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The world is passing through several major crises today, the main being the Agrarian crisis. Large tracts of agricultural land are losing fertility due to misuse or over-use. Experts expect a 40% loss of agricultural land in the next 50-60 years, by which time there will be about 30% increase in the world population. There is an imminent threat to food security.

Jyotirmoy Goswami in his article emphasizes the need for a commitment of every citizen to embrace the route of harmony and nonviolence for rural reconstruction. G.V.Ramanajeneyulu, The Executive Director, CSA explains the need of the nation towards agroecological approaches in his article on the Union Agricultural Budget 2019. According to him the budget lacks in focus on ecological sustainability of farming. He also reiterates that there are number of examples across the country to elucidate scientific agroecological approaces of farming that could reducem impact on environment, make food safer and help farming resilient to climate change. Suresh Ediga critically reviews the Union Agriculture Budget 2019 and puts forth his views to mitigate the agrarian crisis and explains that the budget is not a mere statement of income and expenditure but it is a powerful tool to envision, plan, prepare, coordinate, monitor and execute. But if this budget itself falls short of the vision to solve the agrarian crisis, then there is no hope left for agriculture.

The UNESCO consultant Garry de la Pomerai reviews a range of the underlying issues and trends adversely affecting our water resources and supply mechanisms around the globe. The paper introduces a few solutions that will potentially aid positive water resource management. He says that Water crisis must not be reviewed as just a local or regional periodic adverse phenomenon such as drought and flood, or as a siloed component addressed only by humanitarian donor WASH strategy, but be respected as an imminent and evolving global transborder catastrophe, realising that "there is not enough to go around now for our ever increasing population needs.

Sustainable Farming, a Collective Learning Approach by PRADAN details the strategies adopted by farmers in Bhandaro village and how they chose to risk going back to organic methods of crop cultivation, controlling diseases and pests through indigenous ways. They brought to life the dying land, ravaged by years of chemical use and the results were better yield, richer soil, and rejuvenated natural resources. Sibu Cherian from Harvest Plus details on Biofortification and the need for Positioning Nutritious Crops as a Cost Effective and Sustainable Solution to Solve Malnutrition. Pratap Mukhopadhyay emphasises on Small Indigenous Freshwater Fish Biodiversity and their Conservation for Nutrition Security & Rural Livelihood Support. Gayathri and Arun Kumar describes the need for Neem leaf meal (NLM) as an ideal candidate for the poultry industry to make their production economically viable and environmentally sustainable. Jitu Mishra in his enticing photostory details on the Traditional water storage structures of Jodhpur and its plight now. Jodhpur is truly a magical city. Its art, architecture, settlement pattern and more importantly water structures are unique in the Subcontinent but one feels disappointed to see this wonderful water heritage on the verge of extinction. The article on Agricultural Terrorism allows us to actively have a glimpse of furious past at a global level, history and recent developments of agroterrorism, analysis of the real incidents or attacks of the past.



MC Dominic
Editor-in-Chief







From the Editors Desk

Gracefully accepting what Mother Nature gifts us year after year, Agriculture has sought to violate her and snatch the last bit from her instantly. While the extracted wealth has flowed steadily towards a handful of centers of power, mankind as a whole has suffered from loss of the soothing proximity to nature. A commonality that binds all people, irrespective of their position in any conflict, is that they live in increasing isolation from nature and from one another.

A disconnect with nature exists in general, which makes people insensitive to degradation of greenery and waterways. Sadly, this misfortune plagues even the most ardent advocates for the environment. Even today malnutrition remains one of the biggest health challenges of the twenty first century that can severely impair sustainable economic growth and human development of the country. Government's inclusion of agriculture as promising means to improve human nutrition will help in create long-term sustainability.

All of nature's gifts – be it coal, oil, minerals, sand or wood – has become fair game for plunder. With life facing such a peril at this juncture of history, we have to seek potent ways of offering worship to Life and Nature. These potent ways are very gradual and the transition process is natural and sustainable and is without external coercion.

Some communities have taken its own time to explore, understand and improvise on practices. Convinced, they are now taking it upon themselves to reach out to the other farmers and are inviting them to explore, creating a learning environment that helps them make informed choices. We need a little bit of Caron Rawnsley in each of us to fulfil what Gandhiji meant by Swaraj. That said, the government too needs to wake up from their deep slumber and take urgent steps.

Dr. Lakshmi Unnithan

Global Food Demand

Global demand for agricultural products is forecast to grow 15 per cent over the coming decade, while agricultural productivity growth is expected to increase slightly faster, an annual report by the Organisation for Economic Co-operation and Development and the UN's Food and Agriculture Organization. The Outlook gives a consensus assessment of the 10-year prospects for agricultural and fish commodity markets at national, regional and global levels, according to FAO. The way in which this demand is met will determine the sector's impact on the natural resource base, notably land, water, and biodiversity.



Much of the additional food demand over the next decade will originate in regions with high population growth, in particular Sub-Saharan Africa, South Asia, and the Middle East and North Africa, according to the report. The use of cereals for food is projected to grow by about 150 million tonnes over the outlook period – amounting to a 13% increase, with rice and wheat accounting for the bulk of the expansion. For nearly all commodities, real prices are projected to remain at or below current levels, as productivity improvements continue to outpace demand growth. The Outlook foresees that yield improvements and higher production intensity, driven by technological innovation, will result in higher output even as global agricultural land use remains broadly constant.

Digital Solutions could be key to end Hunger in Africa: Report



Digitalisation for agriculture can increase agricultural output, raise employment opportunities in Africa as well as ending hunger in the continent, according to a report by the Technical Centre for Agriculture and Rural Cooperation (CTA).Over the last 10 years, there has been a significant growth in digitalisation for agriculture (D4Ag). D4Ag is the use of digital technologies, innovations and data to transform business models and practices across the agricultural value chain. It includes solutions like agronomic advice and information delivered via short message services (SMS) and interactive voice response (IVR) to smart phone applications that link farmers to multimedia advisory content, farm inputs, and buyers.These solutions offer farmers access to tailored information and insights that help them optimise their production, gain access to appropriate products and services, and explore new linkages with markets.The digital solutions can help in making agriculture more climate resilient and are able to eliminate hunger in the African countries.

Heat stress spike Predicted to Cost Global Economy $2.4 Trillion a Year

The impact of heat stress on labour productivity is a serious consequence of climate change. The International Labour Organization (ILO) warned that the lost output will be equivalent to 80 million full-time jobs or 2.2 per cent of total working hours worldwide during 2030, highlighting that the world's poorest countries will be worst affected, particularly in West Africa and South-East Asia.

The total cost of these losses will be $2.4 trillion every year. ILO's working on a Warmer Planet report maintains, based on a global temperature rise of only 1.5 degrees Celsius by the end of this century. Heat stress is defined as generally occurring at above 35 degrees Celsius, in places where there is high humidity. Excess heat at work is an occupational health risk and in extreme cases can lead to heatstroke, which can be fatal.With some 940 million people active in agriculture around the world, farmers are set to be worst hit by rising temperatures, which indicates that the sector will be responsible for 60 per cent of global working hours lost from heat stress, by 2030. Construction will also be "severely impacted", with an estimated 19 per cent of global working hours lost at the end of the next decade, ILO says.



Neem Chemical can disable Cotton Pest in Multiple ways: Study

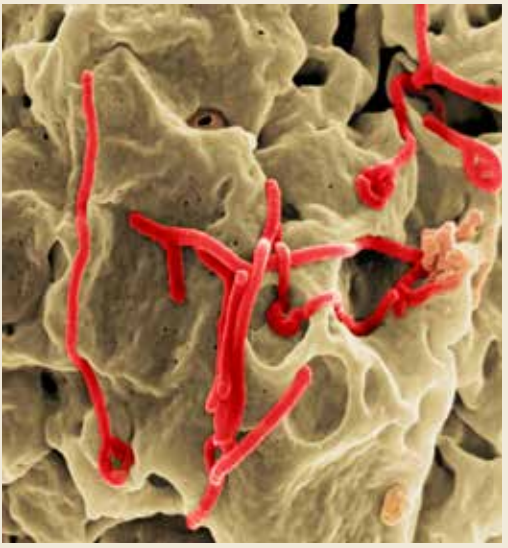
The neem plant, Azadirachta indica, is known to contain a potent phytochemical Azadirachtin-A (Aza-A) that can ward off several pests. Scientists from India and Germany have now deciphered the mechanism by which Aza-A does this. Their research on cotton bollworm reveals that the phytotoxin acts in multiple ways to suppress growth of the pest. Cotton bollworm (Helicoverpa armigera) is a dreaded pest attacking several crops of economic value and has become resistant to most insecticides in use.Unlike synthetic pesticides which target a single protein, Aza-A aims several proteins in pests.

This, in turn, triggers actions that change their feeding habits and metabolism, thereby arresting their growth. Even a small amount of Aza-A could alter primary metabolism in the insect. This suggested that Aza-A could have several targets for its toxic mode of action. Aza-A has a complex structure, and it has taken several years to understand it. Owing to this complexity, it cannot be synthesised in the laboratory. However, the metabolites can be. By exploiting this, we can develop broad-spectrum bioinsecticides can be developed.



Ebola outbreak in Congo

The World Health Organization declared the Ebola outbreak in the Democratic Republic of Congo a global health emergency, citing the virus's recent spread into Goma, one of the country's most densely populated cities. Two million people reside in Goma, which is the epicentre of the outbreak. The WHO emergency committee said that despite efforts by both the government and the people in Congo to fight Ebola,the outbreak in Congo has been on-going for almost a year, with 2,418 confirmed cases and 1,676 deaths.The WHO estimates 12 new cases to be reported daily. It is the second deadliest Ebola epidemic ever. The WHO reports that there have been almost 200 attacks against health care workers and patients since January. The declaration included advice not to cross any borders.

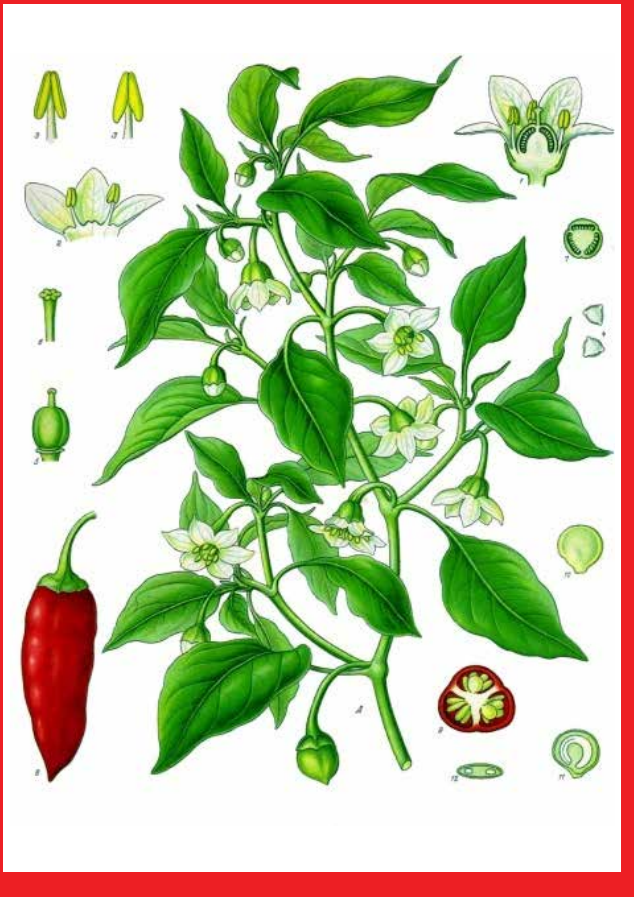


Fruits in space, says NASA

A team of scientists at NASA has picked a new edible plant to be grown aboard the International Space Station, and it's seriously spicy. NASA has selected none other than the Española chile pepper to be its next space crop project. While such peppers are often lumped in with vegetables, they're actually fruits, and this means the chile pepper will be the first fruit ever grown by NASA in space. There are many challenges to growing crops in space. NASA is looking for varieties that don't grow too tall, and yet are very productive in the controlled environments that we would be using in space. A plant must be easily pollinated and able to survive in a high-carbon-dioxide environment. Scientists found that certain chile peppers can do both these things.

Growing peppers might have other benefits as well, such as giving astronauts an option for spicing up their sometimes bland food options in space. As an added benefit, peppers are rich in Vitamin C, which is important for space diets.

NASA has already grown plenty of different space vegetables on the ISS, including lettuce, Swiss chard, radishes, Chinese cabbage, and peas.

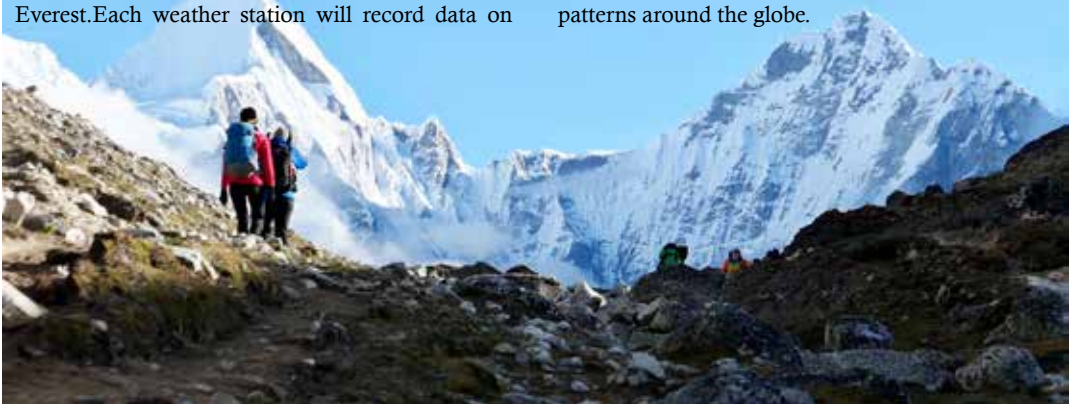


Highest weather station in the world

The National Geographic Society has announced the successful installation of the world's highest operating weather stations on Mount Everest to provide researchers, climbers, and the public with near real-time information about mountain conditions.

The multi-disciplinary team installed the world's two highest operating automated weather stations at Balcony area (8,430 m) and South Col (7,945 m), as well as three other weather stations on Mount Everest.Each weather station will record data on temperature, relative humidity, barometric pressure, wind speed, and wind direction.Data from the weather stations, will help communities respond to climate risks, that threaten the lives and livelihoods of the more than one billion people in the region.

The successful installation aims to break new ground in our monitoring and understanding of climate change, as the stations will help continuously monitor the upper reaches of the atmosphere, which is critical to tracking and predicting weather patterns around the globe.



Joshua Tree

The Joshua tree is an unusual tree-like species of Yucca, a member of the Lily Family (Liliaceae), and sometimes considered in the Agave Family (Agavaceae) It grows uniquely in the desert southwest of the United States, principally in California's Mohave Desert, Antelope Valley and the surrounding area, and also in parts of Arizona, Nevada, and the southwest corner of Utah.

It is found typically in the high desert, around 4000 feet (1200 m) elevation where there are freezing temperatures during winter nights, and very hot, dry summers. The Joshua tree is not a true "tree," in that it does not produce a trunk with annual rings. It grows very slowly, only 1/2 to 3 inches (1 to 7 cm) per year, typically reaching 5-10 feet (1.5 to 3 meters) before the first blossoms appear.

Archaeological evidence indicates that the Joshua Tree dates back to the Pliocene Epoch, some two million years ago, when the climate was more moist and warm, and its habitat more extensive. Native Americans knew the Joshua tree as a source of food and fiber. The flowers were considered a sweet delicacy, roasted over a fire. The leaves were used for baskets and cordage.Early European settlers often saw the Joshua Tree as grotesque and misshapen. However, the Mormons, trying to find their way back from California to Utah, used the Joshua Tree as a guide. They gave the plant its name in the early 19th century, because it reminded them of the biblical prophet Joshua, with his arms upraised in prayer. They saw this plant as a spiritual sign of welcome into the Promised Land.



Ichiban Crop Science: Bridging the Gap

"Agriculture Technology" to the door step of Indian Farmer

ichiban CROP SCIENCE LTD.
(Powered by Japanese Technology)





We live in a Technology driven World and we witness a global scenario of revolution of changes in Agriculture too. India is far behind in agri-technology,our farmers still use age old cultivation practices and age old formulations. Keeping this in mind, Ichiban's vision is to tread a different path and to bridge the gap between tecnology and farmers .Ichiban visions to bring Agri-technology to the door steps of Indian farmers!

Ichiban boasts to be India's technologically advanced company introducing new safer molecules ! These molecules are Greener, Safer and undoubtedly the new Generation products. In the shortest span of time, Ichiban is leading by launching maximum new molecule products in India. Ichiban also remains committed to bring the latest agrochemical chemistry to India.

Ichiban understands that Japan is a front runner in terms of technology development,be it be in any industry,including Agriculture! All this while, the Indian Agriculture science thought of increasing yields through soil nutrition. The focus in India was to provide nutrition to crops via the roots. Its very intresting to know that the Japanese envisioned the leaf as primary source of energy provider to the crop. The Japanese technology, thus is **focused on enhancing photosynthetic activity in the leaf.** This technology also provides balanced nutrition required depending upon the stage of crop life cycle to increase yields. This Enhanced Photosynthetic Technology is called the EPP Technology. With increasing population in India, there is an increase in demand of food. Ichiban understands this growing demand and is working towards bringing Knowledge, technology, and new formulas from Japan to fill in this gap.

Ichiban Crop Science proudly announces its tie up with the Japanese number one company in farm productivity. For the first time, our Indian farmers will not only be able to increase the yield but also will be able to enhance quality parameters of their crops! This would fetch them higher price for their produce.

The game changer products that will be imported directly from Japan, will now be available in India. **EPP technology is a new concept being introduced for the first time in India by Ichiban Crop Science Ltd.**

Merit, is the latest foliar application technology product imported from JAPAN and developed by **Enhanced Photosynthesis Process** (EPP) Technology. EPP technology is a brand new concept that uses foliar feeding and nutrigation and fertigation that brings about increasing yield using precision agriculture.

MERIT is specially designed to be applied directly to the leaves of a plant. In **FOLIAR FEEDING, plants take in nutrients more efficiently through stomata** (plant pores) in their leaves than they do through root uptake. Tests have shown that **foliar feeding can be 8 to 10 times more effective** than soil feeding.

MERIT is the latest foliar application technology that provides balanced nutrition to the crop depending upon the stage of the crop Vegetative, or flowering or fruit setting and is available in three formulations Blue, Yellow or Red Nekkorin, another innovation being imported from Japan, contributes to sustainable agriculture. Based again on EEP technology, it enhances plant growth, health, by improving nutrient efficiency. Nekkorin also improves quality attributes nutritional content, appearance and shelf life. India had never heard of a SOIL CONDITIONER, that conditions the soil. Ichiban Crop Science is also importing KIPPO a unique soil conditioner that effectively softens the soil. This effectively means it improves drainage and water retention, deeper root growth, improves soil aeration thereby improving the microbial activity in the soil.

Ichiban is committed to bringAGRICULTURE TECHNOLOGY to the door steps of Indian farmers!

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India home to 1,256 Species of Orchid

The Botanical Survey of India has come up with the first comprehensive census of orchids of India putting the total number of orchid species or taxa to 1,256. The 1,256 species or taxa of orchids belong to 155 genera and 388 species are endemic to India. A State-wise distribution of orchid species points out that the Himalayas, North-East parts of the country and Western Ghats are the hot-spots of the beautiful plant species.

The highest number of orchid species is recorded from Arunachal Pradesh with 612 species, followed by Sikkim 560 species and West Bengal; Darjeeling Himalayas have also high species concentration, with 479 species.While north-east India rank at the top in species concentration, the Western Ghats have high endemism of orchids. There are 388 species of orchids, which are endemic to India of which about one-third (128) endemic species are found in Western Ghats. The publication points out that Kerala have 111 of these endemic species while Tamil Nadu has 92 of them. Among the 10 bio geographic zones of India, the Himalayan zone is the richest in terms of orchid species followed by Northeast, Western Ghats, Deccan plateau and Andaman & Nicobar Islands.



Black Tiger Shrimps comeback to Kerala

Ending a decade's slide in the production of black tiger shrimps, Kerala is experiencing a comeback of the top healthy seafood, thanks to a much-needed initiative of the Marine Products Export Development Authority (MPEDA) launched earlier this year. The mass sale of seeds since the past 100 days shows a rapidly growing interest among the farmers to raise the disease-free variety, the authorities said.The Kochi-headquartered MPEDA had on February begun supplying black tiger shrimp seeds from its new multi-species aquaculture complex (MAC) at Vallarpadam.

The ₹ 7.26-crore MAC, which was inaugurated on last year December features a hatchery with an annual production capacity of 20 million black tiger shrimp seeds, besides nurseries for four varieties of fin fishes. It was from 2010 that the black tiger shrimp, an endemic species to south-east Asia, began to face a slump in its traditional reputation as a major variety of cultivated shrimp item in India. That was after aquaculture farmers in the country began to focus on growing the exotic vannamei species of shrimps in a big way.



