific source of water pollution. The productivity of some lands has declined by 50 per cent owing to soil erosion and desertification. Globally, the annual loss of 75 billion tons of soil and thus soil nutrients loss effected production severely. To the extent that most food is locally produced and consumed, small farm holders are at the heart of the food security challenge. The majority of the extremely poor and about half of the undernourished people in the world live in a total of 500 million farms in developing countries (almost 90 per cent of farms worldwide), each comprising less than two hectares (ha). Small-scale and diversified farming continues to have significant advantages over large scale monoculture systems in terms of productivity (20-60 per cent higher yields), food production and environmental protection (including climate change mitigation). An appropriate institutional setting is also crucial in respect of supporting small-scale farming so as to increase agricultural investment and productivity and preserve natural resources. We propose to utilize the concept of a sustainable agricultural innovation system (SAIS) to focus on developing a comprehensive policy framework for innovation which can respond to the double challenge of increasing productivity in food production and environmental sustainability. Finally UN bogged down to supporting GM crops use in developing countries, on one side saying that the GM seed is in

the hands of few powerful MNCs and on the other side saying need clean and green, but GM do not fit in to that concept. GM uses the same green revolution technology. UN says such technology is unsustainable but supports the MNCs interests by saying it is good. We must not forget the fact that the green revolution chemical input technology is successful only with irrigation scenario at the cost of environment at huge cost.

The same was reflected in Dr. Manmohan Singh, the then Prime Minister of India, speech on the occasion of the ICAR’s 83rd Foundation Day wherein he stated that large yield gaps in the dry-land agriculture that contributing about 60 per cent of the cropped area and 45 per cent of the total agricultural produce and that contribute more than 80% of the pulses and oilseeds as well as a substantial part of horticulture and animal husbandry produce. And finally emphasized the need for the second green revolution wherein it embraces the dry-land agriculture -- that is more broad-based, more inclusive and more sustainable; we need to produce more without depleting our natural resources any further, and we look towards our agricultural scientists for ushering this green revolution. He also emphasized that irrigation efficiency is estimated to be around 30% which needs to be raised to at least 50%. This could contribute considerably to increase in agricultural production. Resource conservation technologies that improve input use efficiency, and conserve and protect our natural resources need to be aggressively promoted. Also, there is an urgent necessity for us to speed up our efforts to evolve climate-resilient crop varieties, cropping patterns and management practices. He also pointed out careful application of biotechnology to improve productivity, enable better resilience to stress and also enhance the incomes of our farmers. The speech is excellent but the ground realities are not showing that. For example, though officially Uttarkhand is organic state, to change this scenario under the pretext of augmenting production the state agriculture department is supplying “mini kits” of chemical fertilizers and micro-nutrients free to small farmers secretly. The whole objective is to replace organic farming with chemical inputs and hybrid seeds. On the name of free the government is addicting the lands with chemical fertilizers and then once this is withdrawn the farmer has to pay for it. Thus, soil degradation and increased cost of production break the back of farmers. Also, this changes the healthy millets to unhealthy millets.

Madhya Pradesh government formed a separate “Agriculture Cabinet” and passed a comprehensive “organic policy” to make MP an organic state. However, this does not translating in to action, as the government is subsidizing (90%) to hybrid maize seed distribution programme involving the US based seed giant Monsanto and two other biotech companies under “Project Sunshine”. This is named as “Yellow revolution” and also it is being implemented in Gujarat, Odisha, Rajasthan, among others. That means, government telling something and doing something else due to the pressure from MNC!!!

In Andhra Pradesh water-rich districts of East and West Godavari, Krishna and Nellore farmers declared crop holiday in three lakh hectares. They expressed that national food security is not important to them but it is the farmers' financial security important. Overflow stocks from the Rabi crop, nobody there to lift neither these stocks nor the farmers getting minimum support price but government is helping millers-business lobby to export rice and amass wealth at the cost of farmers.

Though the first part of UN report and PM's speech follow what the author submitted to planning commission regarding approach paper to the 12th 5-year plan and later the author's talk on All India Radio in March 2011 that follows "green" green revolution technology that is environment friendly and sustainable technology. On the contrarily, the later part of the two reports, namely UN report and PM speech, follow "yellowish-blue-green" green revolution technology, which is environment unfriendly and unsustainable technology. Thus, we don't need 2nd green revolution as proposed by these two reports but we need a "green" green revolution technology as the author was advocating. The so called 2nd green revolution technology is aimed at monopolizing seed industry including paddy seed by Western MNCs under the disguise of hybridization and genetically modification that put farmers under great risk. India does not need such a technology. Under the present scenario we need an environment and farmer friendly – no suicide technology, known as "Green" Green Revolution Technology, known as 2nd Green Revolution Technology. To achieve these two important ingredients are essential, namely organic farming under cooperative farming setup. That is, the technology must be: (a) Low input farming that includes: intercropping, mixed cropping, crop rotation; (b) No adulterated seed and inputs farming; and (c) No chemical inputs farming. Let us see this in light of the above presentations.

Farmers' innovations related issues

Funds crunch, lack of adequate assistance from government officials and private sector firms, and lack of awareness among people are the main deterrents in identifying rural innovations as a national movement. Besides being cost-effective and eco-friendly, these potential scientific discoveries need to be commercialized and even exported. Governments are ready to provide subsidies to the tune of 90% to MNCs seed and technology packages but at the same time governments are reluctant to provide subsidies to indigenous technologies. It is a great pity as we are still living under the colonial legacies! Let us see some of the indigenous innovations.

Failure of government agencies

While the innovations are happening, to increase farm productivity in the country, the government of India has released Rs. 181.35 crore till May this year under the Rashtriya Krishi Vikas Yojana scheme to extend green revolution to the Eastern states. As-

sam, Bihar, Chhattisgarh, Jharkhand, Orissa, Eastern Uttar Pradesh and West Bengal are covered under this scheme with a total allocation of Rs. 400 crore. The programme targets improvement in the rice based cropping system in the selected states. Though, Eastern India with more rainfall compared to the North-west regions in the country, unexploited good quality ground water aquifers has an advantage for sustainable production of rice, banana, sugarcane and aquaculture, the agricultural productivity in this region is dismally low in spite of the adequate availability of natural resources required for higher production. The scheme aims to increase the crop productivity of the region by intensive cultivation through promotion of suitable agricultural technologies and practices. This shows how Indian officials work!!!

