

**corrected version**

1 message

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 To: Debal Deb <debdebal@gmail.com>

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Sir,
 Corrected version. Thanks.
 I am pasting the whole story here.

Essay

The fragile food web

Changing climate, depleting soils, and Big Food join forces to create a giant nutritional crisis.

Agriculture by GBSNP VarmaOct 24, 2023



Land-to-water-to-atmosphere connections—the perennial circulatory flows that birth and nourish life—are out of balance and Venkata Rao knows it. The 37-year-old tenant farmer from the village of Penakalametta in West Godavari district of Andhra Pradesh is sensitive to these flows, for his life is entwined with it.

The area where he has his farm is called uplands, a stretch of approximately 4,000 acres, suitable for crops like tomato, bryonia, cluster beans, plantains, black gram, corn, tobacco and other produce. Bore wells pull the water up for irrigation.

Venkata Rao has planted cauliflower on an acre and next to him, his uncle sowed black gram. Beyond that, there are trestles of cluster beans, bryonia and angled cucumber. Still beyond, there are tobacco clusters, spiking the moist air with their raw pungency. In the middle distance, the area slides into water logged fields, where it's all paddy.

Rao is aware this is not the world he once knew, in which he grew his cauliflower. His cauliflowers too seem to know that. They are drying and withering. On a recent morning in the first week of September, the air should have been cool. Instead, the road resembled a pulse of lava that had just flowed; faces drip; per capita crankiness increases.

“We need cool weather for cauliflower but this is searing hot. The crop is going to die,” he says looking at it. The last two years were okay, but before that, he faced the same heat. The crop died. These episodes are starting to recur.

What happens in this heat, he says, is that the head doesn't remain compact; the flora gets splayed out and the flower is damaged. When everything goes well, each flower fetches ₹15-20, and he may get a profit of ₹30,000. Farmers here grow three crops. Corn, grown from January, is a surefire winner, up to ₹50,000 in profits per season if all

goes well, and they say it often goes well. It brings in the major profit, whereas black gram and cauliflower and other things may or may not be profitable.

Farmers cannot be considered sustainable unless they are sovereign

“Pests have increased and we have to go on spraying pesticide. That’s costly,” he says. Mostly, though, the weather and its vagaries, like a haunting melody playing over and over, are an undercurrent to the thoughts on the surface.

The north too is facing its own problems with heat. Subash Nataraja Pillai, head of the division of agricultural physics, ICAR-Indian Agricultural Research Institute, New Delhi, has interacted extensively with farming communities in the Gangetic plains. He finds them stressed. Their woes range from temperature increases through days and nights, erratic monsoon, sometimes delayed in arrival and vanishing often in the middle, dry spells, prospects of drought. The last decade has been worse than others. The farmers, he says, try adjustments like changing planting times, inter-cropping and mixed crops. They use drought-tolerant varieties, they try to retain moisture in the soil. In short, they adapt with the resources available.

“However, even with these measures, yields are decreasing or stagnate, or increase slowly, affecting food security,” he says. Wherever they are, farmers have to live with volatile times, for which they are not entirely prepared.

As Satynarayana from village P. Savaram in West Godavari district says, “The climate has become hostile to people and crops and farming.”

In general, stress affects farming in many ways. Heat, flood, drought and cold each carries its own peril and can affect several crops. Of these stresses, drought is the principal factor. Researchers worked mostly on drought-resistant varieties in the past. Now, however, climate change has upended even the regime of stresses.

“The situation is such that the same region can be hit with drought and also floods in the same season,” M. Prabhakar tells *Fountain Ink*. He is a principal investigator of the National Initiative on Climate Resilient Agriculture (NICRA), an ICAR network project implemented by part of ICAR-Central Research Institute for Dryland Agriculture (CRIDA).

Bihar is hit by both drought and flood. The Indo-Gangetic Plains including Punjab get roasted by heat waves. With such aberrations in weather across regions, happening in succession or in a pile-on, he says, “We changed our strategy to develop varieties that can withstand multiple stresses.”