CIMMYT and UAS-Bangalore jointly signs



The International Maize and Wheat Improvement Center (CIMMYT) and the University of Agricultural Sciences-Bangalore (UAS-Bangalore) have jointly signed an agreement for establishing a maize doubled haploid (DH) facility at the Agricultural Research Station in Kunigal in Karnataka.Occupying 12 acres of land, the facility is estimated to produce at least 30,000 DH lines a year. CIMMYT hopes the facility to be operational by the last quarter of 2019. The maize DH facility, funded by the CGIAR Research Program on Maize (MAIZE), fulfills a very important requirement of the region. It has the potential to accelerate maize breeding and hybrid development and significantly increase genetic gains through maize breeding in Asia. The maize doubled haploid facility will be the first of its kind in the public domain in Asia. The work done at this facility will certainly benefit the farmers of the state, country and the Asian region, by accelerating maize breeding and improving efficiencies. DH maize lines are highly uniform, genetically pure and stable, and enable significant saving of time and resources in deriving parental lines, which are building blocks of improved maize hybrids.

Curd into Low-Cost Gel That Enhances Wound Healing

To address the concern of the increasing presence of antibiotic-resistant bacteria in the environment a team of scientists from IIT-Kharagpur has synthesized a low-cost gel from curd which not only retards the growth of antibiotic-resistant bacteria but also enhances wound healing. Scientists made curd by inoculating three strains of bacteria – Streptococcus thermophilus, Lactobacillus casei, and Bifidobacterium bifidum, which they obtained from National Collection of Dairy Cultures at Karnal-based National Dairy Research Institute. They then collected the drainage water from the curd and purified it for bioactive peptides.



They added ten micrograms of the peptide to 0.1% trifluoroacetic acid and zinc nitrate to form a hydrogel. Scientists tested the efficacy of the hydrogel against two antibiotic-resistant strains. The hydrogel killed both the strains. Pseudomonas, however, required a higher dose of hydrogel/peptide than Staphylococcus. To evaluate the wound healing activity of hydrogel, scientist used laboratory-grown skin cell lines. Scientists scratched the surface containing the skin cells and applied hydrogel over there. After 24 hours, cells were observed at the scratched surface. This confirmed that hydrogel can enhance the proliferation capacity of damaged cells and therefore has property of wound healing also.

Healing the Soul, Soothing the Soil



Jyotirmoy Goswami, Associate Professor, Vivekananda Mahavidyalaya, Burdwan


“An indicative proposal for
realization of the
capital value of goodness

The world is passing through several major crises today, the main being the Agrarian crisis. Large tracts of agricultural land are losing fertility due to misuse or over-use. Experts expect a 40% loss of agricultural land in the next 50-60 years, by which time there will be about 30% increase in the world population. There is an imminent threat to food security. Increasingly globalized competition is squeezing returns from small farming. People in India and elsewhere are moving out of agriculture and allied professions at a rapid rate. Migration seems to be at a rapid rate.

We also see the steady destruction of forests leading to acute environmental degradation and disruption of the water cycle. Acute environmental degradation leading to migrants into every country called environmental refugees. In 2009, the UNHigh Commission on Refugees estimated that there were 36 million of them worldwide. According to a study published in the Lancet journal last year, pollution was linked to about 9 million deaths in the year 2015. Biodiversity being destroyed with species after species being wiped out at an unprecedented rate, while leaving humans in an increasingly lonely and scary world.

Crisis of imbalance

A defining characteristic of human history has been the unchecked triumph of masculinity. The go-getters have not only been rewarded disproportionately, but have also been eulogized. The glitter of achievement has consistently induced awe and admiration of the general populace. Masculinity has thus proceeded to conquer one frontier after another. Until recently, the object of that conquest had mostly been other men and women. The misery caused by their violation had been somewhat localized. Since the industrial revolution, however, the intent to conquer and plunder has been directed increasingly towards nature. All of nature's gifts – be it coal, oil, minerals, sand or wood – has become fair game for plunder.

Rather than gracefully accepting what Mother Nature can give year after year, agriculture has sought to violate her and snatch the last bit from her instantly. While the extracted wealth has flowed steadily towards a handful of centers of power, mankind as a whole has suffered from blighting of air, water and soil, and loss of the soothing proximity to nature. A commonality that binds all people, irrespective of their position in any conflict, is that they live in increasing isolation from nature and from one another. Few people have any role in the production of the food they eat. The sight of a single green leaf emerging through the crack of a seed, the sound of crickets at night, the smell of freshly collected milk or the touch of grass under the bare feet is unknown to many. The distance inevitably turns food into a commodity, rather than an opening through which the human soul can connect to the flow of life.

There is a similar disconnect with nature in general, which makes people insensitive to degradation of greenery and waterways. Sadly, this misfortune plagues even the most ardent advocates for the environment. A good example is the mechanism of carbon credit under the Kyoto protocol, which permits a country to pollute its own air in exchange for planting trees in another faraway country. Increasing isolation of humans from their source of sustenance leads to accumulation of stress and degradation of their mental and physical health. Unlike a broken electrical circuit, a spiritual disconnect is hard to repair.

Benefits of technology, which have reached near and far corners of the Earth in varying degrees, generally keep people somewhat pacified and oblivious to the terrible losses that they suffer. There are occasional exceptions though. Acute deprivation and marginalization sometimes prompt people in certain regions to fight back. There have been many struggles of this kind over the past century.

Ironically the struggle is often aimed at mimicking the achievements of the adversary. The proletariat has to become the dictator, and the woman has to become manlier. That confounds the very purpose of the struggle. The ultimate triumph becomes indistinguishable from abject surrender to masculinity. We have forgotten that life on earth depends crucially on nurturing, nourishing, soothing, reconciling and such other qualities that are commonly identified as feminine. The evolution of agriculture, family and society would not have been possible without these. While these attributes are generally associated with women, they are also found in ample measure among men. Rather than falling for a stereotypically binary characterization, it has to be recognized that for millennia women and men have tended their young and the animals together, watered plants, stored provisions for future, cared for one another and indulged in a hundred other activities that have nothing to do with the so-called masculine qualities. These activities have been expressions of an inner strength that is overlooked if we think of civilizations as founded solely on exploration, conquest, extraction, innovation and such other 'masculine' qualities.

Civilization has historically been driven by two types of relation – human relation and business relation. The former invokes feminine qualities, starts from family, extends to society and aspires to

embrace the universe. The latter invokes masculine qualities, connects the self with the city and transcends to the state and the global market.

Human relations tend to defy the self and even the state, while business relations tend to dismiss the family and the society. Human relations are driven by anxious fondness and expressed as contentment and thankfulness; business relations are driven by fear and greed and expressed as dissatisfaction and doubt. The former seeks the immortal while the latter seeks to stave off extinction. Yet the former has perpetuated the flow of civilization all along, while ironically the latter is now threatening to bring it to end.

The emergence of business relation as the domineering component of human endeavors has been a relatively recent phenomenon. This imbalance can easily be seen to be an important factor behind the aforementioned crises. No expert can restore the balance by injecting a dose of femininity in people. One needs a holistic view of life that spirituality can imbibe.

Pattern of response

Patterns of response to different aspects of the crises vary. Some work towards empowering the affected people in various ways. Some push for change in laws, practices or social order. The changes advocated by them are meant to benefit the worst affected people, but are often unacceptable to some others. Those who propose a particular change and those who oppose it generally havedifferent fragmented visions of the issue. A common ground is missing. The efforts of the non-religious groups are also generally devoid of spirituality.

There has been focus on salvation of individual souls or helping the affected people to cope with their trauma. Relief work pursuant to a disaster is another area of their work. These groups also provide a linkage between the disadvantaged and the advantaged people through the vehicle of charity. Many provide value based education. Through this and other activities, they conserve, and possibly expand, the number of people under their influence. This aspect of their work has invariably led to escalated conflict. Sometimes profound messages become narrow when they are sought to be held through a rigid structure. The rigidity of the structure is often mistaken as a sign of durability. Yet a powerful message can outlast the structures designed to hold it.

A good example is the influence of Buddha's message on people who are not even Buddhist by religion. By focusing on the central message rather than the narrow interpretations, people may have a better chance of serving their cause. For example, a displaced person may find it impossible to rebuild connections with nature, which had been an integral part of the life left behind. A person staring at imminent displacement may not be soothed by the prospect of relief after that catastrophe hits.

The mantra "Prevention is better than cure" transcends the medical sphere and is applicable to all aspects of life. Let us now see how this insight can help us in finding concrete ways to avert crises before they happen. The world is too diverse a place to be amenable to a straight-jacket solution. There may be some general principles, but rather than laying these out as bullet points, I would provide an example in the form of an indicative proposal.

An indicative proposal

The example relates to the state of West Bengal in India, where I come from. The area lies in the delta of the river Ganga. The land-holdings are small and numerous, and the centuries-old practice of family farming isnow being rendered uneconomical.In India, there is a government scheme called Mahatma Gandhi National Rural Employment Generation Scheme (MGNREGS). Funds of MGNREGS are generally used for labour intensive projects such as building of dirt roads and renovation of ponds. These projects do bring people together for a common activity, though in a somewhat mechanical way. This can be turned into an occasion of organic cooperation, if it is for an inspiring cause that holds potential for common and tangible good.

About a square kilometer of agricultural land may be identified as the core area for the proposed work. Some parts of this land would invariably be unutilized or under-utilized. Typically, these parts are irregularly shaped, too small, too narrow or not flat enough for regular cultivation. Such pieces of land can be located at the edge of an agricultural field, in between fields, by the wayside or next to a water body. Without any change of ownership, these plots may be used for planting trees that would become vital resources for the entire community. These would consist mostly of fruit trees and some trees for timber.

There would be a place for daytime upkeep of these animals – much like crèche for children. This animal crèche would provide regular feeds to the animals and a limited amount of fenced space for recreational movement. Owners would be encouraged to keep their animals there for a fee, instead of taking them out for grazing. Farmers enjoying protection from animal intrusion would also pay a fee.

MGNREGS funds may be used to put together the infrastructure of the animal crèche. Consolidation of the animals would lead to economy of scale, which would encourage others to keep animals for supplementary income. The idea is to channel MGNREGS funds from scattered projects towards a single integrated endeavor for Rural Rejuvenation. With some investment on infrastructure, the crèche would be able to utilize animal waste and urine to produce organic/natural fertilizers and pest repellents. There would be other gainful downstream activities such as preparation of fodder, rearing of livestock, preservation and exchange of organic seeds, nursery for saplings, fruit processing etc. These activities would be left to initiatives and creative energy of the local people. As they begin to get results, the common cause would gain further prominence, thus enhancing the spirit of cooperation. The importance of moving away from the green revolution-era technology (chemical fertilizers/ pesticides, patented seeds, etc.) is being stressed all over the world. Many farmers appreciate the need for sustainability, but are afraid to take the plunge towardsnatural and diversified farming for fear of immediate reduction of income. Easy availability of natural fertilizers and pest repellents may make the vital difference for local farmers, particularly in the core area.The endeavor described here is far more complex than a typical MGNREGS project. A dedicated group of people is needed. This job may be entrusted to a body selected unanimously by the villagers. We will refer to this group as the club.It is absolutely essential that the club is formed through complete participation of the entirecommunity. This participation may be facilitated by an external group, whom we can call the agency.

Several aspects of the work such as identification of unutilized or under-utilized land, allocation and coordination of multiple tasks, networking and so on come naturally to women. In fact women might be natural choices as members of the club. It is said that farming was born at the hands of women, and it would only be fitting if it is revived at the hands of women too.

Natural and diversified farming, largely a lost art, is being reinvented and improved upon. It is also a subject of cutting-edge research. The technology of many varieties of natural farming is not readily available to small farmers, who may find it difficult to adapt to them. This is where universities and colleges or NGOs working on these matters can step in, at the invitation of the facilitating agency. In India, short term farming is often done through sharecropping. This practice can be extended to medium and long-term farming of timber and fruit trees in unutilized and under-utilized land, mentioned earlier. The proceeds of this farming would be shared by the owner of the plot (whose only role is to allow the trees to be grown there), the club (which provides the human capital required for the activities, over and above the MGNREGS resources, and manages the activities) and the agency (which facilitates knowledge acquisition/dissemination and possibly fund flow under MGNREGS). There can be tentative sharing formula (say 40:40:20)that would be an incentive for generating new wealth for everyone.

A ready means of saving is absolutely essential in areas receiving MGNREGS funds, just as drainage is essential in fields receiving a sudden dose of irrigation. The ill-effects of too large a role of money



in society have been well documented, and need not be listed here. Poor people often do not have access to banks for lack of assets or surety. The club can absorb their excess cash in exchangeforstocks, and invest that cash. Everybody would contribute and everybody would get some stocks. People can buy stocks in the name of their loved ones. Some of the young and infirm can also participate in the activities of the club.

While the present proposal is exclusively for rural areas, there is potential for voluntary participation of people in urban areas through contribution of part-time labour, purchase of shares and purchase of quality produce. In the age of Foreign Direct Investment, there might emerge scope of investment from cities to villages, however small that might appear initially.



The bigger picture

The multiple global crises call for a commitment of the general public to every citizen's right for a healthy environment and the complementary duty to it. The indicative proposal provides a context for fulfilling that duty and asserting that right. Its mission is to heal the souls of not only the victims of the system of aggression and exploitation, but also those who uphold that system. Rather than getting embroiled in a conflict, it embraces the route of harmony and nonviolence for rural reconstruction. In fact, this had been an area preferred by Mahatma Gandhi for practice of nonviolence, though he is better known for using nonviolence as a weapon for India's freedom movement.

As an aside, I might add that Rabindranath Tagore, another towering personality of that era, had predicted that Gandhi's nonviolent movement for freedom would follow the logic of a movement– and not the logic of nonviolence. Gandhi's response had been that he was ready to learn from experience. We do not know what he had learnt, but the nation experienced much violence in the wake of freedom, and is still grappling with the long-term effects of that legacy.

Through the millennia of human history, we have observed the power of self-interest as well as the power of goodness, compassion and love. We have seen the pinnacle of the power of self-interest. We have also watched with horror the all-round destruction that it can unleash. No government and no regulation can reach the breeding ground of destruction that lies deep inside the human mind. The only way to address it is by invoking the streak of goodness that is as basic to human nature as self-interest is. It is in communion with nature and other human souls that this goodness blossoms. That need not happen in isolation from other aspects of life. Let the capital value of goodness be realized through activities such as the proposed initiative.

This initiative demands a very artistic, sensitive and sobering touch from the part of the facilitating organization. I would invite all such organizations to come up,be a part of it, and perhaps take up similar work elsewhere. Worship starts with a solemn offering to life the eternal as Om Pranaya Swaha. With life facing such a peril at this juncture of history, we have to seek potent ways of offering worship to life and Nature. I have presented what I consider the most appropriate way in my area. Can you think of a way in yours?

Budget for Farming



Ramanjaneyulu GV
Executive Director, Centre for Sustainable Agriculture

The Budget is not just a collection of numbers, but an expression of our values and aspirations.

~ Jack Lew



In a Kisan Rally in Bareilly on 28 February 2016, the Prime Minister of India Shri Narendra Modi made a clarion call to double farmers' incomes by 2022. This statement assumed an official tone when the finance minister recalled it in his budget speech of financial year 2016-17 (FY17). It was followed by setting up a committee for Doubling Farmers' Income (DFI) under the chairmanship of Ashok Dalwai, then additional secretary in the Union Ministry of Agriculture and Farmers' Welfare (MoA and FW).

The Dalwai Committee on DFI clearly states that the objective of the government is to double farmers' incomes in real terms by 2022 over a period of seven years (2016-17 to 2022-23). Realizing, the objective would require farmers' to grow at a compound annual growth rate (CAGR) of 10.4% per annum in real terms.

Whereas NABARD All India Rural Financial Inclusion Survey (NAFIS) 2016-17 estimates that an average Indian farming household earned ₹8,931/month (₹1,07, 172/year) in the agriculture year 2015-16. This is up from ₹2,115 earned in 2002-03 as per NSSO's SAS, implying a compounded annual growth rate (CAGR) of about 12% in nominal terms and 3.7% in real terms (2015-16 base).

To achieve the DFI by 2022-23, the Dalwai committee points out that farmers' real incomes need to grow at 10.4% per annum, i.e., 2.8 times the growth rate achieved historically (3.7%) and it has not achieved this. Instead it went down to less than 3.0% by 2017-18 and the achievement was far lower than the targets. With less than two years left its high time we revisited the strategies.

Similarly, the dependence of agriculture on natural resources requires sustainable management of these resources for risk mitigation and management, particularly in the context of increasing farmer distress and vulnerability to risks associated with climate change.

Towards this a shift away from high water intensive, high chemical intensive, high energy intensive and high carbon emitting production systems to low water, low chemical, low energy and net carbon fixing production systems is essential and states are really not performing well on several ecological sustainability indicators On 26 November 2017 during The Prime Minister's address to the nation (Mann ki Baat), he requested in halving urea consumption by 2022.

On various occasions the Prime Minister and other ministers and also The 2019 Union Agricultural Budget have emphasized that organising farmers into producer organisations is the best strategy forward and the government proposes to establish 10,000 farmer producer organisations.

All the above calls for a substantial shift in the way agriculture is understood and supported in the last 70 years. These fundamental shifts have to happen in terms of budgetary allocations, institutions functions, policy articulations and regulatory systems operate. Annual Budgets are the time to articulate these shifts. But we wonder whether the 2019 budget presented by Smt. Nirmala Seetharaman has made any effort in this direction.

Zero Budget Natural Farming or a shift towards agroecological approaches was stated in the budget but nearly 36% of the total allocations were for chemical fertilisers which is nearly 24% up from previous year allocation. Whereas allocations for organic/natural farming is under Paramparagat Krishi Vikas Yojana was only Rs. 325 Cr up only by 8% compared previous year, Organic Value Chain Development for North East Region was Rs. 160 Cr down by 12% and National Project on Organic Farming allocations were only Rs. 2.0 cr down by 20% compared to previous years.

All the 18 odd central schemes are bundled under 'Green Revolution' had an allocation of Rs 12,560 crore for 2019-20 as against the revised estimate of Rs 11,802 crore for the 2018-19. The budgets under some of these schemes like RKVY (Rs. 3800 Cr), National Food Security Mission (Rs. 2000 Cr), National Horticultural Mission (Rs. 2000 Cr), National Mission on Agricultural Extension (Rs. 950 Cr) all will be used only to promote the conventional chemical farming. The entire budgetary allocation for agriculture research also is spent on researching and promoting the conventional agriculture in the name of improving the productivity to meet the Food Security Needs. Whereas focus should have been on ecological sustainability of farming.

Any increase in the farmers income can only happen if there is increase in the prices or reduc-

tion in the costs of production. The data from the CACP (Commission on Agricultural Costs and Prices) and other data economic indicators show that overall agri-GDP tumbling down from about 4% in the last three years of the UPA II government to 1.8% in the first three years of NDA I rule. Even including 2017-18, the performance of agriculture GDP under four years of the current government may turn out to be just 2%. The Minimum Support Price operations are restricted to very few states and very few farmers and have problems in fixing the price to procurement.

For example, Farmers cultivating paddy, maize, cotton, soybean and potato have all experienced loss in 2014-15 compared to 2012-13 and 2013-14 and further. During Kharif 2017-18 (for which data is available now) out of 361.08 Lakh Metric tons (LMT) of paddy procured, Punjab contributed maximum (118.33 LMT) followed by Haryana (39.92 LMT), Andhra Pradesh (38.76 LMT), Telangana (36.22 LMT), Odisha (32.6 LMT) and Chhattisgarh (32.07 LMT). During Rabi 2018-19 out of 355.12 LMT of wheat procured, Punjab contributed 126.91 LMT followed by Haryana with 87.39 LMT, Madya Pradesh with 72.87 LMT and Uttar Pradesh 50.88 LMT.

The budgetary allocations for crops which are procured by the Government for Market Intervention Scheme and Price Support Scheme (MIS-PSS) (Rs. 3000 Cr) which was used most of the times to help consumer price stabilisation than to help farmers , Distribution of Pulses to State / Union Territories for Welfare Schemes (Rs. 800 Cr), Pradhan Mantri Annadata Aay Sanrakshan Yojana (PM-AASHA) (Rs. 1500 Cr) which is a new scheme to subsidise losses states/private players may make in the process of ensuring MSP to farmers. However, last three years experiences show that the stocks procured by national agencies like NAFED have been released into the market at much cheaper prices and depressing the prices for farmers.

Therefore, Government should come up with a comprehensive approach of market intervention schemes so that it will distort the prices for farmers. This can only happen if the FPOs can be strengthened and market reforms are carried out in favor of farmers. To address the marketing issue, the finance minister again talked about forming 10,000 Farmer Producer Organisations. In the last five years more than 5,000 FPOs have been formed but are struggling to find their feet on ground as enough support is not being provided. This budget also has not earmarked any budget for FPOs. Access to affordable credit, simplified tax and legal compliances is important as the producer companies get governed under Companies Act, 2013.

As the income of the farmers were not going up,the Centre announced what they call as Pradhan Mantri Kisan Samman on the lines of Direct Income Support measure like Rytubandu in Telengana and KALIA in Odisha.Similar schemes were announced by other states like Krishi Krishak Bandhu by West Bengal and YSR Rytu Barosa (earlier Annadata Sukhibava) by government of Andhra Pradesh. Unfortunately, all these schemes have picked random numbers in terms of support provided under Direct Income Support and has not made any effort to institutionalise the process, linking it to the inflation like the salaries of the employees. Another major problem is all these support measures are linked to land ownership. This excludes large numbers of tenant farmers. Measures like this along with interest subvention on farm credit, disaster compensations, income tax exemptions going for land owners, more incentives are created for landowning and less and less for cultivation. This is creating a disastrous situation in states where tenant farmers numbers are in high.