There is a crisis in rice—both for the farmer, battling unprecedented changes in weather and escalating costs of cultivation, and the government, which needs to ramp up rice production by two million tons annually to ensure the nation's food security. The biggest worry is stagnant yields. India has the largest area under rice in the world—about 44 million hectares (ha)—but its productivity is way behind a dozen other countries. High-yielding varieties cover slightly over 80 per cent of the rice acreage, but the yields of these varieties—the result of decades of research by the huge network of public-funded institutions— have touched a plateau. In contrast, China, the biggest producer of rice in the world, churns out 193 million tons of paddy on just 29.2 million ha, notching up yields of 6.61 tons per ha compared with 3.37 by India. There lies a huge perception gap between the farmer's search for sustainable livelihood and ecologically sound practices in the face of climate uncertainties and dipping water table, and the government's focus on industry-promoted solutions for boosting rice yield. In 2008-09 the yield (kg/ha)/area (million ha) in West Bengal was 2533/5.94, Andhra Pradesh 3246/4.39, Uttar Pradesh 2171/6.03, Odisha 1529/4.45, Punjab 4022/2.74 and Assam 1614/2.48. At all India level they are: 1950-60 - 829.9/31.57, 1960-70 - 998.9/35.85, 1970-80 - 1156.4/38.63, 1980-90 - 1467.1/40.65, 1990-2000 - 1852.0/43.21 and 2000-10 - 2052.8/43.40. The yield (tons/ha)/area (million ha) in China are 6.61/29.2, in India are 3.37/43.91, in Indonesia is 4.88/11.85, I Bangladesh is 4.01/11.60, in Vietnam is 4.88/7.35, in Thailand is 2.75/10.68, in Myanmar is 2.61/6.70, in Philippines is 3.82/4.40, in Brazil is 4.45/2.92 and in Japan is 6.78/1.63. Yet, states are exporting rice legally and illegally lakhs of tons.

In India over different parts localized innovations are aplenty. The government must introduce a system to collect such innovations and stabilize the system for different ecological zones to achieve maximum benefits. While projecting the food production they must take in to account the present scenario: How much is produced and How much is wasted and Why? Without this simply

paper work lead nowhere. Because even the Finance Minister in his 2011-12 budget speech talked of wastage by more than 30%. This was also the case at world level.

National project on climate resilient agriculture launched to implement the scheme in 100 districts, which has been promoted by ICAR constituent unit Central Research Institute for Dry-Land Agriculture [CRIDA, Hyderabad] the innovations, appears to be not part of this scheme. The M. S. Swaminathan Research Foundation in association with Indian Overseas Bank planned to implement this through five farm schools in five states where progressive farmers will train other farmers – the transfer of technology is land-to-land hither to it was lab-to-land that failed. Let our scientists come together and assess innovative systems of agriculture and their suitability to different agro-climatic zones. Here it must also be looked into human consumption as well animal feed context. We must encourage animal husbandry in agriculture to reduce the risk at house hold level of a farmer. Without this process by simply adapting MNCs technology to benefit them lead to disaster in rural India in the next few decades. The government's economic reforms must shift from urban centric to rural centric that provides alternate income to withstand volatile weather conditions that hither too encouraging rural to urban migration that affecting agriculture.

Reports state that "Andhra Pradesh gears up for climate change". Also, they state that for such study ICAR/CRIDA selected six districts in Andhra Pradesh with 1000 farmers in each. The report starts with the assumption that "crop failure and reduction in yields due to climate change". The basic question here is: was there any study to substantiate this statement or it is a statement from the air as usual or simply using the word climate change as an adjective? The results presented at the end of the report show that they are using weather as climate change and thus attributing the changes associated with weather to climate change. The report says in some parts rainfall is showing decreasing trend and some other parts increasing trend. Though the report also stated temperature increase but it does not state the increase in temperature is more associated with urban effect or rural agriculture zones effect? This is vital to achieve the goal of the objective stated above.

ICAR's findings -- temperatures above 35 degrees Celsius and below 23 degrees Celsius resulted in pollen sterility in rice -- this is a standard phenomenon (see [3]) but rice is cultivated in summer, rainy season and winter in low latitudes and high latitudes. That means based on the variety used in a specific zone or season the limits vary. Also, the tolerant limits vary with growth stages – the author carried out such analysis with Sorghum varieties, published in 1984 --. Grain yield reduction of up to 70% was observed in rice with rise in ambient temperature -- this depends primarily on moisture and then soil and relative humidity. We have seen in AP 2008-09 Rabi season with pumping of Godavari water AP produced

bumper production. In the report they state that thermal stress reduced wheat economic yield by 18% and 60% in Mustard. Such results depend upon several other parameters, such as weather, soil parameters and seed variety. But, all these refer to weather only. For example during 2002 and 2009 drought years the temperature has gone up by 0.7 and 0.9 degrees Celsius. Drought, temperature and evaporation (water need) vary and their impact vary with soils, varieties of seed, etc. The rise in temperature under climate change is miniscule when compared to the temperature changes observed in different years. See IMD Red book that provides extremes in temperature over different parts of the country. The author presented increasing trend in AP rainfall as back as 2000 due to cold island effect along with cyclic variations. The cold island influences locally all the meteorological parameters. In such studies, therefore, it must be accounted to get realistic conclusions from the experiments.

Tenants' role in agriculture

In this regard, the author sent a mail to Hon'ble Prime Minister of India on 17th April 2016. This is presented below:

"It appears that the NDA government unable to push through the amended Act on Land Acquisition Act brought out in 2013 after a lengthy deliberation in the last Parliament Sessions and thus, now NDA government wants to achieve or accomplish the same goal through the back door method by the present model "Agricultural Land Leasing Act, 2016". This is not a credible process.

The NDA government thinks that only the rich business interests are paramount to Indian economy? But this is wrong notion. In India more than 80% of the populations are suffering from ill health due to chemical input agriculture technology. Instead of saving the people from such disasters through organic farming under cooperative farming that provide a means to effective utilization of natural resources like water, the government appears to augment the disaster furthermore.

Agriculture and allied activities encompass the raising of crops including food and non-food crops, fodder or grass; fruits and vegetables, flowers, any other horticultural crops and plantation; animal husbandry and dairy; poultry farming, stock breeding; fishery; agro-forestry, agro-processing and other related activities by farmers and farmer groups. This contains short and long duration agricultural activities. Thus, this creates another hurdle to owner. Finally, it could be concluded that the act is created to benefit businessmen and industrialists through tenants only.