All stress, of course, cannot be mitigated through a single crop variety. Depending on the problems and climatic change perceived in a particular region, researchers develop the varieties that can grow in the changed milieu.

“To the extent possible, varieties are made to withstand the major stress of that particular area,” Prabhakar says.

NICRA has developed 16-17 varieties of different crops that can withstand major weather disruptions. They include drought and heat-tolerant varieties of rice and wheat, heat and flood-tolerant varieties of tomato. Researchers relied on traditional plant breeding techniques to get the most of these varieties. For tomatoes, which are notoriously water sensitive, they used grafting. That’s basically using brinjal as a root stock, because brinjal can tolerate flash floods better than tomato, and then grafting tomato as scion on brinjal root stock. This is laborious work and requires skilled manpower, thereby adds to the cost, Prabhakar explains.

Vagaries of weather can also lead to problems with their experiments. If they are working on drought-resistant varieties, for instance, a rainy spell in the kharif season can stop them in their tracks. So they have “rain-out” shelters in the experimental plots.

The shelters have sensors that detect a rain drop falling and immediately close the whole field. These dome-like structures run on railings on both sides. These help them save the experiment instead of getting it rained out. They have these facilities in Bengaluru, Jodhpur, Pune, New Delhi and other places.

Despite an ample buffer stock of staples—rice and wheat—India is vulnerable to climate and other shocks, including geopolitical shocks. More than 80 per cent of farm households are small and marginal. Rain-fed agriculture faces severe disruptions in a climate of uncertain monsoons. A truant monsoon is one thing, farmers are used to that. But when coupled with extreme weather events like flash floods and untimely rains, which are increasingly likely, the effects on food security are telling.

In the Indian context, food security is having something to eat throughout the year, for everyone. Food sovereignty is the food producer having sovereign rights over what they grow, how they grow and what seeds they choose—these elements of sovereignty cannot be at the mercy of industry or government or NGOs. The farmer has ultimate control over the means and method of production; it is not dictated by the market.

“Farmers cannot be considered sustainable unless they are sovereign,” says Debal Deb, an independent ecologist. He runs a farm called Basudha, devoted to ecological approaches in the foothills of the Niyamgiri Hills in Rayagada district of Odisha. He has collected and saved, so far, 1,440 varieties of indigenous seeds. Interested farmers can choose from his collection. Sustainability, in Deb’s words, is a farm without any external input, except sunlight and rainwater.

In the pre-Green Revolution era, India had 110,000 indigenous rice varieties, according to Deb. The Green Revolution’s emphasis on widespread use of chemical fertiliser and pesticides pushed farmers to the brink. Corporations now control seed, fertiliser, pesticide and equipment, and the food supply itself. What’s more, they all run on fossil fuel, contributing to global heating.

In India and elsewhere, monoculture robbed people of diversity in diet. Indigenous seeds that were suited to and thrived in their climatic zones vanished, along with memories of traditional farming practices. Farmers in India, over the last few decades have been locked into rice, wheat, mostly, and sugar cane here and there, with the government announcing minimum support prices (MSP) and promising widespread procurement of produce.

The result is that soils have been degraded; water sources are polluted and water tables have been depleted across the country due to water-intensive farming. Chemicals have entered soil, water, and bodies; the environmental toll as a result has been catastrophic. Climate change takes the existing problems to a new level.

Wheat and rice apart, India faces a shortage of pulses and oils and imports them from different countries. One aspect of the Canada imbroglio is that India may not get lentils from Canada until the tensions over the murder of Canadian Khalistan activist Hardeep Singh Nijjar are resolved.

While the Green Revolution happened in many countries, “India implemented it as a cereal revolution,” says, Nandula Raghuram, professor of biotechnology and head of the Centre for Sustainable Nitrogen and Nutrient Management at Guru Gobind Singh Indraprastha University, New Delhi. He is also president of the Sustainable India Trust and a member of the Inter-ministerial National Nitrogen Steering Committee set up to promote sustainable nitrogen management.

India has more than enough acreage under basic items such as cereals, wheat, rice and others, but may be falling short of more nutritious foods such as pulses and edible oils.