To conclude, leaving the debates about whether ZBNF is scientific or can meet the food needs of the nation, shift towards agroecological approaches is essential. There are number of examples across the country shows that a scientific agroecological approach to farming can reduce impact on environment, make food safer and help farming resilient to climate change. Similarly, organising farmers into collectives to increase their bargaining power is important.

Farmers Producer Organisations is certainly a way forward whatever be the format.The Finance Minister has mentioned promotion of ZBNF and FPOs but no allocations have been made in budget. No policy changes are announced in making the mainstream institutions and making a shift towards these. This becomes only a lip service to the cause and may not help farming sector.

Union Budget 2019- The Road to Agriculture

Zero Budget Farming or Zero Budget for Farming



Suresh Ediga
Co- Founder, i4Farmers.org



What do I use the water for?", asked a farmer, who bought the water from a tanker for a few thousand rupees. "Do I use it for drinking? Do I use it for the farm? Or Do I use it for the farm animals?" - a question that no expert committee or no agriculture scientist can answer because for a farmer, family, farm and farm animals are all equally important.

Make no mistake, this situation is not because of the severe drought, but due to the lack of a proper drought management in place, lack of water management, lack of soil management, lack of crop management and essentially lack of management of all the aspects pertaining to agriculture that is contributing to the agrarian crisis.

The budget is one effective way to mitigate the agrarian crisis and make no mistake, the budget is not a mere statement of income and expenditure, it is a powerful tool to envision, plan, prepare, coordinate, monitor and execute. But if this budget itself falls short of the vision to solve the agrarian crisis, then there is no hope left for agriculture.

This is exactly what the Budget 2019-20 is all about - a document with no vision for agriculture. This is not a mere conjecture or a criticism which has no basis. The farmer of yesteryear was revered, patronized and idolized. The farmer of today is scared, worried, ignored and insecure, every day of the season and every day of her life.

It is in this context that when the budget allocation towards agriculture is viewed, it falls short of expectations in every aspect. Now to the specifics of the budget and understand why that is the case.

Zero Budget Farming - There is no doubt that Zero Budget Farming is the need of the hour because it is based on sustainable farming practices and which also helps maintain a healthy ecological balance. However, this alone is not enough. The necessary support system must be built to help sustain this farming. For e.g. the cow plays a vital role in the Zero Budget Farming.

But the cow needs fodder, water, regular health checkups, insurance etc but the farmer is finding it increasingly difficult to maintain the farm animals due to low farm incomes. The farmer



needs access to proper storage, access to the market, access to food processing and several other such support systems must be made viable. Unfortunately, the budget doesn't address any of these needs.

Subsidies to Fertilizers and Urea - It is quite an irony that the budget that talks about Zero Budget Farming allocates a mere 325 crores to organic farming and allocate an absurd amount of 79,996 crores towards fertilizer subsidies, and 53,628 crores of urea subsidies. Where in the budget is the intent to promote Zero Budget Farming as an alternative to chemical based farming?

There is no incentive for the farmer to do Zero Budget Farming if all the benefits are diverted to the companies producing chemicals. When was the last time a celebrity was in an ad solving organic or natural fertilizers or even for that matter natural or organic food, but one would have definitely seen them selling chemical fertilizers. If the govt was really serious about sustainable farming practices, it would have dramatically reduced these subsidies.



Increase spending on agriculture budget - It is true, in terms of the allocation, this years agriculture budget is the highest. But a simple breakdown shows that a significant portion of this budget is allocated for the fertilizer and urea subsidies and towards the PM Kisan, which equates to Rs500 per farmer per month. There is no rhyme or reason for how this figure of 500 was arrived at and there is certainly no criteria as to how the beneficiaries would be identified, which indicates that this is an ill conceived implementation and mostly done as an election stunt.

Decades ago, when chemical based farming was introduced or what is also known as the green revolution, the govt left no stone unturned in successful adoption of these practices. From the subsidies to buy more chemicals and fertilizers to easily accessible loans for the irrigation pumps to TV and newspaper ads to community level interventions to agriculture extension officers rolling out these adoptions, the govt machinery was working at a remarkable pace. The only difference between then and now, is the clear lack of intent. Budget increase doesn't mean much if the increase is not targeted to benefit the farmer.

Crop Insurance - A very simple analogy can explain the functioning of crop insurance. Imagine a bucket with a hole in the bottom. No matter how much water one pours, the bucket will never reach its capacity. Either the hole has to be fixed or the bucket has to be replaced. The crop insurance is that bucket that is leaking money to the insurance companies in the form of premium subsidies. Without addressing this problem, what is the use of allocating more funds. The other major problem with the current insurance, which is often overlooked, is the inability to assess the crop loss.

There are various approximations and extrapolations done, by considering a few farmers from an entire mandal. There is no mechanism to track and monitor at the individual farmer level. When the farmer pays the insurance, it is at an individual level, but when it comes to the claims, it is done at a mandal level and worse even at district level.

With no transparency and accountability for the insurance Co, they are only bound to fill up their coffers with the premium subsidies. Also there is very little effort on reducing the inherent risks involved in farming. These days insurance com-



panies (health, life, vehicle) invest in ways to reduce the risk by encouraging their customers to take preemptive measures, incentive for their good behavior etc. There is no such initiative undertaken for the farmers or even less for the farm animals.

MSP - Minimum Support Price, instead of a policy to help farmers, it has become a policy for politicians exploited for their political gains. 24 crops make this elite list of crops which come with some price guarantee, on paper. Out of these 24, only a handful (2 to 3) have the luxury of procurement by the government. The rest are left to the open markets which are openly manipulated by the traders and other people involved in this racket. Come elections, the MSP becomes the most sought after policy, based on which political parties wage their campaign fights.

One says MSP+50%, the other says MSP doesn't even cover the input costs, the other says that MSP doesn't follow the MS Swaminathan committee recommendations. No one really bothered to ask what the farmer wants. What crops can grow better under what conditions to meet the local needs, is a dialogue that is missing all together, before, during and after the elections. MSP is skewing the cropping patterns and since it only includes grains, there is no incentive to grow fruits and vegetables. The budget only claims they delivered MSP+50% but there is hardly any evidence that substantiate this claim.

So what is the way forward?

First, this excerpt from 2017-18 economic survey- "The reason why agriculture cannot be the dominant, permanent source of livelihood is its productivity level, and hence the living standards it



sustains, can never approach— and have historically never approached—those in manufacturing and services. That, of course, means that industrialization and urbanization must provide those higher productivity alternatives to agriculture. But this must happen along with, and in the context of, rapid productivity growth in agriculture, to produce greater food supplies for the people, provide rising farm incomes, and permit the accumulation of human capital."

While the economic survey indicates that higher productivity will relieve some of the agricultural workforce giving rise to urbanization, if the allocations of the 2019-20 budget become the actuals, there will be a mass exodus from agriculture - not due to productivity but due to the lack of it. Our inability to respond to this agrarian crisis effectively will only expedite this forced migration.

Hail damaged fruit crops in Himachal Pradesh state



Himachal Pradesh, the major state for apple production in India, has been affected by a hailstorm (Photo: hds.hp.gov.in).

In India, agricultural production in the state of Himachal Pradesh has just suffered a new hail storm that has damaged many crops, including apple orchards. Himachal Pradesh Horticulture Department said that apple crops had suffered considerable damage in different parts of the state in the previous days due to hail. This is the third time this year that fruit production is affected by rains and hail.

The exact estimate of damage is still being evaluated but apple orchards and many other crops have been affected.

source: newindianexpress.com, dailypioneer.com, business-standard.com

India: In search of a new Apple supplier?



India has imported millions of kilos of American apples in 2018, but since this month these American apples are subject to higher taxes, which will cause a decline and possibly a halt of these imports. Who will supply apples to the Indian market?

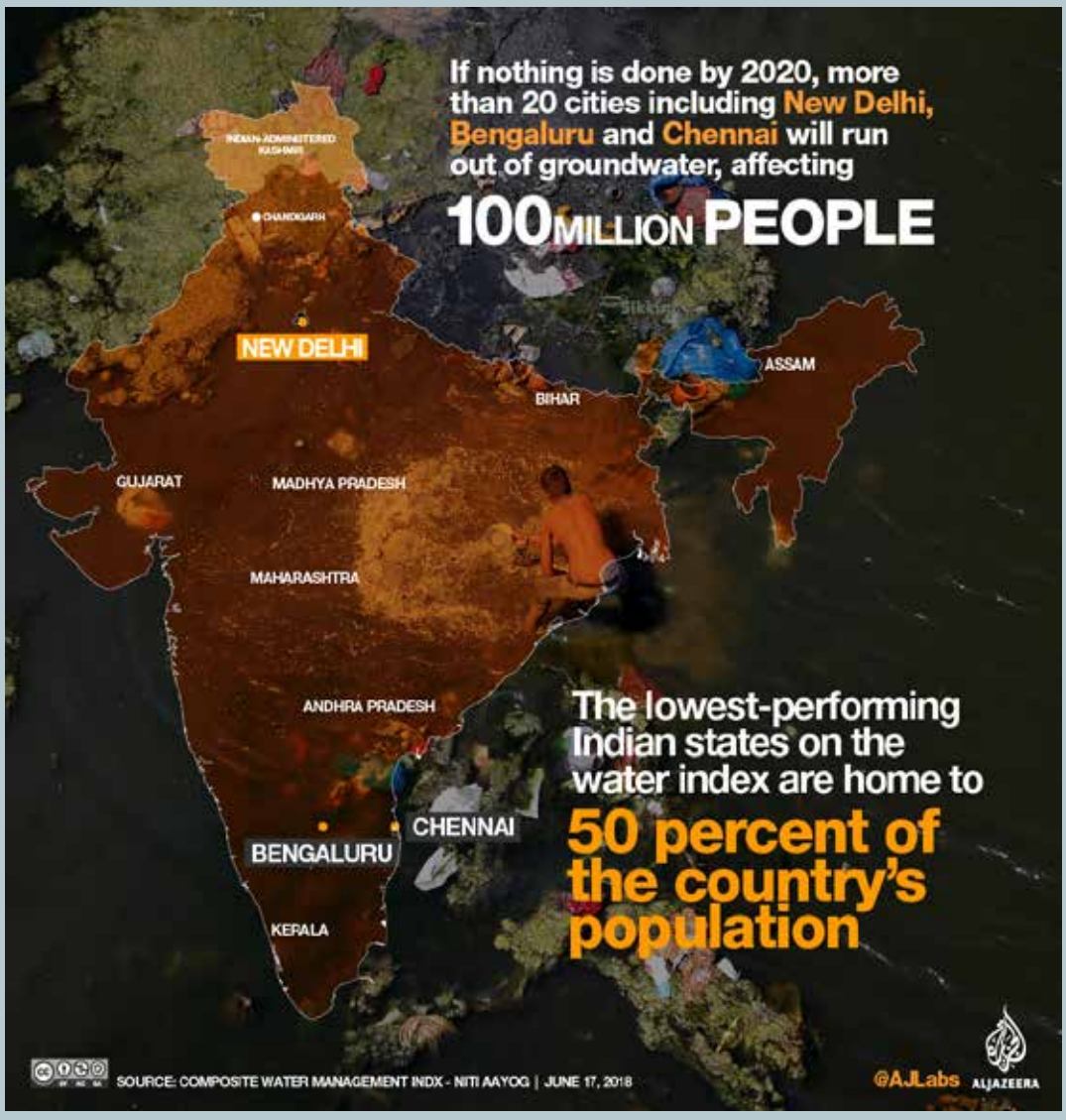
By 2018 India had imported from the United States 8 million boxes of 40 pounds (18 kg). Since mid-June 2019, increased customs duties have come into effect. For Indian consumers, American apples now cost between INR 160-170 (US $ 2.30-2.45). A dissuasive price for the majority of consumers, which will cause a collapse of the demand for American apples. Indian importers are looking for alternatives and new suppliers of apples.

Water Resource Management-

Water Crisis and its Underlying issues



a Global Problem





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This paper reviews a range of the underlying issues and trends emerging globally adversely affecting our water resources and supply mechanisms. Finally in summary the paper introduces a few solutions that will potentially aid positive water resource management. First let's review the statistics. We should all recognise that fast expanding Cities need a sustainable supply of usable water. However with global water resources remaining constant but its access, quality and its management deteriorating, water is mankind's nemesis. Put into context, it is established that 97.5% of all water on Earth is salt water, leaving only 2.5% as fresh water of which less than 1% (approximately 0.007% of all water on earth) is accessible for direct human uses.

Agriculture across Asia extracts nearly 80% of its' accessible fresh water for irrigation. Industry continues to dump, disproportionately polluting the vast potential water resources, desperately needed to sustain our cities. We must listen to the indicators, warnings and alarms.

"By the year 2030 the World Economic Forum calculates that there will be a 40% deficit in the available fresh water " [3]. UNHABITAT have stated in 2016 that within the next 30 years, the present urban footprint will double from what we have achieved in the last 10,000 years. In 30 years! That's an incredulous rate of growth. However this was warned ten years previously [5].

We have witnessed Cities virtually running out of water already in the last two years, in South Africa and this year Chennai [6]. Recent reports even suggest that India with 1.3 billion people, will have almost zero access to drinking water by the year 2040; and even sooner in 2020-21 cities across India will have exhausted their ground water reserves. [1][7] As recognised in a report from South Africa News24 recently, this suggests not only a lack of water but equally a 'governance crisis' where institutions have failed to build resilience and adapt to changing conditions [20].

India faces 'worst-ever' water crisis: report by Zeenat Saberin 2018 [21].Consequently this is no longer just a National Problem, but a GLOBAL problem. Why? Because if a country literally runs out of water, it will naturally look towards the next easiest source of water, such as neighbouring countries. This could happen by negotiation; but lets assume their water supplies are ebbing away too, then we have the prospect of conflict, if not instigated by the administration, then by the desperate people; first seen as mass migration, next as pure anarchy as communities literally fight for survival.

Equally smaller communities are also realising that they can hold the greater majority of the population to ransom by accessing and restricting supplies as was recently experienced in New Delhi in 2016 by a sector being disgruntle with Government policy, thus they forcibly closed the inlet gates to the Munak Canal, one of Delhi's main water sources, over a weekend, causing seven water treatment stations to shut down [15].

The fact remains that Humans require water daily. On average a human can survive only three days without any moisture before there is irreversible damage to their internal organs, often leading to terminal illness during the following few years. Five days of zero moisture and you can guarantee for the majority of the population it means death[2].

The primary purpose of this article is to highlight some key disturbing adverse trends affecting us all globally, from shortages to politics, to commercialism to emerging 'climate apartheid' demonstrating that our present course of political, economic and educational strategy for use of water has been wrong; where country States create restrictive legislation for the use of rain water in favour of utility companies' commercial rights.

Millions of people within cities are presently denied access to free water as identified by a WIN report in 2016[16], enabling the emergence of water mafias. New cities continue being built with no long term water sustainability. Older cities water supply dissipates through antiquated infrastructure and archaic agricultural irrigation practices thus reducing the potential supply by up to 80%. There is no single causation, although mismanagement through ignorance is a key issue; equally there is no silver bullet solution, but we could start by a more coordinated approach. Let's review some of the potential critical causations along with adverse trends being witnessed in recent years.

Causation one: Reservoirs globally are drying up, primarily because their capacity cannot



meet the increasing need of water supply to satisfy cities potable water usage, often initially used for hydroelectric to power our cities and then enroute siphoned to irrigate our farms that feed our cities. In order to develop a Resilient Cities strategy, we must look to where water derives from and understand how we need to build a Resilient Water Resource Management policy to support those managing the catchment and distribution of water from within the rural communities.

Basically we are using beyond the capacity of our present centralised resources, which do not have the ability to replenish fast enough. Originally the reservoirs catchment capacity sustained the supply to maintain levels matching demand even throughout the dry seasons. Now catchment zones have either been decimated by human initiated environmental change with deforestation, urban development encroachment or agricultural diversification or simply the reservoir no longer has the capacity to meet its originally designed demand [7].

Causation two: climate change is altering our traditional precipitation rates and the zones in which rain has traditionally fallen[7], thus our present catchment zones and their reservoirs are becoming naturally obsolete, being no longer in right place or capable of sustaining the required capacity.

In order to build resilience, we need to adapt. Does this mean we build more large reservoirs in different locations or somehow expand the catchment zones? Large reservoirs are vulnerable and as seen from research in Thailand create indefinite challenges and disruption, seemingly solving one component but creating many more [13].

Maybe we need think outside of the traditional box by considering a multitude of alternatives, from controllable rain enhancement technologies to encouraging the creation of smaller community managed storage at a capacity to suit their sustainable local needs, ensuring independence and resilience. Unclear policy along with confusing legal and institutional frameworks governing basin areas, makes it difficult to effectively implement 'basin management', as discussed in a research document deriving from Thailand [14].

The continuity and consistency of message and best practice is essential when creating regional strategies. Often communities themselves generate simple solutions if empowered and allowed some autonomy.

With the value and importance of water increasing annually, large reservoirs simply are unsustainable to be our only source of water. They are vulnerable for a variety of reasons including; water security, easily contaminated through mistake, neglect, conflict and terrorism. The dams remain potential targets, where a large proportion of a resource is accumulated behind one manmade structure. Equally if one sector of society causes a dominant extraction, other sectors become deprived with limited alternatives for supplementing their needs, having been reliant upon a centralised supply.

But even with its reservoirs, as quoted within





a World Bank report in 2009 "India can still store only relatively small quantities of its fickle rainfall. Whereas arid rich countries (such as the United States and Australia) have built over 5,000 cubic meters of water storage per capita, and China can store about 1,000 cubic meters per capita, India's dams can store only 200 cubic meters per person. Moreover, India can store only about 30 days of rainfall, compared to 90 days in major river basins in arid areas of developed countries"[27].

Because of the reliance upon these mega storage structures, when waters dwindle to 40% capacity and less, replenishment requires not only 'above average' supply to replenish to sustainable supply levels, but additional continuous supply due to increased depletion rates to serve the growing population and increased industrial and agricultural water demand during the dry season when sectors requirement for water increases, in a Catch 22 scenario.

Causation three: non regulated ad hoc ground water extraction. The land is similar to a sponge. It requires hydration. This is fed from both the sky in the form of rain onto the land and into rivers, plus from the subsurface aquifers absorbed upwards. Consequently if the rains alter in pattern, then the land relies more upon its water table and deeper aquifers. But with the unregulated extraction through bore wells to meet the ever growing demand of intensive farming and potable water for growing populations and industrialisation during economic growth, ground water is being contaminated and the aquifers themselves are becoming depleted and in fact as quoted in one example, 21 Cities within India expect to have depleted their aquifers by 2020 next year![1].

It is a spiralling vortex of mismanagement cascading to disaster, beyond anything we have experience within any other type of natural disaster, drought now emerging within green pasture and forested lands, normally only experienced within semi-arid and desert environments. And when this happens within the back yard of our mushrooming cities, water depletion will certainly be our nemesis.

Causation four: mismanagement and greed and corrupt political manipulation by corporates, monopolies and tycoons is an even greater threat than depletion by exhaustive use. Examples are surfacing globally, where either antiquated historical rights or present manipulative lawyers are subdividing plentiful waters away from traditional smaller land owners, isolating them from the resource that they rely upon, literally drying them out of their lands.

A prime example is California's complicated and often unjust 100-year-old fight over water rights. Where "The state's laws were designed to settle the frontier, and under the "first in time, first in right" rule, the most "senior" water claims are the last to be restricted in times of drought.

This means some farmers are still able to flood their fields to grow cattle feed, even as residents of towns such as Okieville and East Porterville have to truck in water and shower using buck-

ets". [19] The California Water Boards explain the modern interpretation in an article on their present website [18]. However the subject of water is often used as apolitical scaremonger football with exaggerations of intended legislation, such as in California spawning from their five year drought, explained in an article written by Bill McCarthy June 7th, 2018 aptly titled "Is it illegal to shower and do laundry on the same day in California?" [17].

Causation Five: Water as a resource cannot be offered for free in today's' society, where everything has a value to corporates and state administrations,. It bares a cost to service and to supply. And for corporates it is a component source of their endless generation of profits and dividends needs for shareholders. We are now seeing commercialism wake up to the fact that water is the new gold, which the rich will afford and poor will become slaves to those with water.

In a report by Philip Alston, a UN special reporter, it suggests that the likely hood of 'Climate Apartheid' is already on the horizon. 'Climate apartheid' to push 120 million into poverty by 2030, UN says… as extreme weather events such as droughts, floods and hurricanes become more frequent, the world's poorest people will be forced to "choose between starvation and migration," the report warned."We risk a 'climate apartheid' scenario where the wealthy pay to escape overheating, hunger and conflict while the rest of the world is left to suffer." Philip Alston concluded on extreme poverty and human rights "the difference between how climate change affects the wealthy and the poor is already apparent" [4].

Causation six: A significant failure has been not to recognise the need to manage flood waters as a positive commodity. Allowing billions of gallons of water to simply wash through our communities and agriculture into river basins and out to sea, often leaving isolated lakes of unusable brackish water. Our cities and especially new urban developments still rely upon storm water disposal into the rivers, which often cause flooding further down stream amongst the farms and villages.