A Brief analysis on farmers' suicides

There are several localized, regionalized, nationalized and globalized causes for farmers' suicides. The main reasons for farmers' suicides are (a) high input cost technology, (b) genetically modified

seeds, (c) facilities, (d) minimum support price and (e) employment. Let us see these [sent to government of Telangana as it is one of the five states wherein farmers' suicides are increasing with the time].

High Input Cost Technology: Both the state and the central governments and other political groups were/are harping on Swaminathan Committee report to bring down the Farmers Suicides. Unfortunately Dr. M. S. Swaminathan and Dr. C. Subramanyam were the root cause for all ills in agriculture in general and the farmers' suicides in specific in India. They both looked at short term gains and destroyed the traditional sustainable agriculture. The traditional system is farming system linked animal husbandry. This used to provide socio-economic and nutrient security at household level. Now this system collapsed with high input mono-crop system of agriculture that works under irrigation. This system also contributed to air, water, soils and food pollution. The high input costs lead the farmers in to debt trap. The government on their part looked at loan waiver, subsidized fertilizers, etc. but did not look at real situation. High inputs under highly variable weather both in terms of space and time lead to farmers suicides.

Genetically Modified Seed Technology: Now, with the support of Farmers' Federation Leaders, Multinational Companies [MNCs] introduced short lived and high risk Genetically Modified Seed Technology [GMOs] in to Indian Agriculture System. This system of agriculture also works under chemical inputs and irrigation without any yield advantage but introduced the higher input costs and higher weather risks. These leaders along with seed companies are taking fraudulent means to stop the sale of traditional high yielding seeds. Thus, farmers are compelled to by duplicate GM seeds. The cost of GM seed is several times to the traditional high yielding seeds; and thus to get overnight profits market is flooding with adulterated seed. Also, with the rampant black market sale in fertilizers, spurious seed is flooding the market as well farmers are unable to get their share of fertilizers. All these are contributing to farmers vows. These leads further increase in the farmers' suicides in undivided Andhra Pradesh, Karnataka, Maharashtra and Gujarat states. This is clear from the farmers' suicides in these four states after 2005, where Bt-Cotton was grown with steep increase in area.

Facilities: Though, with the chemical input technology with high government subsidies and loans achieved excess food production as the production is a function of chemical inputs. Unfortunately, 40-50% of produce is going as waste in India – FAO observed this around 30% at global level, this I presented in my All-India Radio talk. This was later noted by the Supreme Court of India and the Finance Minister [the present President of India] in his budget speech. That means we are wasting natural resources to that extent. Governments are least bothered in reducing this waste.

Now the present NDA government decided not to procure the food grains from farmers. That is, the fate of farmers is put in to the hands of businessmen. The businessmen get PDS rice and police them sent the same in to the market. This is affecting farmers' sale of rice. The businessmen with the political help, collects lakhs of tons of rice and export to foreign countries and other states. This is not benefitting the farmers. Same is the case with cotton and other food items.

To protect the produce from unseasonal rains, they needed storage/shelter facilities. This is clearly evident in this year. In every budget speech Finance Ministers' allocate funds to build storage facilities but with the stiff opposition from the local businessmen, they rarely grounded.

The other important issue is the rapid decline of ground water and poor quality power supply as well not providing supply when really needed. This is clearly seen in Telangana and Andhra Pradesh as both the governments are more interested in real estate business with least priority to agriculture.

Minimum Support Price [MSP]: Though the Central Government is increasing minimum support price, they are rarely implementing this in principle. Also, the government did not look at creating farmers cooperatives to export the produce what they are producing, like rice, cotton, etc. In both these cases the beneficiaries are businessmen with the tacit support from politicians.

Some argue that MSP only benefits the rich farmers. This is not so. The main beneficiaries are the small and marginal farm holding farmers that constitute around more than 90% of farmers. During the previous NDA regime the rise in MSP was very little but UPA steadily raised this. But here the main problem is the farmers are not getting the MSP as they were compelled to sell to businessmen at lower price quoted by him as the farmers invariably have no storage facilities. In this connection, with my letter to the then PM in 2013, Manmohan Singhji, a minister from agriculture ministry visited Hyderabad and expressed his displeasure to AP CM on this issue and asked him to implement the scheme through cheque payments. Unfortunately, this was not executed at the behest of Businessmen. The businessmen-politicians nexus exported more than 30 lakh tons of rice legally and around 30 lakh tons illegally. With this, neither the government got benefitted nor have the farmers got benefitted. Same is the scenario with cotton. The agriculture policy of India, under US pressure is bad. The governments are looking at pleasing US at the cost of poor Indian farmers. This must change.

Employment: In India, around 65 to 70% of population depends upon agriculture, either directly or indirectly. While acquiring fertile agriculture lands governments rarely look at this

angle. On one side government says they are creating employment through industry and on the other hand through land acquisition they are creating more unemployed. All these lose their earning that may lead to suicides. The governments are giving importance to unsocial activities like tourism-sanyasi based activities. Though the governments may argue that through industry they are creating employment but this is for below that of job losses from agriculture. Our central Minister says in parliament that agriculture is uneconomical so the government can acquire fertile agriculture land or for that matter of fact lands in ecologically sensitive zones. In Telangana and Andhra Pradesh, governments are creating land banks to the tune of around 15 lakh acres each. They are not worried on the food production as they think that they can import food from China.

The scenario with NDA looks to me that they wanted to bring in Corporate Agriculture. As a first step they tried to avoid the agriculture insurance at village level or farmers' cooperative level or at farmers' level. This was also seen in the previous NDA time, where its partners openly canvassed for corporate agriculture. May be because of this they are down playing Farmers' Suicides.

Alternate crops to replace cotton

There was a steady increase in area under cotton and decrease in area under sorghum and millets in Andhra Pradesh [before bifurcating] -- from 1984-85 to 1996-97, the area under Jowar [sorghum] reduced from 18.62 lakh hectares to 8.53 lakh hectares [Bajra (Pearl Millet) from 3.95 to 1.32 lakh hectares] and cotton increased from 5.54 lakh hectares to 10.15 lakh hectares. This increase shows an opposite pattern to Jowar [Sorghum]. The area under cotton was 1.94 lakh hectares during 1984-86 and 5.26 lakh hectares during 1994-96 in Telangana. Though in 1984-86 the area under cotton in Telangana was only 33% of total AP but rose to 55% by 1994-96. In Warangal district alone the area under cotton increased from 53,353 ha in 1993-94 to, 1, 25, 000 ha in 1998-99.