“As far as basic food is concerned, access is an issue for a substantial part of the population. They may not have jobs that allow them to buy enough. For the more nutritious items like dal, prices tend to be high, which is partly because of lower

production of pulses, putting them out of reach of most people,” says Reetika Khera, a professor of economics at IIT-Delhi.

We may have overflowing stocks of staples, but distribution remains faulty. India, according to the Global Hunger Index, is in the “serious” hunger category, and ranks 111 out of 124 countries. Anaemia among women is the highest in the world. A whopping 58.1 per cent of Indian women aged 15-24 years have anaemia. The index points out that the child-wasting rate in India is the highest in the world, at 18.7 per cent. The government has rejected the findings of the index, calling its methodology erroneous.

“The incomes of our people are insufficient to maintain adequate levels of food and nutrition through the year,” says T. Jayaraman, professor, M. S. Swaminathan Research Foundation. Climate change adds another layer to this mix. Increasing temperatures reduce yields; floods devastate crops; pests eat away crops.

“As per projections, the occurrence of weather extremes will increase and their occurrence during the critical pheno-phases of the crop will affect grain-fruit formation and thereby final yield level,” says Pillai of ICAR-IARI.

Beyond the yields, the most important aspect of rising carbon dioxide levels is that they’re robbing plants of nutrients, according to research from mathematical biologist Irakli Loladze. Micronutrients and proteins in plants are lost because of rising carbon dioxide levels; it also fills plants with more carbohydrates. The loss of micronutrients like zinc, iron, iodine and others in plants course through bodies and brains and societies.

“Every time you eat any type of plant food, rice, potatoes, vegetables or fruits, that means you’re going to get slightly more carbohydrates and slightly less minerals. It’s not a one-time thing. And it’s not some years away. It’s here and now. For the rest of your life, every day, every bite,” Loladze told *Fountain Ink* in an earlier interview.

Apart from all these factors, the greatest danger to food security in India might just be the government’s own policies, especially in handing over natural resources, the commons, to corporate interests. Two recent events lay out the trajectory of the government’s thinking. The central government has pushed changes through the Forest (Conservation) Amendment Act and recently, the Odisha government did away with the requirement for social impact assessments and providing food security while acquiring land.

Farmers too notice it. G. Prasad of Kumaradevam village sees bleak times ahead for agriculture. The 55-year-old farmer is by no means poor. He has 20 fertile acres. His son is a software engineer in Bengaluru; his daughter is in Canada. He says acute labor shortage and input costs have made farming non-remunerative. There is nobody to take up farming after his stint is over.

He points to the vast paddy fields, burnished green in the sun and swaying to the breeze off the river Godavari a little distance away, and muses, these lands are going to be taken up by corporate interests. In his telling, they need not bother about labour and policies and the daily hassles of farming. “Land owners like me then work in the corporate farms as supervisors or do any work allotted to them.” Then, what happens to the we-grow-food-for-the-people ethic of farming?

He smiles. “It dies.”

He is seeing it both in his mind’s eye and right in front of his physical eyes. The heavy machinery that they bring does the tilling and planting and threshing and storing. Trucks carry the produce to processing units and then on to the malls in India, ships carry it to other countries, and this dirt road transforms into a gleaming black top. India becomes an export powerhouse while a vast swath of its people move from one part of the country to another, a migration that resembles a war-time exodus, people carrying their bags and empty bellies.

Raghuram says India is in transition between public contract farming to the biggest private contract farming. The transition slowed down—did not stop—due to the

2020-21 farmers' agitation.

Debal Deb thinks there could be a famine on the scale of the Bengal famine of 1943 when about three million people died. Before you dismiss it as the figment of a fevered imagination, consider the facts. The famine was not caused by drought or a shortfall in production. It was caused by a set of inter-related factors connected to World War II, raging across three continents. The result was a fall in normal supply, which saw a spike in prices. People had no money, no power to buy food. Amartya Sen, in his monumental work, showed this counterintuitive fact, of how the lack of purchasing power caused mass hunger deaths. The British and some Indians exported food grains even then and made money.