We must learn to harvest this flood water, store, treat and retain for irrigation, alleviating demand upon potable water supplies..

Causation seven: Commercial agendas to gain control of 'God water'. Whilst some weakly suggest that because of the their commercial agendas, that the age old harvesting of rain water from a building roof now retains contaminates and therefore ought be controlled; others counter this argument by suggesting that initiating green roof policies help enhance and filter rain waters [10]. Water butts and rain harvesting has been the traditional method for a community and household garden sustainability. However commercial agendas present counter policy to manipulate legislation which leads onto the most disturbing control of water trend globally.

It is recognised that three days of absolute zero access to water brings a population to its knees, 8 days guarantees mass human extermination. Whole sectors of society potentially being purposefully held to ransom via withdrawal of water, contamination of water and disturbingly….legislature, where already we potentially see the fledgling practices of creating legislature to support restriction or even banning and fining people for using rainwater run offs, as some call it in California 'God water'.

Legislature being developed and coerced into existence, which could be perceived by many, as initiated by individuals or bodies with hidden agendas for gaining control of our water [11]. It is agreed that Utility companies globally have



Vast volumes of water are waste during flood run offs……

Some will reach aquifers…

Most flows out to sea



Mae Chang reservoir, Northern Thailand, March 2016



Photo by Srini Swaminathan, Chembarambakkam reservoir 2018

needed to reassess their control of surface and precipitation water, especially where they are deemed responsible to supply quality and sufficient water, but Governments are now having to review control of water access as humanitarians, as society struggles to maintain access to a sustainable supply of water[12].

In addition to the California scenario, every country experiences the Soft Drinks Industries, simply sucking dry the ground water and aquifers with their unquenchable thirst of water to sustain our desire for cold fizzy drinks. Communities across Asia , in fact globally have witnessed significant water resource depletion when these industries establish or expand. Accusations in India are widespread [22].

Water is the new oil and access to it is the kingpin for mega corporations or indeed individuals wishing to exert influence over government and communities as per a case in California [19]. This pattern is not new but now it seems to becoming an increased trend within every nation. This trend which will not reverse itself by a few placards outside city hall. It needs a comprehensive central government policy change and indeed in the long term a UN directorate, if we are to avoid water wars Armageddon.

Causation eight: Political manipulation of water supplies. Some governments try using water as a political tool within sectors of urban communities by refusing to extend designed supply infrastructure in the hope of dissuading emerging slums [16]; this backfires and simply encourages the water mafias to take control as highlighted by Aman Sethi in 2015[23].

"At the Mercy of the Water Mafia. Pumping wells in the dark of night, criminal bosses rule the liquid economy in one of the world's busiest cities. Can anyone stop them?"; The same mafias that purportedly already supply drugs and illicit materials to some sectors, now realise that all sectors need water. A golden handshake to organised crime, funding potential terrorism and anarchical propaganda. Water is in fact the guaranteed WMD, if manipulated in a clandestine manner.

Causation nine: Apathy and Complacency within the wealthy Arid Regions and within communities of previous plentiful water supply. They are being too slow to appreciate potable water being sacrosanct for the purpose to supply to kitchen and wash faucets and critical industries. In many communities their original water storage lakes and ponds have been forgotten,



Illicit supplies during day time to the marginalized Photographs by Sanjit Das



At night a man fills a tanker while another drills a borehole at an illegal water-filling point in Delhi



Stench, vermin from sewage-filled lakes rile Kukatpally residents
Officials remain indifferent as Pragati Nagar Lake, Amber Cheruvu are filled with garbage and filth.[24]

neglected or filled in, communities more recently relying upon the now failing centralised dams and decaying distribution and supply infrastructure.

Treated sewerage effluent [TSE] is now becoming predominantly used for irrigation which remains essential not only to maintain the aesthetics of the city but for their combating desertification, land degradation and agricultural production of produce. But it has health risks if treatment standards are not maintained. It is not free water.

City and national heads openly declare that they need meet that UNHABITAT prediction of doubling their urban footprint if they are to sustain economic growth. This directly conflicts with what we witness within present water resource supply and management capabilities. This alone suggests strife and conflict ahead.

Causation ten: Heavy reliance upon inefficient technologies coupled with the lack of infrastructure investment. In recent decades we have witnessed heavy reliance upon desalination and Reverse Osmosis as the only options to convert sea water and treat brackish or contaminated waters, but because of up to 50% of intake is discharged as with excessive mineral residual, it is raising coastline sea temperatures, bleaching the local sea bed ecologies and traditional fishing grounds. It's causing a vicious demise of resources and importantly the coastal environment. Reverse osmosis systems are equally destructive of the ground water and aquifer reserves, where similarly RO plants dump up to 50% residual waters containing extreme levels of extracted minerals as salt and other contaminants, which contribute to agricultural productivity demise.

However, even with desalination and RO systems within our developed well established cities, water sustainability is dramatically failing, where they are literally running out of sufficient access to water, for many of the previously discussed reasons but also because their failing infrastructure is outdated, so even if they can increase supply, the existing pipes, storage and treatment can not cope with processing and distributing the extra capacity, witnessed within America [25] to Europe [26] to India [28].

A significant contributor to waste is agriculture, with up to 40% of irrigation water failing to reach the plant, within cities it is estimated that between 20 and 40% of water is lost due to leaks through antiquated supply pipes. The lack of investment has been disastrous globally. Apathy at its worst.

You see a pothole and demand it to be fixed for comfort of travel. When we see a puddle from a subsurface leak pipe, we ignore it, yet that's our lifeblood wasting away, leaking 24/7 potentially







A worker rummages through plastic waste filling a "river" in the Taimur Nagar district of New Delhi, on June 12, 2018. The waste will be washed away by rains and eventually reach the Indian Ocean through the Ganges River. (Mainichi)

losing millions of valuable litres of treated water, creating sinkholes and danger to motorists and surrounding properties, before it is fixed.

Causation Eleven: Disrespect for water. Resilient Cities require Resilient Water Resource Management and as yet we really don't understand water. Its been abused. We are good at joining pipes, sometimes, at engineering mechanical infrastructure to satisfy human needs, most of the time, but we still have little understanding of what the actual water needs in order for it to present its self as usable. That has been our fundamental mistake, taking water for granted.

This approach to understand water is critical if we are to maximize this dwindling life resource. Disposal of waste, especially plastics into water courses has increased dramatically in recent years. Many streams and tributaries blocked with debris or in fact flowing wall to wall with discarded plastic. Water needs respect after all its the lifeline to mankind's sustainability.

To conclude on a few positive initiatives. There is a glimmer of hope in the medium long term for water sustainability. Multiple initiatives are being developed globally, with some new ideas and some common sense initiatives taking control of their national water resources. It needs a combination of efforts.

There remains one in-exhaustive reservoir of purified distilled water; enough to satisfy global needs and certainly capable to supplement our ground water supplies and rains for centuries. More water than four months of all the land mass run offs, which instantly replenishes itself, purifying the water during its process. And this is no longer concept but operational.

The breakthrough is efficient Atmospheric water extraction[29].

Purified evaporation into our atmosphere of which we all breath. Even water from the saline oceans evaporates into purified distilled drinking water. And water from the most contaminated surface waters purify in the evaporation process. Potentially this can in fact replace local Reverse Osmosis plants and long term replace Desalination systems, using the same source of water, the sea, without creating the 50% residual discharge of extreme contaminated water. Another positive initiative is in the Gulf Regions[31], where the UAE are now taking the difficult decision to ban new subsurface extraction and in some regions not renew licence or force closure of existing bore wells, having once relied upon plentiful aquifer water supplies. They now pipe water 150kms across the deserts from neighbouring emirates or indeed from their neighbouring country Oman. The deep aquifers are deemed now as a sacrosanct supply and storage for times of dire need. Restrictions are also being implemented to control supply of the previously plentiful TSE [treated sewerage effluent] to irrigation programs.

This is an indication of concern, as they continue infrastructure construction across the desert, for planned future urban development to maintain much desired economic growth; all of which will require not only potable water supplies to homes but also 365 daily irrigation for amenity tree and soft landscape planting. Thus it's a difficult decision to protect aquifers, as in the short term, until efficiencies are found elsewhere, water supply will remain limited. But long term, by protecting the aquifers the nations realise that they will maintain independence and a secure backstop during any potential crisis.

China pioneers the coastline 'sponge city'[9] This is another positive initiative for water sustainability addressing the retention of coastline

storm waters by cities affected by typhoons with excessive rains and simultaneous storm surges. "In the case of China, the sponge strategy requires that 80% of all urban land is capable of absorbing or reusing 70% of storm water. The goal is to repurpose and retrofit cities – including public spaces, schools and residential areas – so that they can absorb more water during floods as opposed to creating excessive run offs. Candidate cities are investing in permeable pavement, artificial ponds and wetlands and rain gardens that store excess rainfall in underground storage tanks and tunnels. Water is only discharged into rivers after rains or surges have receded".

But there is no reason that this mechanism can not be used for inland cities in conserving and retaining flood waters in storage and controlled ground hydration for future irrigation, recycling and grey water needs, reducing demand upon existing potable water extraction.

The treatment of brackish water [30] is another recent development by converting it from worthless unusable water to beneficial irrigation water, by a simple low cost inline process of magnetisation, converting the molecular structure of the salts to an absorbable state, transporting the much needed minerals beneficially throughout the plant. Brackish water has been a growing blight upon agriculture for decades, generated by farmers extracting high mineral bore well and river waters allowing the salt minerals to build a saline residue within the soil to such an extent that the land becomes totally contaminated and encrusted, consequently becoming non productive. Millions of hectares globally have been affected already and this increases dramatically annually. This could now be reversed.

In summary, this paper with its goal to avoid water conflict, water mafias emerging and water monopolies holding communities to ransom, recommends that we must review global and national strategies targeting the development of water resource management if we are to curtail human disaster, which consequences are potentially far beyond the wildest nightmares of present administrations.

The DRR Disaster Risk Reduction sector must embrace 'water resource management' within its scope, prioritising and embracing key element assessments within its indicator strategies to prevent emerging crisis and disaster.

Critical action plans need include:

• Establishment of a National water resource strategy
- Reviewing every component of water resource cycles
- Creating interstate collaborations and contingency plans
• Establishing a new approach strategy to Catchment and storage
- From direct rain fall
- From consequential flooding
• Review of Agricultural irrigation methodologies
- Reducing their present 80% of fresh water consumption
• Create an action plan to counter agriculture contamination
• Create an action plan to counter industry contamination
• Improve strategies for water treatment and recycling
• Review new technologies and scientific approaches to generate water

Water crisis must not be reviewed as just a local or regional periodic adverse phenomenon such as drought and flood, or as a siloed component addressed only by humanitarian donor WASH strategy, but be respected as an imminent and evolving global transborder catastrophe, re-



alising that "there is not enough to go around now for our ever increasing population needs". UNICEF water strategy for children through their WASH programme applaudably targets the front line issues as a donor [8], but each Government needs a stand alone Department for their holistic water strategy, outside of the standard, often privatised, Utilities Services, with a Minister of Water and full proactive Secretariat. Each State needs its own Water Commission to initiate assessments, risk management, continuity and recovery strategies, protecting water from Political and Commercial manipulation whilst simultaneously seeking and engaging best practices.

The UN must embrace water within an autonomous proactive Secretariat functioning 365 creating more than just its UN advisory Water Agency; it, observing and investigating trends and emerging flashpoints where tolerated thresholds are broken. Water should not be siloed off into non transparent political agenda committees or delegated to within unaccountable single agenda humanitarian Agencies. The UN with an independent Water Secretariat, as it does for Food and Health, would monitor, coordinate international response and advise regulation and governance, identifying best practice for Sovereign states to consider embracing within their national strategies.

Water access is a fundamental right for all life. However due to mal practice, mismanagement, commercialism and political agenda, water is emerging as and remains our nemesis.

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Abstract

Grass pea (*Lathyrus sativus* L.) is an important winter legume crop of India mainly grown in low rainfall regions of Chhattisgarh, Bihar, Madhya Pradesh and West Bengal. It can tolerate drought and water logging and serve as a dual purpose: food and fodder crop of farmers.

However, long-term consumption of *Lathyrus* can cause lathyrism (degenerative motor neuron syndrome), which is due to a non-protein amino acid called β-N oxalyl α,β diaminopropionic acid (β-ODAP). Lathyrism can be managed by cultivating low β-ODAP varieties of lathyrus, detoxification of lathyrus seeds and application of zinc to reduce the concentration of β-ODAP in lathyrus; then can be safely utilized for human consumption.

Introduction

Lathyrus

Grass pea (Lathyrus sativus L.) is a crop of immense economic significance, especially in developing nations like India, Bangladesh, Pakistan, Nepal, and Ethiopia. Grass pea (*Lathyrus sativus* L.) is a food, feed and fodder crop belonging to the family of Leguminosae (= Fabaceae), subfamily Papilionoideae, tribe Vicieae.

Other economically important species are *Lathyrus cicera* and *L. tingitanus* for grain purpose and *L. ochrus, L. latifolius* and *L. sylvestris* for forage purpose. Further, a newly described species, *Lathyrus amphicarpus*, is presently found in the Middle East has the potential of self-seeding forage species. In India it is commonly known as Kasare, khesari, karas, karil, kasar, khesari dhal, khesra, lang, chural, latri, lakhori, Lakhodi, chattra matur, santal, teora, tiuri, batura, chickling vetch, chickling pea (Campbell., 1997).

Advantages of *Lathyrus*

Grass pea can be grown in drought affected areas, flooding prone areas and on poor soils due to its hardy and penetrating root systems. It possesses the high nutritional values (Table 1), which make this crop is so important both for human consumption and animal feed.

It is also efficient crop in biological nitrogen fixation in the soil through symbiotic relationship with rhizobium bacteria and helps in lowering the N input needs in subsequent crops. This property also makes it suitable to be used as green manure in sustainable farming system (Almeida et al., 2015).

(*TMEn = True Metabolizable Energy)

Table 1. Chemical composition of *lathyrus* seeds

Components	Amount (g/ kg)
Dry matter (Ḥair dry basis)	907.8
Crude protein	283.4
Crude fat	12.0
Starch	281.4
Crude fibre	49.6
Ash	18.0
Nitrogen-free-extract	637.0
ODAP	4.2
TMEn*(MJ/kg)	12.4

Source: Chowdhury *et al.*, 2005

Anti-nutritional component of *Lathyrus*

Lathyrus seed contains a significant amount of β-N-Oxalyl-α,β-diaminopropionic acid (β-ODAP). This neurotoxin is responsible for the motor neuron degeneration syndrome lathyrism. On prolonged consumption i.e. more than three months as main diet it may result in outbreak of the disease called "neurolathyrism" (Gosh et al., 2015).

β-ODAP

β-N-Oxalyl-α,β-diaminopropionic acid (β-ODAP) is a non-protein amino acid and a structural analogue of the neurotransmitter glutamate found in the grass pea *Lathyrus sativus.*

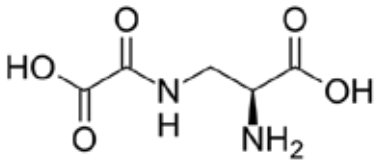


Fig 2. Chemical structure of Oxalyldiaminopropionic acid (ODAP)

ODAP acts as agonist for the ionotropic AMPA (α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid receptor) glutamate receptor. This property of ODAP is known to cause neurolathyrism in human and animals. ODAP causes activation of AMPA receptor which can induce excitotoxity. ODAP also acts as mitochondria poison by inhibiting the glutathione synthesis which is an antioxidant. In lack of glutathione production reactive oxygen species increases and cause mitochondrial damage (Van Moorhem *et al.*, 2011).

Management of β-ODAP

Grow low β-ODAP varieties of lathyrus

There are several low ODAP varieties are available in India. (Table 2). Farmers can prefer such low ODAP varieties for production of safe feed and fodder.

Application of zinc

It was observed that in zinc deficient soils the incidence of lathyrism is more common (reference). It is reported that application of zinc micronutrient in soil can reduce ODAP content at significant level. For example a three year study at ICARDA with nine grass pea showed that application of zinc at 5-20 kg/ha has reduced ODAP content by 10-40% (Abd-El-Moneim *et al.*, 2010).

Table 2. Improved varieties of Lathyrus developed in India

Improved variety	Pedigree	ODAP (%)	Yield (kg/ha)	Days of maturity
Pusa 24	Selection from germplasm	0.2–0.3	1655	125–130
Prateek	LS 82046 × A 60	0.08	1560	110–115
Ratan (BioL212)	Somaclone of Pusa 24	0.05	2530	108–116
Mahateora	Ratan × JRL 2	0.07	1550	110–115

(Source: Kumar *et al*., 2011)

Detoxification by processing

Cooking and processing of grass pea can reduce ODAP content by 40%. There are several processing methods can reduce ODAP content (Table 3).

Table 3. Percentage of ODAP reduction in grass pea (Lathyrus sativus L) by different processing methods

Processing method	ODAP reduction
Dry heating (flour), 200^{0}C	75
Roasting (seeds), 150^{0}C, 60 min	82
Pressure cooking, 15 psi, 15 min	91
Autoclaving, 120^{0}C, 15 lbin^{-2} -	
10 min	9.5
30 min	39
60 min	25
Boiling, 20 min	11.4
Soaking in -	
water	52
boiled water	69
in tamarind solution	48
in lime water	19–45
in sodium chloride	8–9
in sodium bicarbonate	9–22
in ascorbic acid	36
Soaking and cooking	79
Fermentation -	
tempeh	93
natural	72
double (present study)	52–95

Source: Kuo *et al*., 2011

Conclusion

It is proved that lathyrus crop is well suitable for cultivation in marginal lands with poor resources. However, the long term consumption of lathyrus or grass pea can cause neurolathyrism to human and animals. But, the neurotoxin β-ODAP concentration can be managed through cultivation of low β-ODAP varieties, detoxification processes and application of zinc in soil to reduce the β-ODAP concentration makes the Lathyrus crop a staple diet of poor farmers in India.

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Krishi Rasayan: The Renowned Agro-chemical Company Across the Globe

KREPL is leading agrochemical maker with world class facilities. CAGR for last several years has been over 17%. It continuous strives for excellence in all its seven manufacturing sites spread over north, east & west of India have resulted its today's status in the competition. All these ISO 9001 & 14001 certified plants are engaged in developing new chemistry and stepping up new routes of formulations following FAO guidelines.

Q1. How did Krishi Rasayan start? What plans you had at that time?

Krishi Rasayan is one of the oldest entities, which have been in India for around 5 decades. In the next 2 years we will be celebrating our Golden Jubilee. Our company has a good presence in pan India. We currently have around 8 manufacturing facilities and very soon we will commence one new manufacturing facility in Gujarat which will have 38,000 tons production capacity. By this, we will expand our business into the exports in various geographies.

In addition, we will be opening our office in Mumbai for the international operations. We are also working to launch products to avoid BPH on Rice and white fly in cotton, few of such products are already launched. For this season, we will launch our own "proprietary " mixture for the control of BPH in Rice.

Apart from that in INDIA climate change is there and we listen about the Monsson is delayed; in this situation how do we address the abiotic stress in the crop protection. We need to focus on the plantsas well as Soil health products. We are seriously working on the technology driven Bio products with a Spain based company called Alga Energy, which can make the crop survive and give the better yields even in the unfavorable conditions. We will also be launching nutritional based products which are highly customized so as to avoid wastage in the soil.

We are tied up with various other companies in terms of co-marketing and B2B alliances. In India, we have good alliance with 2 fertilizer giants including Coromandel International. Apart from that, we have also started our own retail outlets in the name of SANKALP, which are very different from other retail outlets providing N2N solutions to the farmers.





Q2. What is Krishaj?

Krishaj is our brand umbrella which works on the theme to help farmers. It is a symbol of quality and service to the farmers.

Q3. What are the goals of Krishi Rasayan?

Our company, Krishi Rasayan has big goals. We want to grow almost by 3x in the next five years. We want to be the most renowned agro-chemical and agricultural company across the globe. Currently we are known in India and now we want to improve our footprints in the global market. Our complete philosophy is based on, think locally and act globally.

Q4. How far are you successful in satisfying your customers?

Across the geographies at the farmer level the products of Krishi Rasayan are greatly acceptable as they give the desired quality and the service which we give. We have almost 1000 plus extension staff reaching out to the farmers. Our products are available across pan India in more than 4000 outlets.

Q5. Who is your role model to whom you look upon?

In India there are many players who have demonstrated what is India for the global market, be it the IT industry like Infosys, Wipro or the automotives. They have made India shining in the global market.

Q6. What are your plans to expand internationally?

We are going to put more focus on the exports in the international markets by developing our brand business. As Mumbai is the hub, keeping this view in mind we will inaugurate our office there in this month.



Sustainable Farming
A Collective Learning Approach

Deepak Kumar, Kathikund block, Jharkhand
PRADAN



> **“ Bringing to life the dying land, rav
> of chemical use, farmers in Bhan
> chose to risk going back to organi
> crop cultivation, controlling disea
> through indigenous ways. The r
> theirs to experience…better yield
> and rejuvenated natural res**



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Dada hum logon ko har saal khet mein zyada kar ke khaad dalna padta hai aur humara khet ka pani bhi jaldi sukh jata hai (Dada, every year we have to use more and more fertilizers in our fields. Our fields also dry up very quickly)," grumbled Sushila Hembrom, as she showed me her dry paddy fields in despair.