Since 2002-03 to 2010-11 after Bt-Cotton introduction the area and yield in AP varied as: non-Bt cotton [area and yield] 8.03 to 0.22 lakh hectares and 229.1 to 919.5 kg/ha; Bt-cotton [area and yield] 0.04 to 17.95 lakh hectares and 212.5 to 545.7 kg/ha.

During 2002-03 to 2010-11 non-Bt-Cotton yield was: 229.1, 383.9, 315.8, 346.7, 380.5, 525.0, 434.0, 213.8 and 919.5 kg/ha; and Bt-cotton yield was 212.5, 408.0, 318.7, 347.3, 381.1, 525.0, 434.0, 376.5 and 545.7 kg/ha. After the development of high yielding varieties, the yield increased with Bt and non-Bt. By introducing Bt in high yielding varieties, the cost of the seed has gone up and caused raise in the input costs. To get profits, the seed companies with their PR groups made sure that non-Bt seed is "not available"

in the market and as a result adulterated seed sale increased. So, increased weather related risk with Bt-Cotton over non-Bt-Cotton. Also, Bt is introducing new pests/diseases problems as Bt is short lived.

In cotton production cost of production is going up and up and thus increasing the risk and thus farmers' suicides with heavy borrowings to meet the cost of production. At the same time with high level of chemical inputs use and growing cotton after cotton in the same piece of land, land degradation is taking place and causing reduction in yield.

Chief Minister of Telangana State asked for suggestions on alternate to Cotton in Telangana State. In the past also, Prime Ministers of India asked for alternate to tobacco. In 1993, the then Prime Minister of India, P. V. Narasimha Rao Garu asked the nation to grow alternative crops to Tobacco; and the same was repeated in 2000 by the then Prime Minister of India Atal Bihari Vajpayee Garu.

With reference to the first, on the request of Asst. Editor in-charge of Economic section of Deccan Chronicle: November 16, 1993 in Business section [page 15] of Deccan Chronicle, I presented an article "Chilies, sunflower best suited to replace tobacco in AP". If the interest is, for some reason or, the other, to replace one crop by other crops of similar importance, it is important to know for the given crop (i) planting time and duration of the crop, (ii) environmental conditions [climate and soil], (iii) socio-economic [inputs, investment, labour, infrastructure, technology, returns, etc.] structure under which the crop is grown, etc. Similar aspects must be assessed for the proposed crops over the existing one.

With reference to the second, on the request of Editor Prajashakti, presented an article titled "Crop rotation is the mantra to control area under tobacco" published [2000, p.28] in a special issue on Agriculture. That means, instead of growing year-after-year tobacco on the same piece of land, alternate years other crops must be grown and thereby the soil can be protected from the degradation and as well area under tobacco could be reduced by 50%. In fact, later the tobacco board put a condition that if "crop rotation" is not followed, they will not buy the cotton from that farmer. So, it worked. I presented articles in Vaartha a daily newspaper under - Agriculture News --, on crop rotation dated 25th July 1998 and 29th July 1998 [special report].

[1] Implement crop rotation, [2] grow sorghum and millets intercropping with pulses [as was the case with traditional agriculture] and [3] encourage cooperative farming with organic inputs.

Government must provide same incentives that are being provided to cotton to the alternate crops or cropping systems in terms of bank loans, fertilizer [organic inputs] subsidies, etc. Agriculture department must develop seed banks to meet the demand for such alternate crops by reducing cotton seed [other-wise seed companies will cry] production proportionately. Also, introduce the extension service with farmers cooperatives – not corporate farming of the governments of Telangana or AP. With the food security Bill, though we have been successful in including sorghum and millets as an alternate to wheat and rice, individual state governments are not moving in this direction: procuring and distributing the same under PDS. This provides minimum support price for the alternate crops. This is a must, to get cotton alternate crops or cropping system to be successful.

If farmers are not practicing crop rotation, stop providing all incentives including free power, fertilizer subsidy, seed subsidy, bank loans, etc.

Agriculture labour needs alternate livelihood. This could be overcome with all schemes in rural areas are linked to agriculture. They could be engaged in production of organic inputs. Storage and food processing units in this area also help in this direction.

To oversee the implementation of all these issues in an integrated manner, government must create a non-corrupt "system".

Suggestions Submitted to 12th five year plan

The author submitted comments and suggestions on "Approach paper to the 12th 5-year plan" to the Director, Plan coordination division, Planning Commission. Though in the past also on several occasions on several issues of national interest comments and suggestions were submitted to Hon'ble Prime Minister, UPA/NAC Chairperson and Planning Commission.

With the Western mindset as dictated by the World Bank of both the government and the planning commission, India, can't achieve "more inclusive, faster and sustainable" growth in terms of agriculture, water, energy and economy. The Western mindset, for example, looks at: Climate Change as Global Warming and Carbon Credit Policy; Agriculture as chemical inputs technology with genetically modified seeds; Energy as nuclear power; Water use as watersheds and check dams, etc. National action plan on climate change [NAPCC] mainly looks in this direction, though it specifies many things, when it comes to implementation Western mindset path gets top priority over the others.

Present system of agricultural practices in India is not sustainable and not more inclusive. At the same time there was no growth in yield. In India, still around 60% of the cultivated area is at the mercy of "Rain God", i.e., Rain-fed. Also, more than 80% of the farm holdings are small and marginal. The government subsidies, loans, etc. are going principally to irrigated-agriculture sector only. In this sector around 50% of the area is under lift irrigation wherein they depend on power to pump water. With all these subsidized benefits, the profits from this sector are going into the pockets of middlemen and not either to farmers or to the government. The two principal crops grown under this sector are rice and wheat also benefitted by including these two under subsidized public distribution system (PDS) even though it is an unhealthy food, which introduced new health hazards. In all these systems the rain-fed agriculture sector is receiving step-motherly treatment, which needs better deal.