Then, as now and later, as things march in that direction, when one or two big corporate houses control land and food production and also seeds, and sell produce—even rice and wheat—at exorbitant prices, who has the purchasing power to buy? The thing rankles small farmers as well as those who are well off.

“Everything will go,” says another farmer. “A farmer remains as he is. When he gets something in profit, he repays loans; when he loses, he goes for loans. In between, sometimes, somehow, he buys things.”

Deb sums up what might happen: “We may be heading towards a place where there are tiny islands of wealth in a sea of poverty.” Meanwhile, middle class have their malls and their branded clothes, they and their children work for the same companies, a sort of sweet spot between the pains of crushing poverty and the predations of the rich, between aggressive servility and servile aggressiveness, a conscience that neither needs or brooks catharsis or redemption.

Lest Debal Deb's prediction sound like dystopian fantasy, here is a troubling scenario from a sober scientific journal. Worldwide, according to this report, more than 500,000 adults could die in 2050 due to climate impacts on food availability. This is a 2016 study in *The Lancet*—“Global and regional health effects of future food production under climate change: a modeling study”.

Climate change effects could hit agriculture badly, jeopardising food production and consumption. People will have vegetables and fruit that are hardly enough, undermining nutrition and bodyweight.

About 75 per cent of these deaths are expected to occur in China and India. In India, the burden of death—136,000—is mostly due to the number of people being underweight, while in China the burden of death—264,000—is due to eating fewer vegetables and fruit, according to the estimate. The other worst-affected are low- and middle-income countries, predominantly those in the Western Pacific region with 264,000 deaths and Southeast Asia with 164,000 deaths. It reinforces the fear that climate change is the grim reaper.

This is a study that links climate impacts and food availability and consumption and diets, and loss of life. Marco Springmann of Oxford University's Oxford Martin Programme on the Future of Food, led the study.

Cutting emissions will save lives. In a medium emission scenario where a global average surface air temperature rise of 1.3-1.4°C in 2046-65 happens, compared to 1986-2005, the number of diet- and weight-related deaths could be reduced by about 30 per cent compared with the worst-case, high-emission scenario, as per the study.

Springmann advocates for public health programmes geared towards preventing and treating diet and weight-related risk factors, such as increasing fruit and vegetable intake. This is, according to him, a matter of priority to help mitigate climate-related health effects.

Food security, or the lack of it, is not hostage just to climate change but also in peril from other factors such as modern factory farming. Some of the solutions are available to hand in the form of sowing patterns and crop diversification, for instance.

Raghuram suggests bringing the cereal-legume production ratio to 50:50 from 70:30 now. That will answer many of the problems; it will raise the quantity of protein available and so help reduce instances of protein malnutrition, stunting/wasting. It cuts the demand for urea fertilizer by at least a third, because legumes can fix nitrogen from the air and leave some behind for the next crop. This can be supplemented by improving manure/urine management and recycling nutrients from wastewater or composted wastes.

Over time, the need to pump potassium and phosphorus will also come down, saving over ₹1 lakh crore on fertiliser subsidy alone, while improving soil carbon and soil health. It will save foreign exchange that's going into importing legumes and oils. It also helps the climate in that nitrous oxide compounds will not be released into the atmosphere in the same quantities as before. All the government has to do is procure legumes and oilseed legumes at MSP and regulate irrigation to make it attractive for farmers to diversify into legumes and restore legume-based crop rotation.

Agro-meteorologist D. Raji Reddy suggests adding value to crops. He is a former director of research and extension, Professor Jayashankar Telangana State Agricultural University, Hyderabad. Simple things like providing opportunities for milling, or livestock rearing, to communities can improve farmers' livelihoods. That includes making pickles and snacks and others. Reddy says shifts in temperatures and rainfall are happening. Rain shadow areas like Siddipet and Sircilla in Telangana are being lashed with rains.

"We need 4-5 year crop plans with an allowance for mid-course corrections," Reddy says. The government should gear up to procure more of the 23 items for which it declares an MSP rather than two or three items. The major part of the procurement effort goes towards paddy and wheat.