Another SHG member said, "Humlog apna khet mein chemical wala khad dalna Bengal jane ke baad sikhe the. Lagbhag 20–25 saalo se humlog urea khad khet mein dalte aa rahe hai (We learned to use chemical-based fertilizers after our exposure to Bengal farmers. We have been applying urea for almost 20–25 years now)."

The story of these SHG women from Bhandaro village is no different from that of many other farmers of Kathikund block in Jharkhand. The effects of using chemical-based fertilizers have begun to show up in the land and were taking a toll on the farmers. SHG members shared with me that earlier when they were not using chemicals, they did not have enough produce to feed their family. Many people from the village migrated then in search of wages to Bengal, where they worked as agricultural labourers. They learned about new techniques, about hybrid seeds and fertilizers, which helped increase the yield considerably.

When the migrant labourers came back to their village, they adopted the same techniques in their fields. They started using chemical fertilizers such as DAP, urea and potash. Initially, the results were significant and the production increased considerably. However, over the years, there was stagnation in production.When the SHG members shared their stories with me, I heard hopelessness and fear in their voices. Year by year, their fields were asking for more and more chemicals. The farmers had no option but to invest more in their fields or to give up agriculture and migrate again. Most of the land in the village was undulated, of poor soil quality and no irrigation facilities. The village had huge scope for chemical-free agriculture farming because of the abundance of cattle population. All the households in the village had livestock such as cattle, goat and backyard poultry, that was used by them to mitigate their immediate money needs. Also, because many of the SHG members were involved in broiler poultry farming, there was bird-excreta available in abundance. Convinced that this huge untapped resource could solve the issue that the SHG members were facing, I asked if we could have a meeting of the entire village to discuss this issue.

Exploring Non-chemical-based Practices

In the village-level meeting, the villagers reiterated that their current farming practices necessitated high input costs in terms of hybrid seeds, chemical fertilizers and pesticides. There was low retention of moisture in the land, and the quality of the land was getting degraded every year due to excessive application of chemical fertilizers. Soil erosion was high too owing to the undulating topography of the area.

When I shared with the community the possibility of non-chemical-based practices, there were mixed responses. Many said that it was impossible to have a good yield without the use of chemical fertilizers and pesticides. People also assumed that organic farming would be very



costly and cumbersome. Some, on the other hand, supported the idea. One dada said "Dada, agar humlog jaivik tarika nahi apnayenge toh aane wala samay mein humara khet banjar ho jayega aur hamara bal bacha uspe kheti nahi kar payega.(Dada, if we do not adopt organic methods of farming, our lands will become barren in time and our coming generations will not be able to do any cultivation.)" Even though the villagers were not very sure, they were interested in knowing more about the non-chemical-based agriculture. A three-day workshop was organized for them, in which the people from Bhandaro village and the nearby Jitpur village participated. The workshop focussed on existing farming practices vis-a-vis traditional farming practices. The purpose was to build a common understanding among farmers so that they could make a choice as to which approach they wanted to follow. A discussion was held about the challenges and the drawbacks of both the practices. Some of the questions that surfaced were: What were the crops that their ancestors used to grow on their land? Had they witnessed any kind of diseases in their village in the past 10 to 15 years? How would they protect their plants in case of pest and disease attacks? How many farmers were still using the traditional variety of seeds and why?



The farmers said that they used to cultivate different varieties of crops on their agriculture land. They had never used chemicals in their crops. One such crop, which the people, nowadays have stopped cultivating, was millet. It was now limited to only a few families in the village. There were some farmers in the village, who were still cultivating the traditional variety of paddy called the Baihad Dhaan. But it was on a limited patch of land and only for their own household consumption. They could use this paddy for a long time because they did not use any fertilizers and pesticides for it; moreover, it was tastier than the hybrid paddy variety, that is, Swarna. The farmers also said that, earlier, people never had health problems. Now, however, people were beginning to suffer from illnesses such as blood pressure, diabetes and gastric problems. People's attitudes too have changed. They do not want to do the hard work that is needed for traditional farming. The young generation tires very soon. One SHG didi said, "Dada aaj kal kodo jo ugata hai gaon mein use garib parivaar samjha jata hai (Dada, nowadays, those who cultivate millet are considered poor farmers)."

A video show called 'Toxic Foods—Poison on Our Plate,' from the popular television show 'Satyamev Jayate,' was shown in the workshop. The villagers were dumfounded after seeing the show and almost everyone in the village wanted to switch to organic practices. Some were also disturbed to see the effect of chemicals on their health and on their land.

Anita Murmu said, "Pehle ke admi zyada mehnat ka kaam kar lete the aur zyada din zinda rehte the. Abhi bhi gaon mein 4 se 5 log hai jinka umar 80 se zyada hai (Earlier, people would work very hard and lived much longer. Even today, there are 4 or 5 people in the villages who are more than 80 years old)." The villagers showed enthusiasm about trying out non pesticide management (NPM) farming although they did fear that production would decrease if they did not use inorganic fertilizers such as DAP and urea. Also, they were not sure about the cost-effectiveness of organic farming and

believed that it would require a lot of physical labour. They, however, were willing to try it on some portion of their land.

Piloting in Bhandaro and Jitpur villages

To begin with, two experienced change animators, Pushpa Devi and Bimla Devi, from an organization called PRAN (Preservation and Proliferation of Rural Natural Resources and Nature), with extensive experience in organic interventions, were engaged to support the villagers in Bhandaro and Jitpur. Their role was to hand-hold the farmers in adopting organic practices and identify and train some Resource Persons within the village on NPM farming.

These Resource Persons would then perform the role of change agents for the rest of the block. For Bhandaro and Jitpur, however, these two change animators were the Resource Persons; they created a base for modern farming practices such as the System of Root Intensification (SRI), provided on-field technical support in preparing organic products and demonstrated its use to farmers. The animators supported the community for almost a year, helping bring about a shift in the practices and enhancing the skills and the knowledge of the farmers about NPM farming. In this process, six SHG didis emerged as Resource Persons for the rest of the village and for the block.

Platform to Experiment and Share

During this period of engagement with the villages, many of the problems they faced when adapting the practices came to light. Some said that it was difficult to collect cow's urine whereas others who had prepared the organic formulation said it smelt very foul. Some farmers observed that practicing organic cultivation required a large amount of animal waste and that the process was very time-consuming. They were not willing to devote so much time and hard work. They wanted quick results and expressed a wish to use the readymade products such as urea and DAP, easily available in the market. learly, going full steam into organic farming would be counter effective; instead, a gradual transition from one practice to the other would be a better alternative. Earlier, we were focussed on adhering to a model Package of Practices (PoP). Therefore, for SRI paddy, we shifted the focus to improved practices, rather than insisting the farmers adopt all the SRI principles. Training was provided to the farmers through audio-visual aids. The IEC (Information, Education and Communication) material was provided to the farmers in the form of booklets and leaflets so that they had the option of choosing or dropping the organic practices, based on the availability of resources and on their convenience. A farm-field school, an informal set-up, was created for farmers to support each other, to enable a group-based learning process, enhance their skills and knowledge and help them make informed decisions. For example, the farmers collected different types of insects and disease-affected plants from the field and brought them to a common place for further discussion. They discussed the types of insects (both sucking and chewing). They learned whether an insect was harmful or beneficial for their plants. They were shown how the presence of harmful pests could be minimized naturally and how the presence of beneficial pests could be increased. Sushila Hembrom from Bhandaro village said, "Pehle to hum to sabhi keedo ko kharab samajh kar uspe dawa daal dete the (Earlier, we thought that all the insects were harmful and we would apply pesticides on all the insects)."

Sarita Murmu added. "Hum ne jab jaivik khad daalne ke baad dekha ki mitti mein keede ho rahe hai to hum ko laga ki kharab ho gayi lekin training mein pata chala ki wo keede mitti ke liye phaydemand hai (When we applied organic manure, we found that there were insects in the soil; we thought it was bad for the soil, but in the trainings, we understood that those insects were beneficial for the soil)." The farmers learned to identify different pests and learned curative measures. For sucking pests, they used Neemastra, an organic pesticide; and for chewing pests, they used Agniastra. Farmers from both the villages used these pesticides and the results were very effective. The best time for farmers to review their decisions was early mornings when they could clearly see the pests in their plots.

To retain soil moisture, farmers were encouraged to use Jeevamrit. In case of less vegetative growth, they used organic fertilizers such as Pranamrit and Bakramrit. In case of viral diseases, farmers isolated the affected plant from the others, identified the vectors responsible for the diseases, and checked their growth by using a coloured sticky plate over their crop fields. This process was repeated fortnightly or monthly, by all the farmers, who had similar kinds of crops in close proximity.

The farmers took measures to protect the health of their crops and the ecology from the ill-effects of chemical pesticides. Some of these measures were: building bird perches, laying pheromone traps, using yellow sticky plates, using border crops such as red gram, marigold and coriander, to reduce pest attacks and applying Neemastra and Agniastra, in case the crop was attacked by the pests. The farmers also shifted to improved agricultural practices, using SRI, making a collective nursery, sorting the seeds, treating the plants with Beejamrit and managing water correctly. The farmers would monitor the texture of the soil, the growth of plants and any attacks by the pests in their fields and would counter these with the application of organic preparations. They also used these preparations in the patches where they had used chemical-based methods. Subsequently, they did an impact analysis in the organic and the inorganic patches, and discussed the results in their SHG meetings for further course of action. They took decisions, collectively, on some crops and monitored them commonly. Accordingly, they also prepared a crop-wise pest and disease calendar. The whole idea was that the community gets engaged in the learning process, doing active experimentation and taking informed decisions.

Some remarkable changes that the farmers of Bhandaro and Jitpur villages adopted, while doing non-chemical based interventions last year were: the adoption of SRI practices, resulting in increased yield of paddy and vegetables during the kharif and the rabi seasons; improved water and animal waste management; preparation of organic pesticides and fertilizers; inculcating NPM interventions in farming practices; creation of awareness about the side-effects of chemical pesticides on human health as well as the ecology; identifying pests and learning how to eliminate them; taking a community approach in learning and making decisions; creating a knowledge nucleus around NPM by building expert resources; demonstrating clear differences between current practices and NPM-based agriculture interventions with the community; and to be able to bring the community on the same platform.

Table 1: Organic Products Used by the Farmers

Product	Use	Material
Jeevamrit	Fertilizer (increased bio-agent in soil)	Cow dung, cow urine, jaggery, gram flour, fertile soil, water
Ghan-jeevamrit	Fertilizer (increased bio-agent in soil)	Cow dung, cow urine, jaggery, gram flour, fertile soil
Pranamrit	Organic fertilizer	Poultry waste, oil cake, ash, water
Bakramrit	Organic fertilizer	Goat excreta, oil cake, ash, water
Beejamrit	Seed treatment	Water, cow dung, cow urine, lime, handful of soil
Beeja Raksha	Seed treatment	Soil from under a big tree, ash, asafoetida, turmeric powder, cow urine.
Mahuastra	Fungal disease	*Mahua*, jaggery, cow urine
Agniastra	Chewing pests	Cow urine, dry tobacco leaf, chilli, garlic, *neem* leaf
Lohastra	Pest control	Rusted iron scraps, cow urine
Mathastra	Fungal disease	Fermented curd and water
Amrit	Tonic/Hormone	*Moong dal* seed, chick pea, wheat, cow pea, *arhar dal*, *til* seed, etc.

Bitiya Marandi of Bhandaro village said, "Jo didi jaivik khad aur dawa khet mein nahi dali hai uska paudha accha nahi hua hai (Those who did not use organic methods in their fields did not have good plants)."

Evident Changes

In both the villages, **farmers found visible changes in their fields after using organic practices. The soil health improved as was evident from the change in the colour of the soil from reddish to black. The farmers also said that diseases and pest attacks were fewer because of better soil health,** seed treatment and preventive measures taken such as sticky traps, plantation of marigold, etc. Bitiya Marandi, who did organic and inorganic paddy in two patches of her land, had a yield difference of seven quintals per acre with a mix of organic practices and improved practice of cultivation than through the conventional method with chemical-based farming. Sonamati Tudu cultivated tomatoes through organic practices as well as the chemical-based method in two patches of 10 decimals each. She had a produce of 20 quintals in the organic field, where she used Pranamrit as fertilizer and sticky trap and Neemastra to control pest attacks.

The yield from the field in which she used DAP was 14 quintals. The water-holding capacity of the farmlands treated with organic fertilizers such as Jeevamrit, Bakramrit and Pranamrit has also been enhanced, with some farmers claiming that it had occasionally saved them from having to irrigate their lands one or two times. Bitiya Marandi irrigated her potato crop in 10 decimals of land twice; she also applied Pranamrit, Jeevamrit, Ghan-jeevamrit and got a yield of 4.2 quintals.

On the other hand, she irrigated the other patch of land of 10 decimals three times, used DAP and got a yield of three quintals. The SHG members also said that the cost of cultivation

Table 2: Cost Analysis of Chemical-based and Organic Paddy Cultivation in 1 *Bigha* Land

Chemical-based Farming		Organic Farming	
Material and labour days used	Cost (in Rupees)	Material and labour days used	Cost (in Rupees)
Seeds: 3 kg	330	Seeds: 3 kg	330
Total man-days for the preparation of the nursery field: 2 days	340	Total man-days for the preparation of the nursery field: 2 days	340
Total man-days for the preparation of the main field: 9 days	1530	Total man-days for the preparation of the main field: 9 days	1530
DAP: 30 kg	900	Pranamrit: (1 time)	220
Urea: 20 kg	200	Jeevamrit/Ghan-Jeevamrit: (4 times)	250
Total man-days for weeding: 6 days	1,020	Total man-days for weeding: 6 days	1,020
Total man-days for harvesting: 16 days	2,720	Total man-days for harvesting: 16 days	2,720
Total cost	7,040	Total cost	6,410
Yield	6 quintals/*bigha*		6.5 quintals/*bigha*

had decreased, contrary to the thinking of the people that organic practices would be costlier and more time-consuming. Table 2 shows the difference in the cost of cultivation between organic practice and inorganic practice in Anita Murmu's field. She had cultivated paddy both organically and inorganically in two separate fields of one bigha (33 decimals) each. The cost incurred through organic methods was low when compared to chemical-based methods, using the same number of labour days. Significantly, the yield through organic methods was also more.

The yield will improve over the years, with the use of organic practices, because of improvement in soil quality. The most visible change observed was in the quality and the taste of the produce. SHG members said that the vegetables produced were much tastier. This also helped them fetch better prices in the market. Their produce was in high demand in the haat (local market). SHG members now, regularly, discuss their experience in the SHG and Village Organization (VO) meetings, and extend their support to other farmers. As part of the farmer field school, they regularly visit the organic and inorganic patches separately, and work on preparing an action plan to scale up healthy and efficient practices.

Making the Idea Viral

Bhandaro and Jitpur villages, in two years, have become the nucleus for the rest of the block for non- chemical-based agriculture. Exposure visits were conducted for the farmers of other villages during the kharif and rabi seasons. SHG members of Bhandaro and Jitpur created awareness around non-chemical-based agriculture in their Cluster and in the panchayat. They sang songs and performed plays to create awareness and had focussed group interactions with SHG members of other villages in the block.

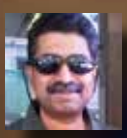
Six women from Bhandaro and Jitpur were trained as master trainers, to develop new cadres in other villages in Kathikund block, who in turn would support farmers. At present, more than 1,000 farmers are venturing into non-chemical-based farming. Some have shifted entirely while the others have made a partial shift.

Although very gradual, the transition process is natural and is without external coercion. The community has taken its own time to explore, understand and improvise on practices. Convinced, they are now taking it upon themselves to reach out to the other farmers and are inviting them to explore, creating a learning environment that helps them make informed choices.

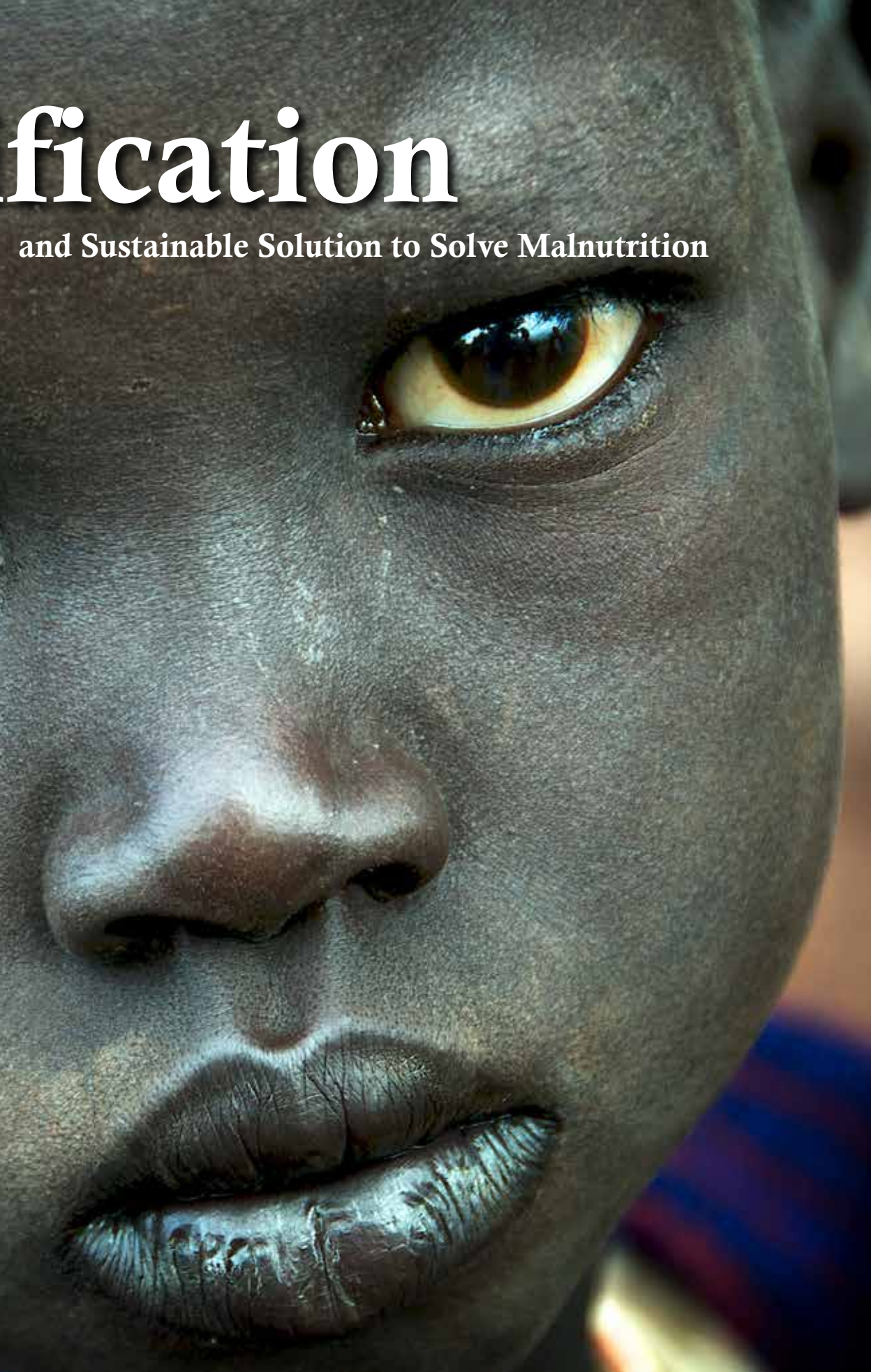


Bioforti

Positioning Nutritious Crops as a Cost Effective



Binu Cherian
Country Manager,
HarvestPlus, CGIAR



fication

and Sustainable Solution to Solve Malnutrition

An estimated more than 2 billion people globally, suffer from insidious effect of micronutrient malnutrition. According to the World Bank report, India alone loses to the tune of more than US$ 12 billion in GDP annually to vitamin and mineral deficiencies. The consequences of malnutrition, also known as 'hidden hunger' can have a devastating impact; they include stunting, impaired cognitive ability, blindness, increased risk of disease, and premature death. Women and young children are especially vulnerable.

According to the World Health Organization (WHO), vitamin A, zinc and iron are among the micronutrients most lacking in the diets of the poor in the developing world. Providing such nutrient through supplements and industrial food fortification can be feasible in regions that has strong health and market infrastructure. It does not serve effectively, in rural areas with inadequate and non-existent market infrastructure where the vast majority of malnourished population live.

The combined trickle-down effect of agriculture and economic drivers has had a huge impact in India on the overall transformation of socio-economic indicators. Nevertheless, from this vantage point, what disturbs is the exceptionally high rate of malnutrition prevalent in India. According to the United Nations, nearly 47 million or 4 out of 10 children in India are not meeting their full human potential because of chronic undernutrition or stunting. India shares a quarter of the global hunger burden. Global leaders agree nutrition binds 12 out of 17 UN Sustainable Development Goals (SDG's), nutrition is an essential ingredient of the SDG's and for sustainable impact. In fact, malnutrition remains one of the biggest public health challenges of the twenty first century that can severely impair sustainable economic growth and human development of the country

There are substantial percentage of poor population who are unable to afford diverse and nutritious diets in developing countries, and consume basic staple food in large quantities to meet their dietary energy requirements and to keep from going hungry. One of the key fundamental causes leading to poor dietary quality is that current food systems do not provide mineral and vitamins in sufficient quantities at affordable prices for the poor.