In such a scenario, planning commission in its plan of action must provide a mechanism to bring down the disparities between irrigated agriculture and dry-land agriculture sectors. Some such to achieve this goal are given as follows:

- Firstly, provide input subsidies directly to farmers or farmers' co-operatives instead directly to industry – Two professors from IIM/Ahmadabad recommended to government to continue giving subsidies directly to industry. While recommending this, they haven't taken into account ground realities on what is happening – fertilizers are diverted to other activities such as in drugs manufacturing, diverting to black market by official-politician nexus, it is benefitting irrigated agriculture sector and less benefitting to dry-land agriculture sector – Government of India agreed to provide subsidy directly to farmers; and on this received a letter from the Ministry of Chemicals and Fertilizers, Department of Fertilizers on 28-12-2011;
- Secondly, grains of dry-land crops that provide healthy food must also find place in subsidized sale under PDS system – at present only rice and wheat are major beneficiaries, which is unhealthy food – Food and Nutrition Security Bill of 2013 included Sorghum, Pearl Millets, Finger Millet at Rs. 1 a Kg [wheat at Rs. 2 a Kg and Rice at Rs. 3 a kg], however, the state governments are not implementing this as part of political game;
- Thirdly, Government must initiate action at war-footing to bring 100% cultivated area under canal irrigation – at present this is only 20% of the cultivated area and another 20% is under groundwater based irrigation, which is rapidly de-

- pleting and proportionately increasing power consumption to extract that water – though lakhs of crores are invested by state governments, moving at snails speed due to corruption at political level;
- Fourthly, encourage farmers co-operatives – at present man-hours wasted by individual farmers to procure the basic needs is too large, natural resources are not properly utilized, sale of adulterated seeds and fertilizers are rampant; with the co-operative farming majority of them could be addressed and improve the economy of the farmers – though Andhra Pradesh government proposed this as suggested by me but negating the concept included some components of corporate farming as proposed by TDP government earlier and thus farmers are not in favour of this model; -- on my letter Chief Minister ordered officials not go ahead with that proposal;
 - Fifthly, improve the storage facilities and timely transport facilities – at present around 50% of the total production is damaged/rotten and illegally exported by middlemen due to non-availability of these facilities, that means it is nothing but we in reality achieving production at 50% level of normal production level effectively, which is still lower than research station results. This level of production we can easily achieve under organic farming by increasing area under irrigation. To achieve this the following also must be attended:
 - Government must encourage adapting traditional farming systems centered approach with organic inputs (that includes animal husbandry) in place of crop centered chemical input technology approach
 - Government must collect traditional inventions of progressive farmers and strengthen these with research and then transfer to farmers with which we can bring down chemical input use and thus air, water, soil and food pollution and achieve good quality better yields/food
 - Government must establish commodity boards and strengthen government based seed development corporations – at present these are infested with private sector seed companies
 - Government must strengthen the NPM in place of chemical pesticides, insecticides, fungicides, etc.

Note: The present NDA government replaced the Planning Commission with Nitee Aayog, a political body.

Cooperative Agriculture

The main systems of agriculture are traditional, corporate, cooperative, etc. In them operates respectively chemical inputs system/GM system and organic inputs system similar to conventional or traditional agriculture with on farm and off-farm concepts. The other is dry-land and irrigated – surface flow and groundwater pumping linked to drip or sprinkler -- agriculture. Crop rotation is a

practice and not a system. I myself wrote several articles in Telugu daily newspapers to educate farmers. In fact this is compulsorily implemented in India in Tobacco cultivation, wherein tobacco buyers put a condition where a farmer grows year after year tobacco on the same piece of land, that tobacco will not be purchased. This condition is to improve the soil condition in terms of diseases, fertility, etc. However, governments unable to implement this with some of the cash crops like cotton and thus under high input agriculture farmers suicides became common scene.

Under variable soil and climate, vary rarely we find sustainable agriculture. Under the traditional agriculture, farming system practices are the main components that vary with soil and climate and place – topography. For example animal husbandry not only contributes to nutrient food but also provides fertilizer through farmyard manure, provide power to till the land, to transport harvested food; crops/cropping system wherein crop rotation is one component, intercropping of cereals with pulses provide nitrogen fixation. All these vary with soil and climate, more particularly rainfall – irrigation [surface and groundwater].

Over different parts of the globe several types of agricultural systems, like cooperative, corporate, etc. were in practice after the World War-II. In some countries they were successful and some other countries they failed due to several reasons. In the West, corporate agriculture is practiced to date as less than 5% people only are in agriculture sector, while in India and other developing countries more than 60% of people are in agriculture sector – providing direct and indirect employment. In India, the white revolution was successful under cooperative sector. Through articles in print media and research papers and books the author started campaigning for cooperative agriculture and organic inputs based farming.

Tagore's cooperative concept

Rabindranath Tagore between 1915 and 1940 written essays in which presented a social vision where exploitation would give way to a just, humane, collectively owned economy. At the core of his thought was the cooperative principle. There is little understanding, much less acceptance, of the cooperative principle and it's potential. Written some eight decades ago Tagore's thoughts stemmed from these concerns "the growing concentration of economic power and the destruction of rural India". Instead, he sought an ethical model of production. What would that entail? Tagore's vision went far beyond notions like 'social responsibility' that are in vogue today. To him, ethical production required that resources (such as land and capital) are collectively owned by producers themselves. This would ensure that the produce is also collectively owned, and that all producers have a say in determining their share of value in the product of their work. The typical small farmer, indebted and impoverished, was much in need of such a structure.

"Imagine if all of our small farmers farmed their land collectively, stored their produce in a common facility and sold them through a common mechanism..." Only then can we prevent profiteering; only then can the farmer recoup the legitimate value of her labour, wrote Tagore. Without such mechanisms, the farmer would never be able to effectively exercise the right to his land, even if he held the title. Structural conditions would make him powerless. Under these circumstances, giving the small farmer the legal right to land was no more than giving him 'the right to commit suicide.' Indeed, in the cooperative principle, Tagore saw the possibility of challenging power, of altering power relations. Ordinary people, whose work constituted what was 'the real capital,' could only do so if they collectively owned that 'capital.' Many economists may well reject this as the misplaced idealism of an ill-informed poet. But it will resonate readily with the struggles for producer-ownership in the world today, such as Via Campesina. As the clout of agri-business grows, food inflation rises, and informal work becomes the norm, challenging dominant structures of ownership. And power is the central challenge of these movements.

Among the main points of criticism of cooperatives in India has been their need for state resources. But our corporations have been also heavily subsidized by state resources. While they flourish, cooperatives flounder. Why? Corporations enjoy state support with no interference; cooperatives do not. State support has come with levels of bureaucratic control that are incompatible with a truly autonomous, member-driven movement.

The author's proposal

Tagore's vision was a generalized cooperative but my proposal was specific to agriculture. Dr. Y. S. Rajashekara Reddy as the opposition leader prior to becoming the Chief Minister of the state of Andhra Pradesh in 2004 asked the author to prepare 'black paper' to counter the Chief Minister N. Chandrababu Naidu government's 'white paper' on agriculture during 2001 and as well of his vision 2020 report – in 2018 he received international award for exactly opposite system of vision 2020 [and exactly what I have been advocating]. The author prepared and submitted to Dr. YSR, which was released to press on 15th February 2001 in the Assembly press gallery, wherein the author was also present along with all opposition political parties MLAs.