"That must change," says Khera, the IIT-Delhi economist.

"It will benefit us in several ways," Khera says. Such an announcement will make farmers consider increasing production of those items, leading to a diversification of crops and diets. It will have environmental benefits such as slowing down groundwater depletion, especially in states like Punjab.

Also, "to the extent that the government starts procuring pulses or 'coarse cereals' such as Bajra, ragi amid others, it can supply these through PDS or midday meal scheme or ICDS. These are nutritively better than rice and wheat."

Khera wants a shift in focus to children under the age of six and to pregnant and lactating mothers to ensure that "we don't miss the window of opportunity" which is the period from conception to 2 years after birth. Improving maternity benefits: increasing it from merely ₹5,000 for the first child through the PM Matru Vandana Yojana to something like Tamil Nadu where it is ₹18,000 with a promise to increase it, as well as nutritional support through anganwadis by adding eggs to the menu.

"As far as diets are concerned," Khera says, "we need to think beyond wheat and rice and move towards a public distribution system (PDS) like Himachal Pradesh or Tamil Nadu where pulses and edible oil are provided. What is heartening is that Rajasthan has recently announced such an intervention, adding dal, oil and spice to the PDS basket, possibly as a pre-election gimmick but hopefully it will stick beyond the election, too."

There are many strands to this problem and solutions. While we go about dealing with climate, we should be careful about how we go about with regard to biofuel policy and developing carbon sequestration, says Jayaraman.

"Mitigation efforts in agriculture may create food insecurity through demand for biofuels, carbon sequestration through diversification of land for those efforts," he says. This is what happened in Brazil, and would have gone on. Lula, after winning the presidency, is credited with having reversed Amazon deforestation.

Dakshina Murthy of the Regional Agricultural Research Station at Maruteru, West Godavari district, says farmers need to be helped with information on the best sowing and planting time, in selection of suitable crops for the climate and so on.

Decision Support Systems (DSS) that integrate multiple streams of information at micro-level and develop contingency plans to address climate variability are the need of the hour, according to Pillai of ICAR-IARI. For instance, he says, India Meteorology Department's (IMD) block-level forecast of five days is good; it would be better if it came up with 7-15 days forecasts at block level with more precision.

For food security, NICRA's Prabhakar says, "We must have proper crop planning and look for crop diversification. With major shifts occurring in climate, we need to change cropping pattern keeping in mind the crop water requirements, soil type and changing climatic conditions.

For bouts of extreme weather, researchers at CRIDA have developed 'District Agricultural Contingency Plans for Managing weather Aberrations and Sustainable Agriculture.' In a scenario, for example, where a heat wave is developing in a region, the district administration can access the contingency plan meant for that region and begin working towards mitigating the situation.

"The plans are meant for reducing the gap between the administrators and researchers," says Prabhakar. "Instead of losing precious time, policy makers can refer to such plans and start implementing recommendations."

They have seasonal forecasts in April, May, and June and further short-term forecasts by the IMD every five days, and then they go about identifying districts or regions which are likely to be affected by floods, droughts or other major disruption. They conduct meetings with the state departments concerned to sensitise the administration on possible weather aberrations in the following season.

"District Contingency plans help in real time response," says Dr. Prabhakar.

For Debal Deb, the very act of farming is a sacred vocation, a way of being and being alive in the world. A field, for him, is a rich ecology of beings, a menagerie of multiple species. We live in the things we grow.

"You cannot look at food security in isolation," he says, "it's your industry policy, mining policy, forest policy, agricultural policy, water policy, land policy—all together." For instance, he explains, the forest is a source of thousands of food items available free to tribals and non-tribals. Indigenous seeds have the capacity to withstand extreme weather. Deb's seeds helped farmers in the Sundarbans after Cyclone Aila struck them in 2009.

The circulatory flows between land, water and atmosphere are best expressed in seeds. They are the last defence against the predations of capital and the vagaries of weather. They embody the security of food and life.

Correction, October 26, 2023: Sentence about indigenous rice varieties changed for clarity and to reflect the correct number.



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is a freelance journalist based in Andhra Pradesh.