According to Dr. Howarth Bouis, Founding Director of HarvestPlus and recipient of 2016 World Food Prize, "agricultural investments and policies in biofortification will not only improve the availability and affordability of more nutritious food but also will help in placing the solution in the hands of farmers and the communities".

Biofortification: A new agricultural approach

Biofortification is a process of improving the nutrition in the edible parts (seed, tuber or roots) of staple crops that are already consumed by the population through conventional tools of breeding to make measurable nutrition impact when eaten regularly as a part of normal diet.

According to the Copenhagen Consensus in 2008, a panel of noted economists that included five Noble Laureates ranked efforts to reduce hidden hunger among the most cost-effective solution to global challenges, biofortification was ranked fifth among them.

Key advantages of biofortification are:

1. Targets the poor who consume large quantity of staple foods as part of their regular diets.

2. Targets the rural areas where an estimated 75 percent of the subsistence farmers live. These populations rely on diets largely based on staple foods cereals. Therefore, locally produced, more nutritious staple food crops can significantly improve nutrition.

3. Cost-effective, after an initial investment in developing biofortified crops, these crops can be adopted at a low additional cost as compared with the existing interventions like supplementation and food fortifications, which requires annual investments.

4. Sustainable approach because this strategy relies on food that population consume on a regular basis. Biofortified crops can be grown to deliver nutrition without any recurring cost.

Biofortification using conventional plant breeding approach is considered as a feasible and effective approach to alleviate micronutrient deficiency because;

A) Conventional breeding can add extra nutrients in the crops without compromising on yield.



B) When consumed, the increase in nutrient levels can make a measurable and significant impact on human nutrition and

C) Farmers are willing to grow biofortified crops and consume them.

Nutritional bioavailability and efficacy evidences

Nutritional studies conducted has established that iron biofortified pearl millet provides a significant improvement in serum ferritin and total body iron was observed in iron-deficient adolescent boys and girls. The prevalence of iron deficiency was reduced significantly in the high-iron biofortified pearl millet group. Results from the same trial indicate that iron biofortified pearl millet consumption also improved cognitive performance

In zinc biofortified wheat, the nutritional studies has established that it helps in reducing child & maternal morbidity; when eaten daily, children spend fewer days ill with pneumonia and vomiting. Women spend less days with fever. A modest 4mg of extra dietary zinc a day (e.g. the amount that can be provided by biofortification) improves DNA integrity. Nearly 70 percent more zinc is absorbed by the body from zinc wheat than from common wheat varieties (regardless of degree of milling).



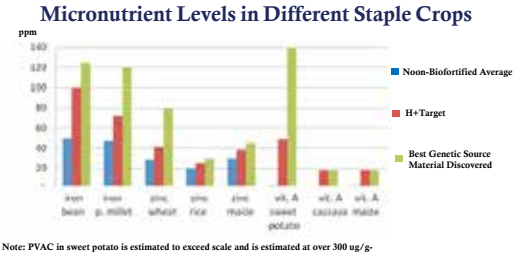
Crops	Nutrient	Country
Iron Pearl Millet	Iron	India
Zinc Wheat	Zinc	India, Pakistan
Zinc Rice	Zinc	Bangladesh, India
Vitamin A Maize	Pro vitamin A	Zambia
Iron Bean	Iron	Rwanda, Democratic Republic of Congo (DRC)
Vitamin A Cassava	Pro vitamin A	Nigeria, Democratic Republic of Congo (DRC)

Creating Sustainable Demand for biofortified crops - Farm to Plate

HarvestPlus has an audacious goal to change lives of one billion people globally by 2030 with biofortified crops. Forging partnerships with multi-disciplinary stakeholders is key to success. Building sustainable markets for biofortified crops will ensure long-term demand across the value chain. These partnerships will help to create sustained opportunities and to garner competitive advantage of biofortified crops in the existing markets. In a long term, biofortified crops can to generate demand from agriculture as well as nutrition sector.

With this overarching strategy, the initial pathway starts with farmers adopt biofortified varieties. HarvestPlus collaborates with partners to initially to test and evaluate new varieties, on supply side to create access and availability of seeds. In addition, simultaneously creating demand in collaboration with seed companies and community organizations. Understanding of market and consumer insights helps in creating awareness about unique value proposition of biofortified seed and benefits of consumption of biofortified grains to the communities.

Market research studies helps in understanding the insights such as barriers, drivers, consumer preferences and behaviors, which helps to position these products with nutrient messages on the benefits of consumption and agronomic superiority for creating demand.



Note: PVAC in sweet potato is estimated to exceed scale and is estimated at over 300 ug/g-

HarvestPlus partnership with National Agriculture Research System (NARES), public and private seed companies, NGO's and community organization will help in reaching farmers, where a major percentage of the consumption of primary food production happens (on farm). This helps in realizing the primary goal of biofortification approach of influencing rural communities for increasing the household nutrition. After fulfilling the household's food needs, surplus biofortified crops make their way into rural and urban markets. Food partnership for value chain linkages can help further generate demand for biofortified crops. Initial market linkages in rural markets with marketable surplus when attained helps in availability of biofortified value added product to non-farming consumers who buy food.

This will require productions with traceability guarantees to preserve identity of the commodity through the dedicated aggregation points in the value chain. Large food companies and retails chains can connect biofortified food products to the urban consumers. This can trigger larger and sustained demand in the market, and will help to realize better value for primary producers of biofortified crops.

Policy support for incorporating biofortified crops in the public food and nutrition programs (Targeted Public Distribution –TPDS; Mid-Day Meal Scheme; Integrated Child Development Scheme) can be other major driver for biofortified food crops which will help in increasing the nutrition component of these programs cost-effectively. Decentralized procurement can help in engaging farmers directly for procurement of biofortified grains, such as zinc wheat, iron pearl



millet and zinc rice can provide farmers regular market. Preferential prices for biofortified grains can incentivize farmers to grow and adopt these nutritious varieties in larger scale. At present, more than 290 varieties of 12 bio fortified staple food crops have been released or are being tested in 60 countries, a number that continues to grow. Globally about 50 million farmers worldwide are growing and eating biofortified crops, and consumers are buying biofortified foods. In India biofortified varieties of iron pearl millet, zinc wheat, zinc rice has been released. More than 1.5 million people are growing and consuming biofortified pearl millet and zinc wheat.



Biofortified crops grown and consumed worldwide



Scaling up biofortified crops in Bihar and Odisha:

HarvestPlus has initiated a project in Bihar and Odisha consisting of zinc wheat, zinc rice and iron lentils in 2018 for improving public nutrition in collaboration with ICAR-IIWBR, CIMMYT, IRRI, Bihar Agricultural University, Rajendra Prasad Central Agricultural University, FPO's and NGO's. With stunting levels at 48% and 38% respectively, Bihar and Odisha are two of the vulnerable states.

The objective of the project is to

(A) Establish sustainable system for production and consumption system for biofortified crops
(B) Promotion of biofortified crops to create demand for seed and grain for household food and nutrition security.
(C) Development of market linkages for biofortifed crops.
(D) Enabling policies for scaling biofortified crops in these two states.

HarvestPlus has collaborated with more than 30 partners to test and evaluate biofortified zinc wheat varieties in Bihar in the last rabi season. Promotion of biofortified crop is also one of the priorities mentioned in the Government of Bihar's Agriculture Road Map documents -2017-2022 to improve household nutrition.

In collaboration with partners, HarvestPlus plans to scale further, zinc wheat access to farmers to grow and consume, which can help to improve household nutrition security. HarvestPlus also plans to establish value chain partnership to link these nutrition crops to consumer market to create a demand, which will also help in incentivizing primary producers and will help in establishing sustainable markets.

Conclusion

Biofortification strategy can complements with the existing market interventions (supplementation and fortification program) and dietary diversity to improve nutrition. It targets the poor rural populations, takes advantages of the existing delivery infrastructure and is extremely cost-effective. Multi-disciplinary partnerships will help in driving adoption and creating demand for biofortified crops. Consumer demand to grow and consume will help to connect rural and urban consumers.

Mainstreaming of the biofortified traits by public and private sector breeding program will create product sustainability. Food companies and retail companies incorporating biofortified food in their existing products and new product pipelines will trigger further demand from consumers. Favorable policy support to include biofortified food staples in the existing public food and nutrition program will help in increasing the nutrition component and generate further demand. Government's inclusion of agriculture as promising means to improve human nutrition in the nutrition policy will help in create long-term sustainability.

However, the prime potential of biofortification is and will be to address hidden hunger among the farming and rural populations. Food industry participation and collaborative efforts will help in rooting deeper biofortification in the existing food value chain and will help to realize the competitive and complementary advantage that biofortified crops has to offer. These efforts in integrating biofortification from rural to urban markets will help in creating long- term sustainability and reaching millions. Biofortified crops can play an important role in providing food-based solution for strengthening the nutrition security in India.

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Small Indigenous Freshwater Conservation for Nutrition Security



Pratap Mukhopadhyay
Retired Principal Scientist,
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Fish Biodiversity and their & Rural Livelihood Support



Inle Lake, Myanmar (Burma)
The art of fishing with one leg paddling

India is one of the 17 mega biodiversity hotspots contributing more than 60% of the world's biological resources including rich and diverse fish fauna. A report from National Bureau of Fish Genetic Resources, Lucknow indicated that out of 2246 fish species in India,765 are from our freshwater ecosystem of which again 450 small indigenous fishes (which grow to 25-30 cm at adult stage of life-cycle).) are distributed throughout the country in about 2.4 million hectare of ponds and tanks and 1.3 million hectare of beels, jheels and other wetlands, in addition to 0.1 million km of irrigation canals and 2.0 million hectare of reservoirs and deep water paddy field ecosystem.

These small fishes including minor carps, catfishes, perch, murrels, eels, featherbacks, cichlids are our potential renewable bioresources. These were abundantly available even a decade ago in our rural ponds and low-lying paddy field environments mostly with the onset of south-west monsoon and continued till end November every year. Most families in rural Bengal loved to depend on such species as source of nourishment and for livelihood improvement purpose including aquarium fish trade.

Declining Trend of Natural Population and Concerns : The scenario started changing from 1980s with the introduction of modified aquaculture practices consisting of three major carp species catla, rohu, mrigal, and three exotic species silver carp, grass carp and the common carp together called composite carp culture system.

The first task of the new culture system was to methodically eliminate these naturally occurring small ones as trash or weed fishes with application of mohua oil cake (suggesting that though this acts as a poison at the start and kill the unwanted fishes but becomes a manure at the end to promote growth of planktonic organisms) to reduce competition for food, dissolved oxygen and even space (in the lentic type of our freshwater ecosystem) between large carp and these small local fish varieties.

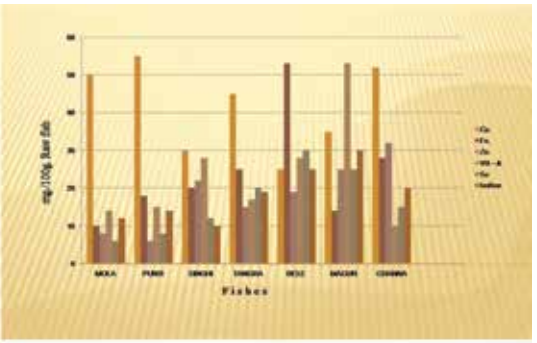


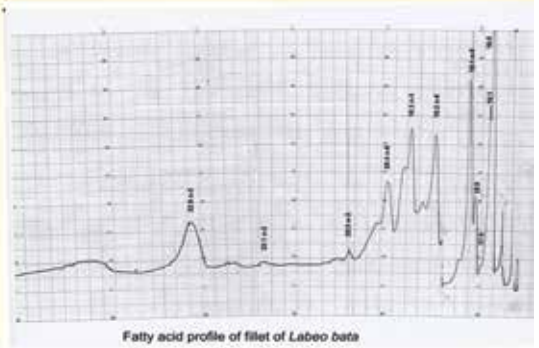
Indigenous small fishes were in plenty even a decade ago in rural Bengal during mid June to November every year

While extensive and continuous efforts are being emphasized even today following the same principle of killing the small fishes first and then development of intensive fish culture technology to augment large fish production involving carp seed stocking beyond the natural carrying capacity of the water bodies, exogenous application of supplementary feed.

Instead, it should ideally complement considering the contribution provided by the available natural food organisms in water and how much is deficient in meeting the fish's nutrient needs to achieve the genetic potential of growth, use of synthetic fertilizer, water exchange if needed, provision of aeration supply, adoption







Fatty acid profile of fillet of *Labeo bata*

This small indigenous fishes are rich source of micro nutrients and certain long chain PUFAs vital for human health



Application of de-oiled Mahua seed powder is used to kill the small fishes to begin the polyculture system of large carps in ponds even today

of prophylactic measures including even deliberate occasional introduction of pesticides and scheduled drugs and antibiotics to control parasitic and other diseases whenever required.

These are in addition to development of multiple reproduction technique through prolonged induced hypophysation, growth enhancement of carp species through selective breeding and marker assisted selection.

In doing all these, research and development efforts on the biodiversity, conservation biology, potential benefits and management strategies for propagation of these diverse small freshwater fish species remained neglected miserably and thus unrecognized as aquaculture activity despite the fact that these small fishes are capable of contributing towards varietal diversity on daily food plate.

Consumers will expect variety of fish in addition to only carp species availability mainly for those living in urban/suburban areas and for those living in rural region providing formidable amount of critical food source of very high biological value in the form of fresh fish for day to day consumption and offering larger benefits in terms of nutritional security particularly provision of household nourishment with regard to micronutrient availability so vital for healthy growth of children.

Malnourishment caused by deficiencies of micronutrients- vitamins and mineral elements in particular also sometimes called 'hidden hunger' weaken the immune system and stunting physical growth and intellectual development)

It is a matter of concern that noticeable reduction in biodiversity of many small freshwater fishes some of which have already exhibited serious declining trend in availability due to emphasis given on production of large sized fish like carp species for commercial gain.

The decline can be attributed in part to several other factors also like habitat shrinking resulting from anthropogenic stress, wetland area reduction due to encroachment, surface run off contamination of non-target organisms-fish from pest control measures in agricultural fields sprayed with agrochemicals, pollution related effects on their reproductive performances due to mixing of discharged industrial and sewage effluents.

Certain Selected Small Fishes of West Bengal and Their Nutritional Benefits: To mention few example of some small species of local fishes from West Bengal showing their risk status are; singhi (Heteropneustes fossilis),magur (Clarias batrachus),khoira (Gadusia chapra),mourala (Amblypharyngodon mola), chang (Channa gachua),bacha (Eutropiichthys vacha) ,bele (Glossogobius giures), reba (Cirrhinus reba), nados (Nandus nandus), kholse (Colisa lalia), pakal (Pancallus pancallus) baspata (Ailia coila), saral punti (Puntius sarana) and several others. These fishes are self recruiting in nature and their biodiversity decline are likely to make the aquatic ecosystem more vulnerable to natural disturbances including eutrophication; moreover they contribute to greater variety for the farmer, by increasing the physical and economic access to food of very high biological value .

Small endemic freshwater fishes as stated above including medium and minor carps like bata, punti, maurala, colisa etc., catfishes like magur, singhi, pabda, tangra, murrels, perch, eels, folui and several others are well known sources for vital macro and micronutrients of immense importance in human nutrition and wellbeing through increased bioavailability of high proportions of myofibrillar protein, long chain n-3 PUFAs,and micronutrients. The minor carp Labeo bata is rich in long chain n-3 PUFA containing EPA (20:5n-3) & DHA (22:6n-3)which have multiple health benefits like preventing arterial damage, altered immunity and degeneration leading to heart attack and cerebral stroke, painful joints, wrinkled skin, premature greying of hair and development of cancer to name a few., vitamin-A, cyanocobalamine, calcium, phosphorus, zinc, iodine, potassium (accompanied by low sodium) are generally not adequately available in common foodstuff including even certain cultured fishes.

Diets deficient in micronutrients are relatively high among rural children and youth whose intake of foods are predominantly cereal –based but low in consumption of food like small fish. The amount of bio- available iron , zinc, selenium for example is dependent on the content & source in the diet as well as on their absorption during food digestion. Their absorption from the plant derived food stuff is generally very low. One of the reasons is the presence of high concentration of endogenous anti-nutritional factors like phytate. Phytate occurs naturally throughout the plant kingdom and is present in



Current trend is to culture some of these species in sanctuary pond or in cages / enclosures prepared inside a large pond

considerable quantities. About 70% of the total phosphorus within cereal grains are in the form of phytate which is largely unavailable due to the absence of the enzyme phytase in our digestive tract ; phytates act as strong chelator forming protein and mineral - phytate complexes with the net result being reduced protein and mineral availability. Again since cereal grains are low in the concentration of carotenoid (precursor of vitamin A) ,the bioavailabilty of vitamin A is also varied with source of carotenoid in the diets. Iron, zinc, vitamin A & iodine deficiencies are the major micronutrients having importance in human health point of view. Restoration of Certain Declining Fish Species Through Development of Controlled Culture System: Presently, however, concerns have arisen with regard to conservation of some of these small fishes which are on the wane and it is nice that certain NGOs, progressive fish farmers/fishery entrepreneurs in West Bengal have come forward and putting their efforts to rear these fishes in sanctuary ponds named as "Abhoy Pukur"- some kind of live gene bank under their control at some selected locations. To name such farmers are Ashis Sarkar of Hemtabad near Raiganj, Uttar Dinajpur and Amrita Das of Dakshin Dinajpur near Tapan. There are quite a few more in southern part of Bengal also including Bankura,Purba Medinipur,North and South 24 Parganas.

Department of Panchayet and Rural development and the Directorate of Fisheries, Govt. of West Bengal have also now realized importance of such resources and initiated captive breeding and culture of some species. The Tamluk Project (with Dr Uttam Laha as the Head of the Project) of Comprehensive Area Development Corporation under Dept.of Panchayet and Rural development have been engaged in the breeding and culture of quite a few small fish species involving women SHGs in leased out ponds. They found that farming of small indigenous fish species (SIFS) like A. mola, Claria batrachus, Heteropneustes fossilis, Anabas testudineus along with major carps (Labeo rohita, Cirrhinus mrigala and Catla catla) and medium carps (Labeo bata and Cirrhinus reba) can be safely done The advantage of culturing these fish is clearly to to get an additional crop that enhances the total revenue generated from this ecological niche.

Prior to monsoon major carps, medium carps and A. mola and the catfishes(early fingerling stge) were stocked in the prepared ponds. The matured male and female (1:1) of A. mola were stocked @ 1000 nos/ha. Simple farm-made feed prepared at the pond site using locally available ingredients like finely ground mixture of rice polish, groundnut oil cake has been found to quite effective and inexpensive also compared to the industrially produced feed sold in the market. In a similar manner, seed production and farming of species like Singhi,Pabda,Vacha,Tangra (Mystus vittatus) reba bata (Cirrhinus reba) are being tried elsewhere with change in farm made feed composition only sometimes adding 5% marine trash fish powder and a little fish oil for catfish culture only.With the revival of such endangered fish species through this kind of conservation efforts, a group of village artisans who used to fabricate various kind of fish traps mostly made of bamboo with knowledge of net mending and presently with no or little work will hopefully also get back to their lost profession for the benefit of conservation based aquaculture and small fisheries management.