Let me quote one of the press report appeared in 16th February 2001 edition with the heading "Cong advocates cooperative farming": "The Congress legislature party (CLP) on Thursday charged that the 'Strategy paper on agriculture', released by the state government, was aimed at paving the way for corporate agriculture at the expense of lakhs of farmers and farm workers in the state. The 'black paper' on agriculture, released by CLP secretary G. Chinna

Reddy here to counter to the strategy paper, apprehended that the proposed corporate agriculture, if allowed to take over the farm sector, would further widen the rich-poor gap. The Congress contended that farmers would become coolies on their own lands, should the multinational and corporate companies be permitted to undertake corporate agriculture. Chinna Reddy regretted that the strategy paper did not make any mention of a spate of suicides by farmers across the state as a result of an unprecedented crisis in rural economy. Even as the farmers in the state required a credit facility to the extent of Rs. 36,000 crore, the strategy paper promised to arrange only Rs. 6,000 crore from the nationalized banks and financial institutions. Consequently, the farmers were constrained to depend on private money lenders for the rest of financial assistance and at higher interest rates. Thus, entangled in a debt-trap, some of the farmers could find remedy by committing suicide, the Congress leader said. The steep hike in the power tariff and erratic power supply also contributed to the farmers' misfortunes, he said. In this backdrop, the solution lay not in corporate agriculture, but cooperative agriculture/farming, he said and stressed the need for the government to encourage the latter approach and ensure remunerative prices for agriculture produce".

The corporate agriculture/farming was advocated at the behest of World Bank and MNCs of the West, as a trial it was undertaken in Kuppam, which resulting a big failure. When Congress took over in 2004, they announced that the government's intension of introducing cooperative agriculture/farming. Unfortunately the advisor to the government, who was associated with World Bank and Western MNCs, proposed corporate agriculture/farming under the disguise of cooperative agriculture/farming. The farmers rejected this. The author exposed this by writing to the chief minister as well presenting in press. The chief minister expressed willingness to review the proposal but unfortunately, he died in an accidental accident. Before this, the author presented this concept in several local print media on the concept of cooperative agriculture/farming. As Tagore advocated few decades back, cooperative farming system of agriculture is the only solution under the present volatile political and climate conditions to achieve near sustainable production at farmers' level and thereby strengthen their economic conditions and as well nation's economy. Israel implements a system of cooperative agriculture. This is government funded system.

Organic farming system related issues

Organic agriculture is nothing but a traditional agriculture system wherein in the later fertilizer is farmyard manure/green manure and for the former fertilizer is vermicompost – several types. With chemical input technology in 1950-60s with mono crop based farming killed the animal husbandry based farming. To overcome the non-availability of farmyard manure, techniques were devised to create compost – on farm and off-farm.

Traditional agriculture systems were developed based on the thousands of years' experiences of our forefathers in terms of soil-weather-crop systems. With the green revolution, mono crop system the traditional wisdom lost in din. To re-work out such systems, we need to study agro-climate of the location-region. Organic agriculture combines tradition, innovations and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Organic agriculture can be defined as: an integrated farming system that strives for sustainability, the enhancement of soil fertility and biological diversity whilst, with rare exceptions, prohibiting synthetic pesticides, antibiotics, synthetic fertilizers, genetically modified organisms, and growth hormones. "Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects".

System of agriculture relates to inputs on one side and seeds on the other. Inputs relate to chemical fertilizers on one side wherein monocrop cultivation is followed; and organic inputs on the other side with vermicompost/Farmyard Manure wherein cropping systems of cultivation is practiced. Under Seed, includes traditional seeds, hybrids/varieties breeders developed seeds, GM seeds wherein GM trait is incorporated into breeders seeds. The choice of selection depends upon irrigated agriculture or rainfed agriculture. All these form components of agriculture systems under different permutations and combinations based on the system of agriculture relates to traditional, cooperative and corporate.

Sustainable agriculture

Organic farming as such is not sustainable form of agriculture, for that matter any form of agriculture under variable climate. To achieve certain level of sustainability with the organic agriculture, it must be operated under cooperative farming system of agriculture. Therefore, the governments must change the policy on agriculture. The policy must include low input costs, pollution free quality food technologies such as organic inputs under cooperative farming setup. This not only brings down the cost of production but also reduces drastically man hours spent on procuring basic inputs by individual farmers, improves the utilization of natural resources and thus helps to reach sustainable agriculture.

In fact progressive farmers with traditional wisdom have developed technologies and achieved far higher yields than the research station yields and received national and international awards/rewards and recognition but neither the governments nor the scientists showed any interest, though there is a mechanism in government departments in India, to stabilize that technology and provide

packages to farmers to achieve environmental friendly progress in agriculture. The states and central governments must allocate sufficient funds to collect traditional inventions of progressive farmers and integrate these in traditional technology to achieve the 2nd Green Revolution that safeguards the environment and provide food safety, biosafety, food and nutrient security; and protect the farmers from committing suicides and provide socio-economic security.

Also, as proposed in new Food Security Bill, distribution of locally produced foods can be given under Public Distribution System [PDS] by which the food subsidy component will come down substantially. This shall also reduce wastage and loss in Food Corporation of India [FCI] storage facilities and transportation.

The Union Finance Minister in his budget presentation highlighted the importance of Organic Farming as well storage issues. Agriculture development is central to our growth strategy. Measures taken during the current year have started attracting private investment in agriculture and agro-processing activities. This process has to be deepened further. While the need to maximize crop yields to meet the growing demand for food grains is critical, we have to sustain agricultural productivity in the long run. There has been deterioration in soil health due to removal of crop residues and indiscriminate use of chemical fertilizers, aided by distorted prices. To address these issues, the Government proposes to promote organic farming methods, combining modern technology with traditional farming practices like green manuring, biological pest control and weed management. The years 2008 to 2010 saw very high levels of food grain procurement.