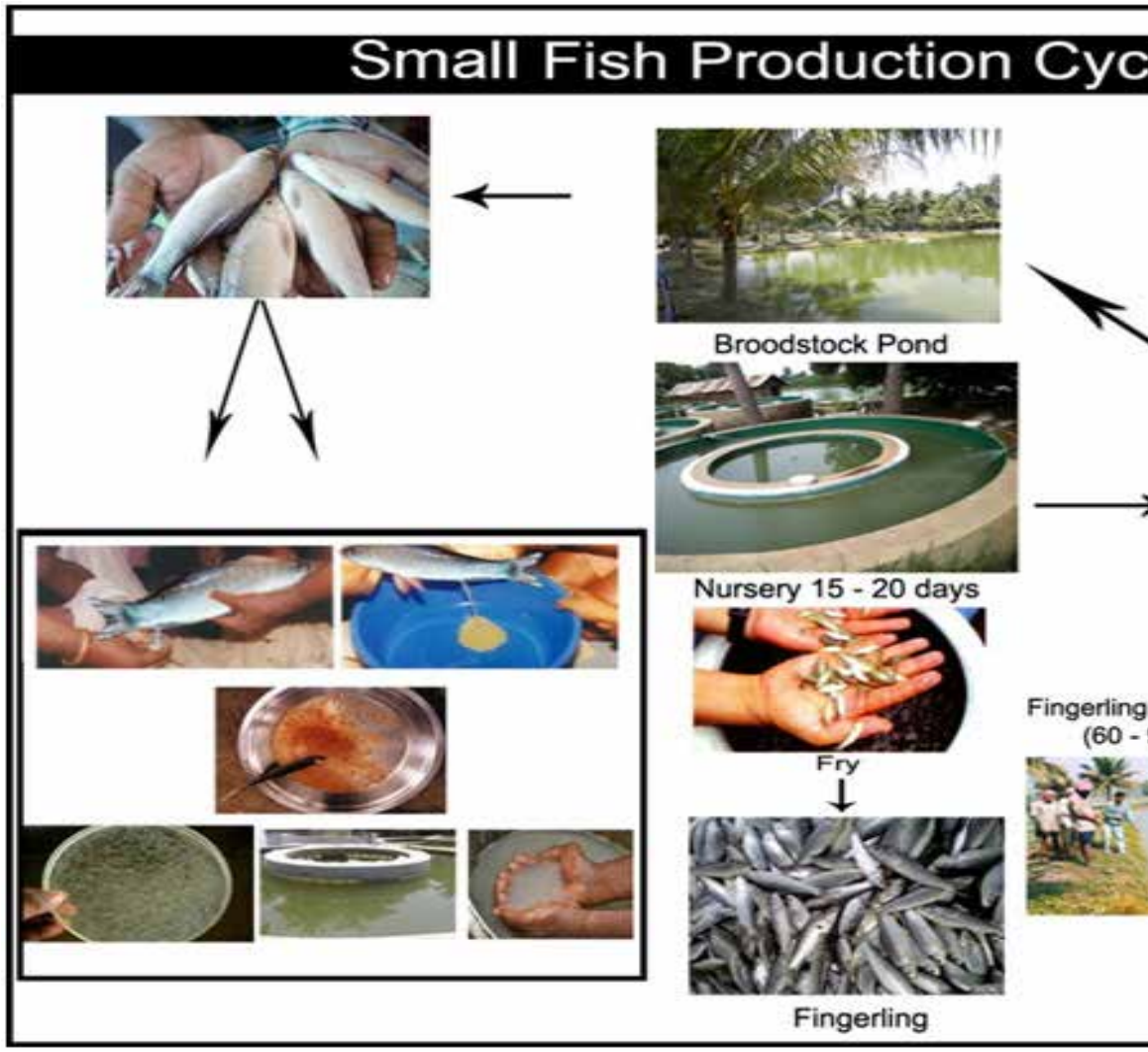
It is important therefore that available water bodies under all panchayets / talukas be utilized for production of small aquatic organic food sources and if possible social aquaculture in the line of social forestry be introduced wherever possible utilizing the small indigenous fish species. This may serve the dual purpose of conservation of these species some of which are becoming endangered as well as production of cheap and best edible animal product for better human health assuring better demographic dividend from healthy rural children in the long run.



A rural pond with small fish under culture. (To protect from bird predation discarded polythene carry bags have been hung along with threads)

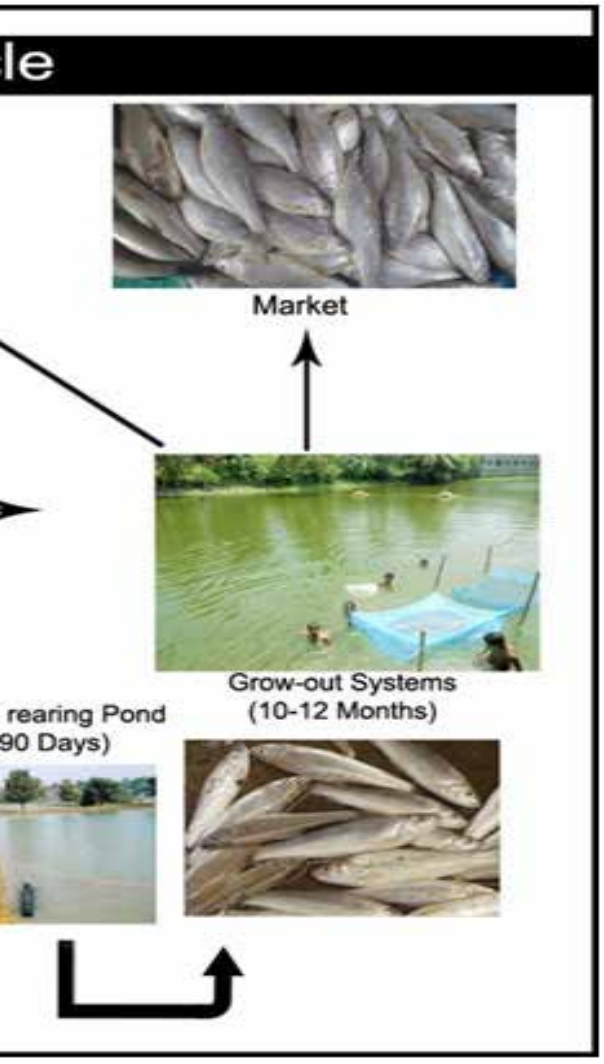


With decline of small fish biodiversity, there will be repercussion on the rural artisans, fish sellers leading to loss of livlihood support





Small fishes can be reared in small seasonal ponds, cement tanks with harvested rain water, folding plastic tanks, bamboo cages installed in ponds with low input system.


le
Market
Grow-out Systems
(10-12 Months)
rearing Pond
90 Days)


Meen Mitra
To provide support
to small fish farmers
troubleshooting
Contact : 93


Farm made feed preparation and application in culture ponds
1st Step
Selected ingredients ground and weighed according to formulations
2nd Step
Mixing the weighed materials thoroughly
3rd Step
Mixing the Micro-nutrients as well as additives
4th Step
Preparing moist dough balls and pellet making using hand/motor operated pelletizer
5th Step
Sun drying the prepared pellets
6th Step
Packging and Storage
7th Step



Impact of Neem Leaf Meal as a Feed Supplement in Poultry

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“Neem leaf meal (NLM) is an ideal candidate for the poultry industry to make their production economically viable and environmentally sustainable.

Background

Poultry is one among the fastest growing sectors of India. Chicken contributes the lion's share to poultry production in India owing to 95% of the total egg production. Feed cost accounts for 65-70% of total cost of production in broilers and 75-80% for layers. Majority of the population in India still subsists in villages and they are getting access only to 25% of total poultry products as commercial poultry farming is limited to urban and semi urban areas. In this context, the major setback of high feeding cost for the small scale farmers in the villages, keeping handful of the birds require a boost up.

Poultry products and its by-products have tremendous potential to enhance the nutrient stability in any household, be it in rural or urban areas. Thus, economic cum healthy production of these little birds obliges and Neem is an ideal choice for it. Neem, a large evergreen fast growing perennial tree is having medicinal as well as nutritive value for poultry. Neem leaves have been found to be useful in relieving pain, fevers, infections and other complaints that it has been called the "village pharmacy".

Scientific studies showed that the inclusion of neem leaf meal in the diet of broilers, layers and other birds showed significant enhancement in their immunity, decreased cholesterol levels and increased body weight gain. Also, neem leaves can be used as an alternative to the antibiotic growth promoter in the poultry ration. Henceforth, it's high time that poultry industry must explore to include Neem as a feed supplement in the ration.

Introduction

Poultry Industry, one of the major role players of Livestock sector, having the highest growth rate is facing one set back ahead their ultimate success, i.e. growing feed cost. The annual egg production, the per capita availability of eggs per annum and growth rate of egg production has reached 88139 million, 69 eggs, and 6.28%, respectively in the year 2016-17 (AHS series-18) in India. Also, the consumeristic health conscious societies of the modern day are looking forward for the intake of low antibiotic residue items in their menu. In this context, Neem leaf meal (NLM) is an ideal candidate for the poultry industry to make their production economically viable and environmentally sustainable.

Azadirachta indica (Neem) belongs to the family Meliaceae, a tropical evergreen tree which is widely distributed in Asia, Australia, Africa and other parts of the world. Neem, a fast growing tree, grows in an extensive array of soils and it is a robust tree which can flourish in poor dry soils without irrigation. Neem tree is also known as the nature's gift to mankind,the tree for many occasions, the tree of the 21st century and a tree for solving global problems.

The short, usually straight trunk has a moderately thick, strongly furrowed bark that has a garlic-likeodour and a bitter, astringent taste. The Neem plant is rarely leafless and is usually in full foliage even during months of prolonged drought. It is grown from the southern tip of Kerala to the Himalayan hills, in tropical to subtropical regions, in semi-arid to wet tropical regions, and from sea level to about 700 metres (NRC, 1992).

Why Neem?

Neem is one of the very few shade-giving trees that thrive in drought-prone areas. In India, Neem trees are been commonly used for shade lining streets, around temples, schools and other such public buildings or in most people's back yards, both in urban and rural areas. Neem products have been used in India for over two millennia for their medicinal properties. Neem contains a vast array of biologically active compounds which are chemically diverse and structurally complex. Biologically active principles isolated from different parts of the plant include: azadirachtin, meliacin, gedunin, salanin, nimbin, valassin and many other derivatives of these principles.

Miliacin forms the bitter principles of its leaves (NRC, 1992). These compounds belong to natural products called triterpenoids (Limonoids). The active principles are slightly hydrophilic, but freely lipophilic and highly soluble in organic solvents like, hydrocarbon, alcohols, ketones and esters (NRC, 1992). Various parts of the tree have medicinal value. Also Neem possesses protolimonoids, tetranortriterpenoids, pentanortri-terpenoids, hexanortriterpenoids, and some non terpenoid. Neem leaves exhibit immunomodulatory, anti-inflammatory, antihyperglycaemic, antiulcer, antimalarial, antifungal, antibacterial, antiviral, antioxidant, antimutagenic and anticarcinogenic properties. Owing to these properties, neem leaf meal has been tried as a

feed additive in animals. An abundantly available biopolymer, Chitosan in combination with neem leaf meal can be supplemented in the diet of broiler chickens to reduce the abdominal fat.

In non-pesticidal management (NPM), neem is a key ingredient providing a natural alternative to synthetic pesticides. Also, it acts as an anti-feedant, repellent, and egg-laying deterrent, protecting the crop from damage. Neem cake is often sold as a fertilizer. Azadirachtina chemical in neem has positive effects on pests, and deformental effects on viruses, mites, fungal pathogens, plant parasitic nematodes, intestinal worms, bacteria, molluscs, and protozoan parasites such as coccidian species (NRC, 1992). Ongoing research studies at ICAR- CIWA revealed that Neem is an ideal candidate to substitute antibiotics in the poultry ration.

Medicinal Properties of Neem

Siddha and Ayurvedic practitioners claims that neem and its products are said to be having anthelmintic, antifungal, antidiabetic, antibacterial, antiviral, contraceptive, and sedative. Neem leaves have also been used to treat skin diseases like eczema, psoriasis;leprosy, eye disorders, bloody nose, intestinal worms, stomach upset, loss of appetite, skin ulcers, diseases of the heart and blood vessels (cardiovascular disease), fever, diabetes, gum disease (gingivitis), and liver problems. The leaf is also used for birth control and to cause abortions.The bark is used for malaria, stomach and intestinal ulcers, skin diseases, pain, and fever.

The flower is used for reducing bile, controlling phlegm, and treating intestinal worms.The A. indica leaf exhibits a wide range of pharmacological activities viz., antiinflammatory, anti-hyperglycaemic, anti-ulcer, anti-malarial, anti-fungal, anti-bacterial, anti-viral, anti-oxidant, anti-mutagenic anti-carcinogenic, immunomodulatory and various other properties without showing any adverse effects. Azadirachtaindica leaves also contain compounds with proven antimicrobial activity.

The antimicrobial activity of extracts of neem leaves against such micro-organisms as Staphylococcus spp., Streptococcus spp.,Pseudomonas spp. and Escherichia coli, and some fungal strains have been reported (Valarmathy et al., 2010). The extract of the Neem leaf is reported to possess diverse pharmacological characteristics such as anti-inflammatory, hypolipidaemic, immunostimulant, hepatoprotective and hypoglycaemic effects. Being accepted by consumers as natural additives, phytogenic and herbal products have received increased attention in the recent years. Earliest ayurvedic literature refers to the benefits of all parts of neem tree including fruit, leaf, bark, flower and root.

Neem – An Alternative

Health conscious consumeristic society associate diet with the probability of experiencing health problems or diseases. The growth and expansion of the poultry industry is confronted by high cost of feed and drugs and their occasional shortages. However, there is the fear that the reckless and continuous sub-therapeutic use of in-feed antibiotics could lead to the development of antibiotic resistant bacteria, which is harmful to human beings.

Thus, efforts have been made in different parts of the world to ban the inclusion of all types of antibiotic growth promoters in animal feeds. The utilization of leaf meal feed ingredient as alternative is not new but the inclusion level at various ages and physiological conditions varies. The green plants have long been acknowledged as the inexpensive and most copious impending source of proteins because of their capacity to produce amino acids from a wide range of fundamentally boundless and readily available primary materials. However the inclusion of antibiotics in livestock rations as feed additives is being discouraged because of the negative effect on the animals and the humans who consume the final animal products (HCWH, 2005).

Thus, there is the need to appraise potential antibiotic alternatives to improve disease resistance in intensive food animal production. Neem, owing to its wide range of beneficial effects can be substituted for Antibiotics in the poultry ration. Furthermore, scientists and researchers are trying to combat against fatal diseases in poultry through the use of medicinal plants, containing the most active ingredients to promote growth, weight gain and immune-stimulant.

Composition of Neem leaf meal

The nutrient composition of Neem leaf meal is 9% moisture, 20.52% crude protein (CP); 16.45%crude fibre (CF); 4.25% ether extract (EE); 7.00%total ash and 42.78% nitrogen free



extract (NFE). Leafmeal contained macro minerals (per cent) that is Ca (0.71), P (0.28), Mg (0.75), Na (0.58) and K (2.00) and microminerals (ppm) that is Cu (34), Zn (18), Fe (745), Co(10), Mn (60), Cr (0.8) and Pb (27) (Ansari et al., 2012).

Supplemental effect of Neem leaf meal on Poultry

Extensive researches have been carried out in chickens about the supplemental effect of neem leaf meal. Studies reported that broilers fed diets supplemented with 2.5 g/kg of Neem leaf meal had significantly greater body weight, highest dressing percentage, improved feed efficiency at 28 and 42 days of age. The daily weight gain at 42 days of age was improved from 3.61 to 8.96% in broilers fed diet supplemented with leaf meal than antibiotic (Ansari et al., 2012). Also, Neem leaf meal fed to broilers gave live performance levels similar to those of the antibioticgrowth promoter and observed improvements of 8.1% in daily gain and 7.7% in feed conversion ratios in 17-day-old poults. Tipu et al. (2002) reported similar effects, where he used salinomycine and A. indica fruit as feed additive and anti-coccidial in broilers and reported better results in terms of weight gain.

Studies showed that the supplementing neem leaf powder @ 1-2g/kg in the ration significantly improved the body weight gain and FCR in broilers. The rise in weight gain is due to the presence of macro and micro minerals in A. indica leaf meal. The higher body weight gain in broilers consuming leaf meal could also be due to its appetite and digestion stimulating, anti-bacterial and hepato-protective properties, which aid to lessen the microbial load of birds and enhanced the feed consumption and feed efficiency of the birds indicating Neem as an ideal substitute to the existing antibiotic growth promoter. Further studies revealed a significant progress in relative weight (liver, heart and gizzard) when adding the neem leaves powder to drinking water by 40 ml/l.The greater bursa and thymus weight in birds supplemented leaf meal suggests that leaf meal supported these lymphoid organs. The leaf meal potentiated immune response in the experimental broilers and caused a marked increase in the weight of lymphoid organs (Ansari et al., 2012).

Serum and tissue cholesterol levels were observed to decrease progressively with increasing dietary levels of A. indica leaf meal. This reduction in serum cholesterol level of broilers fed leaf meal diets possibly propose a general decrease in lipid mobilisation. This is due to the indirect inhibitory effects exerted by the neem leaf meal at the levels of HMG-CoA reductase, a key enzyme in cholesterol biosynthesis. This suggests that leaf meal diets were capable of dropping serum cholesterol, thereby helping to reduce the deposition of cholesterol in the skin and muscles. This correspondingly indicates that A.indica leaf meal should be used to produce animal product with reduced cholesterol content.

The reduction in total cholesterol in serum reflects the hypocholesterolemic properties accredited to the defatted part of the leaves which are rich in fibrous content and may block intestinal cholesterol absorption.The liver functioning, after the supplementing of neem leaf meal was studied and the decreased activities of SGOT, SGPT and ALP in serum evidenced the positive effect of leaf meal on liver parenchyma of the birds. Scientists verified that A.indica leaf meal is a promising hepatoprotective agent and this protective activity of leaf meal is due to its anti-oxidant and normalisation of impaired membrane function activity.

Also, the A. indica leaves contained quercetin and rutin compounds which are extensively studied bioflavonoid in the class of flavonols. It is well-established that quercetin, one of the most abundant flavonoids, is a more powerful anti-oxidant than the other anti-oxidant nutrients such as Vitamin C, Vitamin E and β -carotene. The maximum tolerance level of Neem leaf meal 10% in starter broilers but 15% in laying birds. The proximate composition of neem leaf meal indicated it as a good source of protein with crude protein values range of 18.10-20.68%. The bioactive principles in Neem leaf meal can be reduced by sun drying. Shihab et al., 2017 reported that Neem leaf powder supplemented @ 2g/kg had a positive role to improve immunity against Newcastle Disease and Infectious Bursal Disease and the qualities of productivity and physiological for broiler chicks.

Haematological parameters indicates the physiological status of birds and its deviation can be utilized in assessing the response of birds to various physiological situations The high concentration of Hb in birds fed diets of leaf meal is due to hepato-stimulatory and hepatoprotective effects of leaf meal resulting in the synthesis of more Hb in the bone marrow which is under the control of erythropoietic factors released by hepatic cells. Nutritional factors affect the blood profiles of birds and this implies that up to 2.5% inclusion of leaf meal had a positive effect on the relative quantity of blood cell as well as total volume of blood.

Serum proteins are involved in transport of important body substances, and maintenance of normal distribution of water between blood and tissues through osmotic pressure. Serum protein content were found to be elevated in birds fed leaf meal at 2.5% levels (Ansari et al., 2012). Also, studies revealed an increase in yellowish colour of cockerel shanks, deeper egg yolk colour, and increased hen-day egg production with increase in Neem Leaf Meal inclusion.

Conclusion

Azadirachta indica, commonly known as neem, has attracted worldwide attention in recent years, owing to its wide range of medicinal properties. Based on the research studies carried out, it may be concluded that Neem leaf meal can be included in the diets of broiler chicks up to 2.5 g/kg without any deleterious effects on their performance, serum biochemical constituents and haematological indices.

The use of antibiotics in boilers should be discouraged and can be replaced with Neem leaf meal. Moreover, the dietary supplementation of Neem leaf meal may lead to the development of low-cholesterol chicken meat as demanded by health-conscious consumers. Also, neem leaf meal can be used as an alternative by the poultry sector for antibiotics.

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WATER HERITAGE OF JODHPUR
Then and Now



Jitu Mishra - Cofounder - Virasat E Hind Foundation



“ Ranisar, Padamsar Ote, Vyapari Gaya Tote

If Ranisar and Padamsar overflow, the market rates will fall as there will be good rainfall and bumper crop and the hoarders and money-lenders will be put to loss

An Old Proverb in Jodhpur





Jodhpur, Rajasthan's second largest city and the cultural capital of Marwar is a jewel in the crown of the desert state. In spite of its hostile terrain and harsh climate, Jodhpur has produced some of the finest artistic expressions and music in the entire Indian Subcontinent (1). The erstwhile Maharajas were not only just great patrons of art and architecture but also skilfully managed the water resources of the region.

So durable was its water management system that it could quench the thirst of its inhabitants till 1950s through a complex network of lakes, step-wells, wells and jhalaras. Jodhpur has hills surrounding Mehrangarh Fort and is a catchment area for monsoon waters that flow down into small and large depressions. Its medieval inhabitants converted them into lakes from where water was drawn to over hundreds of step-wells and jhalaras built in different periods of time in the walled city area and beyond (2 and 3).

Every neighbourhood in the old city had its own baori and the maximum concentration of baoris is in the Chand Pol area. These baories not only provided water to its inhabitants but also refuge to birds and a variety of aquatic life. Teeming with the life they were a cool refuge from the heat of the desert to spend some time in (4).

But with the construction of Indira Gandhi canal, the Himalayan water started flowing into every household of the desert town through pipes and taps. People started detaching themselves from their





roots of harvesting and respecting the water. Slowly the places and related customs became obsolete and turned into a refuge for tons of trash. The most vulnerable were the underground baoris; hidden from plain sight these have become a safe haven for anti-social elements.

Rao Jodha decided to build his capital on the summit of Pachetia Hill in the 15th century CE because the area had immense potential for harvesting rainwater and perennial springs that were visibly flowing in-between the rocks.

The first water project undertaken was Ranisar for supplying water to the fort above. The southern embankment of Ranisar has masonry walls of red stone with symmetrical steps descending up to its depth, exhibiting the great architectural skill of Jodhpur's formative period. Water was collected from by both the common people as well as the royal family. Women would come to fill water in their pots for their household needs. For the royal family, labourers would carry water in large vessels up to the palace. From the turret (burz) water was also drawn up to the fort by Persian wheels (5 and 6).





The construction of Ranisar was patronized by Jasmade Haddi Ji, the Maharani of Rao Joddha in 1460 CE, which was later expanded during the rule of Rao Maldeo.

Beside Ranisar is the Padamsar tank, yet another marvel constructed by Rani Uttamade Seesdini Ji, who was the daughter of Rana Sangha of Mewar. Rani Uttamade's other name was Padmavati. The project was also financed by Seth Padamsar Shah of Mewar at the behest of his mother to assist Rani Padmavati. Hence it came to be known as Padamasar after its patron.