On January 1, 2011, the food grain stock in Central pool reached 470 lakh metric tons, 2.7 times higher than 174 lakh metric tons on January 1, 2007. The storage capacity for such large quantities requires augmentation. Process to create new storage capacity of 150 lakh metric tons through private entrepreneurs and warehousing corporations has been fast tracked. Decision to create 20 lakh metric tons of storage capacity under Public Entrepreneurs Guarantee (PEG) Scheme through modern silos has been taken. While we will be able to add about 2.6 lakh tons of capacity by March 2011, based on existing sanctions, the addition will reach 40 lakh tons by March 2012. During 2010-11, another 24 lakh metric tons of storage capacity has been created under the Rural Godown Scheme. Investment in cold storage projects is now gaining momentum. During this year, 24 cold storage projects with a capacity of 1.4 lakh metric tons have been sanctioned under National Horticulture Mission. In addition, 107 cold storage projects with a capacity of over 5 lakh metric tons have been approved by the National Horticulture Board. To attract investment in this sector, henceforth, capital investment in the creation of modern stor-

age capacity will be eligible for viability gap funding scheme of the Finance Ministry. It is also proposed to recognize cold chains and post-harvest storage as an infrastructure sub-sector.

Health per acre concept

FAO in 2011 released an edited book titled "Climate Change and Food Systems Resilience in Sub-Saharan Africa". In this, it states that "Ecological agriculture holds significant promise for increasing the productivity of Africa's small holder's farmers, with consequent positive impacts on the food security and food self-reliance. Crop yields of major cereals and pulses have almost doubled using ecological agricultural practices such as composting, water and soil conservation activities, agroforestry, and crop diversification. The use of chemical fertilizers steadily decreased. The green revolution system has shown that increase in yields doesn't necessarily translate into food security. That is, technological strategy does not guarantee food security or even social security. The so-called success of the green revolution system was due to heavy government incentives in terms of providing subsidies, building infrastructures and providing guarantee for credits. It is not a sustainable agriculture.

We must look at reduction of hunger and poverty, improvement of rural livelihood and human health, and equitable, socially, environmentally and economically sustainable development. In sub-Saharan Africa only 4% of agricultural land is irrigated compared to 37% in Asia and 15% in Latin America. Sustainable and ecological agricultural approaches, including organic agriculture, can be in many forms, but generally integrate natural, regenerative processes; minimize non-renewable inputs (chemical inputs); rely on the knowledge and skills of farmers and depend on locally – adapted practices to innovate in the face of uncertainty. It is also biodiversity based. Thus, organic agriculture is a production system that sustains the health of soils, ecosystems, biodiversity and people." However, this book also used climate change as an adjective like many others and did not delve in to realms of the climate change in the agriculture.

A new report from Navdanya, called "Health per Acre," was released in New Delhi in March by Syeda Hameed, a member of the Indian Planning Commission, whose chairman is Prime Minister Dr. Manmohan Singh. According to the report, "a shift to biodiverse organic farming and ecological intensification increases output of nutrition while reducing input costs." Agricultural output should be measured in terms of "'Health per Acre' and 'Nutrition per Acre' instead of 'Yield per Acre,'" the report says. The paper said that "this should be the strategy for protecting the livelihoods of farmers as well the right to food and right to health of all our people." Vandana Shiva, the Indian environmentalist and advocate who founded

Navdanya, claims that organic farming produces more food and nutrition than conventional methods. Through intercropping, one organic farm could produce 900 kilograms of food per acre, including 400 kilograms of corn and 500 kilograms of beans and other crops, according to Navdanya's studies of the farms of its members. A comparable conventional farm growing one crop would yield 500 kilograms of corn but would lose the other products. Organic farming produces "twice the amount of nutritional needs by intensifying biodiversity rather than monoculture and chemicals," Ms. Shiva said. These show that there are several types of organic farming are in use world over under different names but with the same basic concept.

Growth concept

The Hindu reports that "Area under organic farming has grown many-fold in six years to 2009-10 in India on the back of thrust given to the chemical-free mode of cultivation. Official figures state that from 42,000 hectares under organic certification in 2003-04, more than 4.4 million hectares area was under organic certification in the country as on March 2010. For quality assurance, India has internationally acclaimed certification process in place for export, import and domestic markets. During 2008-09, India produced about 18.78 lakh tons of certified organic products. Of this, nearly 54,000 tons food items worth Rs. 591 crore were exported. With more than 77,000 tons of organic cotton lint production, India became the largest organic cotton grower in the world a year ago. Indian organic exports include cereals, pulses, honey, tea, spices, oil seeds, fruits, vegetables, cotton fibre, cosmetics and body care products.

The Ministry of Agriculture is promoting organic farming in the country under National Project on Organic Farming, National Horticulture Mission, and Technology Mission for North East and Rashtriya Krishi Vikas Yojana. National Project on Organic Farming is being implemented since October 2004 through a National Centre of Organic Farming at Ghaziabad and six Regional Centres located at Bangalore, Bhubaneswar, Hissar, Imphal, Jabalpur, and Nagpur. The project supports organic input production infrastructure, technical capacity building of stake holders, human resource development through training, statutory quality control of organic inputs, technology development and dissemination, market development and awareness. Under the National Horticulture Mission and Technology Mission for North East, assistance is provided at the rate of 50 per cent of cost subject to a maximum of Rs. 10,000 per hectare (up to 4 hectares per beneficiary) for organic horticulture cultivation. Assistance is also provided for setting up vermicompost units at the rate of 50 per cent of cost up to Rs. 30,000 per beneficiary. Assistance of Rs. 5 lakh is provided to a group of

farmers covering an area of 50 hectares for organic farming certification. Under the Rashtriya Krishi Vikas Yojana, States are being assisted for area expansion of organic food crops, capacity building of farmers and organic input production”.

Access to technology and innovation: who benefits?

Technologies and innovations are vital to the achievement of the human desire to meet the needs for food, fiber and development. Assessing technologies within the frame work of sustainability is vital to effective agriculture and food systems. Promoting the use of specific technology should be built on numerous criteria, including economic feasibility, social equity, cultural acceptability, long term resilience and environmental impacts. The end users of technologies may be quick to accept and use technologies once it offers economic returns without immediate and noticeable detrimental effects to that user, even if wider impacts are being experienced by others and by the environment. This is nothing new. We report this few years back based on the experience. Green revolution chemical fertilizer based technology. The cost to restore the pollution caused to water resources is unimaginably huge sums. Gulf of Mexico became dead zone for thousands of square kilometers with agriculture pollutants carried by Mississippi river. Same is the case with River Ganga that starts from Gangotri and joins Bay of Bengal at Gangasagar at 2525 km away. These pollutants are non-point sources. This will change only with technology that doesn't cause pollution. Genetically Modified Technologies follow the green revolution technology in terms of water use and chemical fertilizer uses. In addition this technology causes numerous other problems to land and farmers and as well to environment. Also, these technologies benefit Multinational Companies [MNCs] and middlemen.

Illegal proliferation of an unapproved Bt-Cotton variety with herbicide-tolerant trait, namely GB-III, which was developed by US-based multinational seed company. It is “Round-up Ready Flex’. The application was withdrawn for commercial release in 2015 yet they are grown in India, more particularly in the state of Telangana illegally. Same was the case with the introduction of Bt-Cotton in India during 2002. Even before the government's clearance for commercial cultivation, seed was produced and supplied to farmers [we filed a PIL in Andhra Pradesh High Court in 2003]. Low moral ethics in GM seed business. The lobbyists compel the seed retailers not to sell non-GM seed and as a result adulterated seeds were rampant. Unfortunately, FAO and CGIAR groups monopolized the tradition germplasm and kept in their gene banks and with the GM seeds they have been ruining the tradition wisdom in seeds in native places/regions.

In a first-of-its-kind study in India, the Centre for Science and Environment [CSE] tested 65 food products available in the market for genetically modified (GM) ingredients. To its horror, CSE found GM genes in 32% of the products; almost 80% of them imported. This is mainly children/infants food.

UN agencies like FAO instead of fighting against such fraudulent activities perforated in developing countries supporting their illegal activities by publishing this type of reports. FAO should thrust to eradicate harmful technologies and food dumping in developing countries [7,8].

FAO Report [1] filled the pages with plenty of references and the text is too much repetitive in nature. In fact most of them don't refer to the original research findings. See for example a recent report by Down To Earth of 18th October 2018 presented the findings of Bengaluru-based researchers article published elsewhere “Day Temperatures, not Daylight, influences flowering”. I presented in my book of 1993, pages 145 to 150 [3]: The two important continuous and periodic elements that affect the development are temperature and photoperiod. In addition to these two, relative humidity, soil moisture, soil temperature, soil type, soil fertility, plant population, agronomic aspects are reported to affect the crop development, and there by crop growth. Discussed all these issues and presented equations for Sorghum phenophases using temperature and relative humidity -- published in Agriculture and Forest Meteorology Journal in 1984. The impact is not the same at different phenological stages. Even before me such works were published by several researchers around the World.

Strengths and weaknesses

The report from the U.N. Special Rapporteur on the Right to Food pointed out that the Green Revolution had focused primarily on increasing cereal crops that contain relatively little protein and other essential nutrients. “Nutritionists now increasingly insist on the need for more diverse agro-ecosystems in order to ensure a more diversified nutrient output,” it said. But some agriculture experts say that while organic farming has benefits, it cannot make a significant dent in total agricultural demand. Organic farming is an important niche market with big potential near major cities. But it is “not a general solution to malnutrition at all,” said Mark W. Rosegrant of the International Food Policy Research Institute in Washington. “You have to put inputs in to get yields. To move fully to organic, you are going to lose productivity”.

A chapter in the 2006 book “Global Development of Organic Agriculture,” co-written by Mr. Rosegrant, said that compared with “high-yielding crops cultivated with the use of fertilizer and pesticides, most organic crops yield less per hectare due to a combination of lower nutrient supply and yield reductions from weeds, fungi, and insects.” The paper cited a study from 28 countries that found “that on average organic yields are 80 percent of those under conventional agriculture”.

They also cite that there are other barriers to the growth of organic farming in India. Organic certification from international agencies is expensive and bureaucratic. A shift to organic farming requires extensive training and support for farmers who are largely uneducated. Farmers must be connected to markets and shops

that sell their goods, usually in cities with wealthy consumers — no small feat in India where roads and infrastructure are poor. Organic food is at least 30 percent more expensive than foods produced by conventional methods.

In India, there is no financial support from the government for organic farming, while the majority of fertilizer and pesticide companies are subsidized. But if organic farming reached a greater scale, prices would fall, said Vinod Bhatt, a director of Navdanya. As he led a tour of Navdanya's tranquil 45-acre farm near Dehra Dun, Mr. Bhatt walked past lush rice fields and explained how ginger and turmeric were grown between rows of corn to retain soil fertility and maximize yield per acre. A botanist by training, Mr. Bhatt said rice should not be grown in successive seasons but should be alternated with peas, wheat, corn and mustard over two years to keep the soil fertile. Marigolds planted on the edge of the field help keep pests away, as do lantana plants and neem trees, and mixtures made of cow urine and worm secretions, he said. Mr. Bhatt joined Navdanya in 1997, and he recalled that interest in organic farming was limited back then. Now, "farmers are coming to us because they can see the results," he said. He pointed out some okra growing on tall stalks. Mr. Bhatt bent a stem so a visitor could peer at the large green "lady fingers," as okra is called in India. "I don't know why people don't believe organic is more productive," he said.

Discussion

Organic farming is referred by different names by different groups. From the above it is clear that the so called hurdles for organic farming are not really a hurdle once the momentum takes U-turn. There is a need that government must look in to providing fertilizer subsidy directly to farmers based on cropped area and farmer should be given freedom in choosing the type of fertilizer: organic or inorganic. To achieve this goal, government must give fertilizer subsidy to farmers or farmers' cooperatives directly and not to retailers, which are under the clutches of politicians and bureaucrats — mostly benami names. Here the farmers' have the flexibility to grow crops what he wants or what the market demands. Crop commodity boards must be established based on the needs of different parts of the country that help in the collection and improvement of technology to maximize yields of such crops in mixed or intercropping as well if needed under more crop condition. By this way we can preserve local seed bio-diversity for sustainable future use. This must be a part of organic farming structure. Timely crop management is the mantra under this system. Though our country is the largest producer of many kinds of millets, they are not as popular as it should be, given their health benefits. This must be done. The other important component is permaculture which is a sustainable urban food gardening in the light of urban surroundings producing food with polluted water that create innumerable health hazards. However, this forms a minor component of food basket.

Conclusions

There are two important components to achieve sustainability in agriculture in developing countries, which are located in the warm-tropics wherein moisture is the limiting factor. They are (a) integration of agriculture system with climate change and (b) implementation of cooperative agriculture. Therefore, any farming system must fit in to adaptive measures to climate system. Chemical inputs plus genetically modified seed technology are inappropriate technologies for developing countries. To protect the environment and provide nutritious food the best way is to use organic farming that includes animal husbandry under cooperative agriculture. UN agencies must motivate governments in this direction. As a basic input, it must also prepare agro-climate analysis — station-wise, region-wise — as a part of natural variability in rainfall in climate change.

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