A little away in the walled city near the Ghanta Ghar is Gulab Sagar along with two temples – Neni Bai ka Mandir and Ranchor Ji ka Mandir (7). All of these were constructed by queens. According to Late Komal Kothari, Rajasthan's foremost folk historian, most of the water bodies of Jodhpur were commissioned when these queens became widows.

The following is an extract from his conversation with Rustom Bharucha that appeared in the book Rajasthan – An Oral History. 'Here we have to understand the laws relating to primogeniture (patvi) inheritance, where the property of father goes exclusively to the eldest son and does not divide among the brothers as in the bhai-bant inheritance system.


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In the patvi system, we find that as soon as the king dies, his widowed queens are removed from the royal premises along with their servants. It is assumed that they pose a potential threat to the new king with their manipulations and conspiracies. Only the new king can sanction whether these ex-queens can hold on to their property; they may however, be denied access to it.

Now so far as movable property (chal-sampati) is concerned, including ornaments and money, this could remain with the queens unless the king orders that it should be returned to the royal treasury. What we find is that when the queens became widows, they would often give their property to a Brahman – this form of donation is known as udakena. It works on the premise that anything given as dan (gift) to a Brahman cannot be reclaimed by the king. Till the queen lived she had rights over the property, but on her death, it became the Brahmin's property. We find that the patronage of many water bodies has come from such sources.

The other prominent donors were female dancers and singers who were patronised by the king and given the status of pardayatpaswan and bhogtan. There were also prostitutes from musician groups like the patar. We find that these women financed the construction of quite a few temples and drinking water sources after the death of their respective masters.'

Unfortunately, the construction and development of water bodies came to an end around 1897-98, when a public water supply system was introduced for the first time. But Jodhpur's inhabitants


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continued to value and maintain the sanctity of old water bodies till the 1950s, after which a collapse began.

On a fine morning when I started walking around the old city admiring its water bodies, what drew my attention were the clean waters of the Toor Ji Ka Jhalra built in the 1740s by Rani Toor Ji (8 and 9). This step well, however, had become a dump yard until recently when it was taken for restoration by local hotels. Water was drawn from this stepwell using Persian wheels once. I was very impressed with the sight, but this happiness disappeared as soon as I arrived at Gulab Sagar, a critically polluted talav with residents having opened their sewage lines into it and also dumping the garbage (10). Here I met Caron Rawnsley, an Irish environmentalist who has made Jodhpur his home for the last many years (11).

We spent almost an hour at the spot to understand his ideas and concerns regarding Gulab Sagar and other water bodies of the city.

From Gulab Sagar, I next went to Mahila Bagh Jhalra, another restored stepwell, thanks to Caron who cleaned it single-handedly recently (12).

From Mahila Bagh, I strolled through the interiors of the Blue city and came across a number of small baories in different neighbourhoods. The most important being the Chand Baori but a great


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surprise was awaiting me on the following day when I and Caron walked through the Chand Pol area outside the walled city.

Our first stop was at Sukhdev Ji Trivedi ka Jhalra, a clean undisturbed water body teeming with aquatic life. There is no information available virtually on its construction or patron. As Caron said it was also not spared until recently by the neighbours and had become a dump yard like many other baories of Jodhpur. He put in a lot of effort in cleaning but vandalism of the structure and its sculptures have not ceased (13).

One interesting feature you see near every step-well in Marwar is a stone post with sculptures of Hindu Gods and Goddesses engraved on it. You also see the inscription of the donor and sometimes his/her image (14).

Our next stop was a hidden gem among all step-wells of Jodhpur – Panchmadi Baori. It is virtually unknown to the outside world and thanks to its almost secret location, it has escaped vandalism. You see pristine water as you descend the steps (15).

From Panchmadi Baori we moved on to yet another hidden gem, the Ram Baori. Though it is located in the heart of the city it offers unmatched peace and tranquillity (16).


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Next, we went to the fairly well-known Suraj Kund, a large square tank with steps and pavilions spread over two floors. The structure is now under renovation by the Mehrangarh Fort authority. Built by Rao Suraj Singh in 1672 CE, the well is built in Mughal architectural style. It is located in the premises of the Rameshwar Siddha Peeth and was built to meet the water demand of the shrine (17).

In close proximity to Suraj Kund is the Raghunath Ji ki Baori, the best maintained of all the baories I saw. The kids there told me they use the place to learn and practice swimming (18).

The last baori visited by us was the Panch Kua Baori located in an open space but close to being encroached from all sides.

Jodhpur is truly a magical city. Its art, architecture, settlement pattern and more importantly water structures are unique in the Subcontinent but one feels disappointed to see this wonderful water heritage on the verge of extinction.

We need a little bit of Caron Rawnsley in each of us to fulfil what Gandhiji meant by Swaraj. That said, the government too needs to wake up from their deep slumber and take urgent steps.


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AGRICULTURAL TERRORISM

A Historical Perspective

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> "All war is a symptom of man's failure as a thinking animal.
>
> ~JOHN STEINBECK



With this arena of development many things have changed. Agriculture after green revolution has changed by various degrees aiming for higher productivity infusing intensive land and crop management practices. Trade after globalization has changed aiming exchange of food produced across borders. Research and development has changed aiming for practical use of each object and has touched milestones in this century. With these changes, principles of mass destruction have also changed.

Terrorists, to gain control over territories, have also changed their ways of attack. Agricultural terrorism is what they now aim to conduct. With aforementioned development of various sectors, threat of agroterrorism has also increased but it's never too late. This article will allow us to actively have a glimpse of furious past at a global level, history and recent developments of agroterrorism, analysis of the real incidents or attacks of the past. Also, inferences from this article will allow us to understand our preparedness towards this crisis, identification of potential threats, ability of involved actors, their motives and strategies of attack and will strengthen our knowledge about agroterrorism in general.

Introduction

Terrorism across time has changed in form of both – the concept and the method. Concept of early terrorism was based on the fact that to shake off nation's security system, whole lot of investment is required. Now, cheap easy to launch and economy centered terrorist activities are at peak. The methods that terrorists adopt are based on its concept and thus require regular monitoring.

Similarly, agriculture across the landscape has also changed its form due to global trade. The economic pattern that the countries follow is based on law of advantage and thus monocultures retaliated. This is the highest price we will pay to tackle any agroterrorism in future. We are now equally exposed to people around us as we are to nature and this indeed will drag us to dearth of human life.

Activities such as bombing, nuclear attack, using tactical weapons and hijacking planes are not their recent trends. Bioterrorism to weaken up the economy and hit the backbone of the country by disrupting services in the country is their new strategy. Bioterrorism is deliberate use of pathogenic strains affecting humans, animals and plants. It is an umbrella term that can be easily understood by its classification.

Bioterrorism can be broadly divided into two categories based on the species it is aimed at. It can either affect human beings directly or affect human beings indirectly by attacking animals and plants. As animals and plants serve to be a category of food for us, this category can be explained as Food Terrorism. It can pose a challenge to food safety and security of any political entity.

The act of contamination of food with an intention to cause health hazards or death of civilian populations in order to create social or economic challenge leading to civic unrest or political instability is known as Food Terrorism. This attack can be practiced with certain injurious chemicals, exposure to radionuclear agents and inoculation of destructive biological agents. The threat can be posed at any time from production of food in agricultural fields to its supply in the ready market after processing.

Food terrorism can be further classified into categories, of which Agricultural Terrorism is widely practiced. Terrorists targeting food during post harvest operations such as processing, storage and distribution is often referred to as terrorism targeting processed food. Another case is contamination of food i.e. agricultural crops and livestock in agricultural fields or during harvesting, transport and storage is called Agricultural terrorism. This is often also shortened as Agroterrorism. The agents used for agricultural terrorism are easy to acquire and relatively cheap. They also do not need too much knowledge to handle and are easy to launch. Laws being not so strong, if caught these types of activities are not immensely punishable and security system being not so aware checks the risk of easily being caught. Very sophisticated labs and instruments are not important to obtain or transport them.

It is often very difficult to differentiate between agricultural terrorism attacks and naturally occurring epidemics. This indeed sets a stage ready for activities like Agricultural terrorism to thrive.

Historical overview and development of Agroterrorism

Agroterrorism started dates back when scientific study gained importance. Some literatures relate early actions of agroterrorism to scientific study of plant pathology. With scientific progress of Plant Pathology and identification of Late Blight of Potato after Irish famine, certain cases of agroterrorism including stock piling of fungal

spores and its release in other territories to harm agricultural economy during cold war were reported. Later, evidences from World War 1 were profound enough to support historical cases of agroterrorism.

During World War I, Germany in order to rise as a world power tried many times to paralyze other countries and inhibit them to either support opposite countries or defeat them in battles. Germany attacked draft horses, both involved in active and passive war using biological agents like Bacillus anthracis and Burkholderia mallei causing anthrax and glanders, respectively.

Historical evidences also reveal that time period between both world wars showed involvement of war participating countries like Germany and France in extensive study and research of agricultural pathogens like Puccinia spp. (causal organism of wheat rust), rinderpest virus, Phytopthora infestans (causal organism of late blight in potato) and various other insect pest spp. Immense research however did not add any advantage to Germany in World War 2 in terms of biological warfare.

However, continuous efforts by United Kingdom fueled this matter in media when it dumped 5 million cattle cakes infected with Bacillus anthracis on Germany. United Kingdom in its early warfare techniques focused on antianimal and anticrop agents to be used against enemies. Other powerful nations were also involved in research and development of biological weapons especially anticrop agents during this period. Japan poured considerate amount of funds to study and strengthen various agroterrorism agents to be used in disturbing peace conditions in China.

Russia was found to be secretly involved in the study of numerous antianimal agents namely FMD virus (causal organism of foot and mouth disease in cattle), Brucella spp. (causal organism of brucellosis), Newcastle disease virus (causal organism of Newcastle disease), Bacillus anthracis (causal organism of anthrax disease), Burkholderia mallei, Mycoplasma mycoides mycoides (causal organism of contagious bovine pleuropneunomia), avian influenza virus, Chlamydophila psittaci (causal organism of psittacosis or Avian chlamydiosis), Orf virus (causal organism of contagious ecthyma in sheep), Rinderpest virus (causal organism of Distemper), Venezuelan equine encephalitis virus, vesicular stomatitis virus, African swine fever virus. Apart from these various anticrop agroterrorism agents were used during cold war like potato virus Y (causal organism of mild viral disease), Magnaporthe grisea (causal organism of rice and rye blast), barley streak mosaic virus (causal organism of barley leaf streak), Puccinia sorghi (causal organism of maize rust), brown grass mosaic virus, Puccinia graminis (causal organism of wheat stem rust) and tobacco mosaic virus.

Period of 1943 to 1969 marked study and strong weaponization of agroterrorism in United States of America. Fort Detrick of Maryland was the research centre used by scientists and government to conduct such researches. Study of biological agents like Bacillus anthracis, FMD virus, Brucella spp., Phytophthora infestans, Chlamydophila psittaci, Avian influenza virus (causal organism of fowl plague), Magnaporthe oryzae Triticum (MoT) pathotype (causal organism of wheat blast), Puccinia graminis, B. mallei (causal organism of Glanders), Magnaporthe oryzae (causal organism of rice blast) and Bipolaris oryzae (causal organism of brown spot of rice), rinderpest virus and Newcastle disease virus were conducted on a large scale.

Gulf countries like Iraq weaponized itself with fungal spores of covered smut/bunt of wheat by extensive research work. Production houses and large storage tanks of aflatoxins were also established in this era. Period after World War 2 marked sincere progress in research activities towards development of anticrop and antianimal agents especially plant pathogens in various other countries.

In 1969, a strong unilateral decision of then President Richard Nixon ended U.S. Biological Warfare Program in one go and led to destruction of already prepared agents of agricultural terrorism. This included destruction of huge quantities of wheat rust spores and other pathogens which were being stockpiled to attack Asian nations. In later stages strong policies were built to promote global peace and harmony which basically included International Biological and Toxic Weapons Convention (BTWC) of 1972.

Analysis of case studies

Agricultural terrorism has occurred from very early ages to strengthen own country or to disrupt political structure of other countries. Food

serves as a backbone of human activities and agriculture and allied activities tend to regulate food supplies. Thus collapse of any structure can be related to situations like food inadequacy, food unavailability or food crisis. Situations resulting from past reflects evident examples based on agricultural terrorism throughout history but very less is available in terms of literature. Here we will discuss about 5 such cases for which literature is available as media reports, research overviews etc. Later we will try to understand about their socio-economic impacts in details.

Case 1: Incident of poisoning cattle in Kenya during 1952

This historical incident relates to national liberation movement against British colonial rule in Kenya in 1952. The Mau Mau Movement activists took advantage of locally available African milk bush plant (Synadenium grantii) to use its extract as a toxin to poison cattle in British station. This caused chaos and moral breakdown of local British leaders and farmers. However in later reports the poisoning was found to be rare due to certain unspecified reasons. An inference can be drawn that this action was an attack of available opportunities to sabotage British farmers and ultimately challenge British rule. It was later verified by Veterinary research Laboratory in Kabete (Kenya) that the extract of African milk bush plant was used as an agent of Agro-terrorism.

Case 2: Poisoning of exported grapes from Chile to US during 1989

A phone call to U.S. Embassy in Santiago reported a complaint about grapes being poisoned by cyanide which were exported from Chile. This created fear among US officials and all the imports were then investigated by Food and Drug Administration. However no such evidences of large scale agro terrorism planning was found but some grape packages were found to be poisoned from cyanide that were shipped from Chile to Philadelphia. This was dealt strongly by US authorities and suspecting of other fruits being contaminated allowed them to destroy 45 million crates of fruits including plums, peaches, nectarines, apples, raspberries, blueberries, pears and table grapes accounting to a total loss of $ 50 million. This shook Chile's economy as the exports were also rejected from other countries.

Case 3: Activity of releasing sewer water in Palestinian agricultural fields during 2000

The mass agitation in 2000 during Palestinian-Israeli conflict reported an unusual activity in the national daily. The report stated claims of Palestinian farmers against the Israeli settlers in the West Bank of releasing huge quantities of sewage water into their agricultural fields in order to weaken their occupation and vacate their lands. This was done in recurring cycles in order to deteriorate quality of their land. This was another impulsive issue of agricultural terrorism during a local conflict.

Case 4: Threatening US and UK livestock with spread of foot-and-mouth disease virus during 2011

Another activity of 2011 caught news attention when a South African man claimed to acquire possessions of Foot and Mouth Disease virus. He threatened governments of United States of America and Great Britain to pay a ransome amount of US$ 4 million. The news sources reported of great economic setback for GDP in general and Agriculture and allied economy in specific, if, this biological agent was released in open.

This posed challenge for both the governments to safeguard their nation from loss of property and economy. Later during investigations after his arrest for terrorism activity involvement he was found with no possession of claimed virus samples. He offered threat due to a personal frustration on both governments not taking actions when 'white farmers' were banished from their lands in Zimbawe.

Case 5: Food contamination by Malathion insecticide in Japan during 2014

Japanese factory worker Toshiki Abe was found guilty for intentional involvement in agricultural terrorism activity by contaminating frozen food products with an insecticide called as Malathion. The insecticide is widely used against agricultural insect pests in open fields especially against fruit flies and mosquitoes. As this chemical is not used by industries very often, it was easier to detect such higher dozes, nature of the chemical and act was found to be intentional. Reports express that doze was found to be 2.6 million times higher than recommended by law. About 2500 people across Japan were sickened

by this act and it was termed as one of the most alarming acts of Japan's history. Hotels claimed products like pizzas, pancakes, croquettes and other such items were contaminated at a large scale and >6 million packed products were destroyed. The person caught in the act was found to be guilty and was sentenced to prison for about 3.5 years.

Conclusion

Although the development and use of biological weapons, especially agents used for agricultural terrorism, is prohibited in most countries and there are strict laws enacted by the governments to gain control of peace in their territories, yet voluntary involvement of people to disturb peace and launch attack against civilians can never be ignored. The Biological and Toxin Weapons Convention of 1972 has been signed and ratified by more than 165 countries to restore peace and stabilizing global harmony. But the tensions still prevails, as some countries have not agreed to some or all points of the accord and are still engaged in research on biological weapons.

If these countries are not suspected to create chaos at international level yet they may fall a prey to global terrorist organizations that may be successful in hijacking their systems and creating nuisance in the society. In fact ambitious politicians can also use these resources in their favour which can lead to proximities of war. However, official list of the countries is not yet declared and there is little or no open source information about them or their up to date achievements regarding status of research and development of biological weapons and their warfare potential presently.

Secret reliable sources reveal that some countries are secretly involved in building bio weapons for offensive use against other nations. Syria, North Korea and Iran are some countries whose names are mentioned in these illicit connections. Also, Russia maintained huge lines of bio weapons under govt. orders of former Soviet Union produced in the past. There is no information about what has been done to dispose off prepared weapons but some scientists suspect them to be in circulation with knowledge of the state.

With time and space things have changed. Development across the globe has also developed agenda, instruments and practices of terrorism. Direct economic and indirect social impacts like panic and fear among civilians, challenged trade relations, political instability and havoc within territories can easily agitate masses and reform systems.

Low cost and efficient agents of Agricultural terrorism do not require scientific knowledge and thus can be used easily at all levels without fear of being punished. Motivations like revenge can easily enable people to fight back against governments yielding greater losses. Globalization with increased food trade has exposed us to agricultural terrorism and more vulnerable attacks.



Singapore's first Seed Bank

Singapore's first seed bank was launched as part of efforts to protect local and regional plant diversity against threats like climate change and habitat loss.The Singapore Botanic Gardens Seed Bank, set up by the National Parks Board (NParks) in House 4 – the largest of the five colonial-style houses within the former Raffles College at Cluny Road – has a storage capacity of up to 25,000 plant species.

This is about half the number of seed plant species in the region and more than double of that currently found in the Singapore Botanic Gardens, which has around 10,000 species. Seeds that can tolerate extreme dry and freezing conditions are stored in a cold room at -20 degrees Celsius to increase their lifespan. (Photo: NParks).Seeds stored in the bank can be used in habitat restoration and species conservation projects in Singapore and the region in future, when the need arises.



Visitors can learn about the seed banking process at an "interpretive gallery" at the seed bank. (Photo: NParks)

The seed bank also houses a seed biology lab, rooms for seed processing and storage freezers, where scientists will conduct research on various storage methods to keep seeds collected from tropical plants for long periods of time.Visitors can learn about the seed banking process at an "interpretive gallery" at the seed bank.

NABARD to Fund India's Five Most Promising Agritech Startups

National Bank for Agriculture and Rural Development (NABARD) felicitated five Agritech startups for their promising role in agriculture on the occasion of the 38th Foundation Day of the government-backed National bank.These promising five Agritech startups included dairy startup Stellapps Technologies, biotech startup Sea6 Energy, aqua-farming startup Eruvaka Technologies, rural e-commerce platform In-Three (BoonBox) and packaged foods startup Kottaram Agro foods (Soulful).

Among the 50 agritech startups including these five startups, NABARD has funded through 16 Alternative Investment Funds (AIFs) with an outlay of INR 272 Cr.

NABARD has set up an agritech, agriculture, rural business and food-focused early to mid-stage startup fund -"NABVENTURES" recently in May set a target of INR 500 Cr with greenshoe option of INR 200 Cr.

NABARD

Bayer Launches Water-Based Insecticide 'Aqua K-Othrine' for Fogging

Bayer Launches Water-Based Insecticide 'Aqua K-Othrine' for Fogging Bayer, after years of research, has launched a new chemical Aqua K-Othrine that can be mixed with water instead of diesel and used for fogging. This is the first new launch by Bayer Environmental Science in the Indian vector control market in 20 years. The new product eliminates the use of diesel and thereby reduces pollution. The cost of the newly launched chemical is Rs. 4,850 per litre and it suffices coverage of 20 to 40 hectares while spraying.

This water-based insecticide eliminates the use of oil-based diluents such as diesel and helps reduce pollution caused by fogging. A nasty stench of smoke and burning eyes are associated with fogging for controlling mosquito-breeding outside our homes.

Aqua K-Othrine can be used in thermal fogging machines, ultra-low volume (ULV) sprayers & cold fogger machines against flying insect pests. Aqua K-Othrine can be applied after diluting with water without losing efficacy. It is water-based, this insecticide eliminates the use of oil-based diluents such as diesel and helps reduce environmental impact.

BASF in Western Canada

BASF will launch an enhanced RetailConnect distribution model for its Agricultural Solutions portfolio, which will work directly with independent retailers across Western Canada. The introduction of a direct-to-retail distribution model follows the acquisition of a range of businesses and assets from Bayer nearly one year ago.

With an anticipated transition at the start of the 2020 growing season, RetailConnect will provide a more direct connection to BASF's retail and grower customers. In turn, it will increase demand transparency and offer improved warehousing, transportation and logistics service – including 24-hour product delivery during growing season to most regions in Western Canada.

BASF'S agriculture solution's division invest in a strong R&D pipeline and broad portfolio, including seeds and traits, chemical and biological crop protection, soil management, plant health, pest control and digital farming. With expert teams in the lab, field, office and in production, we connect innovative thinking and down-to-earth action to create real world ideas that work – for farmers, society and the planet.



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India's farmers have achieved the record production of US$ 414* billion worth of agriculture produce in the year 2017.

*World Bank