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Biochar: Future of Agriculture

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ABSTRACT
The amount of carbon in the soil is a direct indication of good quality of soil. Higher carbon stocks have a direct correlation with increased agricultural yields through improved soil health. In the current scenario of climate change and global warming, much of carbon in atmosphere has to be sequestrated into soil carbon pool so that increasing CO₂ in the atmosphere and resulting warming could be reduced. The use of biochar can be a simple yet powerful tool to combat climate change by sequestering much of atmospheric carbon into soil as well as providing an opportunity for the processing of agricultural and other waste into useful clean energy.

What is Biochar?
Biochar is a solid material obtained from the carbonisation of biomass. Biochar is produced through a process known as pyrolysis, means thermal decomposition of organic material (i.e. wood chips etc, crop waste and manure) under limited supply of oxygen (02), and at relatively low temperatures (<700°C). This process often mirrors the production of charcoal, which is perhaps the most ancient industrial technology developed by humankind. However, it distinguishes itself from charcoal and similar materials by the fact that biochar is produced with the intent to be applied to soil as a means to improve soil health, to filter and retain nutrients from percolating soil water, and to
provide carbon storage. Due to the molecular structure of biochar, it is in a more stable form than the original carbon (i.e. plant biomass, manure, etc.) both chemically and biologically. As a result, it is more difficult to breakdown biochar in the soil, resulting in a product that can remain stable in the soil for hundreds to thousands of years.

One of the great things about producing biochar through the process of pyrolysis is the fact that the main by-product is a gas, known as syngas which is a form of bio energy waiting to be used. It is easily captured and can be used to produce heat and power, to generate electricity as well as power the pyrolysis machine in the process, making the machine largely sufficient.

**Application in Agriculture**

The potential benefits that biochar offers for farming includes:

1. Improved soil fertility and crop yields
2. Increased fertilizer use efficiency
3. Improved water retention, aeration and soil tilth
4. Higher cation exchange capacity and less nutrient runoff
5. Clean and efficient biomass energy production from crop residues and forest debris
6. Combined heat, power, and refrigeration opportunities from pyrolysis
7. Leads to net sequestration of carbon from the atmosphere to the soil thereby increasing soil organic carbon (SOC)
8. Greater on-farm profitability
9. Can be financed through carbon markets and carbon offsets
10. Decreased nitrous oxide and methane emissions from soils
11. Provides powerful tool for reversing desertification
12. Provides alternative for slash-and burn agriculture
13. Can work as component of reforestation and afforestation efforts
14. Can produce electricity, bio-oils, and/or hydrogen fuels
15. Can use wide variety of feedstock including crop residues such as wheat
16. Acts as a liming agent to reduce acidity of soils
17. Carbon sequestration by the natural process of photosynthesis
18. Net production of energy in form of bio energy

**Environmental Impact of Biochar**

- Biochar can be a simple yet powerful tool to combat climate change. Biochar sequestration is considered carbon negative as it results in a net decrease in atmospheric carbon dioxide over centuries or millennia time scales.

- It can make a big difference in the fossil fuel emissions worldwide and act as a major player in the global carbon market with its robust, clean and simple production technology. As organic materials decay, greenhouse gases, such as carbon dioxide and methane (which is 21 times more potent as a greenhouse gas than CO₂), are released into the atmosphere.
• Instead of allowing the organic matter to decompose and emit CO\textsubscript{2}, pyrolysis can be used to sequester the carbon and remove circulating CO\textsubscript{2} from the atmosphere and store it in virtually permanent soil carbon pools, making it a carbon-negative process. By charring the organic material, much of the carbon becomes “fixed” into a more stable form, and when the resulting biochar is applied to soils, the carbon is effectively sequestered.

• It is estimated that use of this method to “tie up” carbon has the potential to reduce current global carbon emissions by as much as 10 percent.

• The use of pyrolysis also provides an opportunity for the processing of agricultural residues, wood wastes and municipal solid waste into useful clean energy. Although some organic matter is necessary for agricultural soil to maintain its productivity, much of the agricultural waste can be turned directly into biochar, bio-oil, and syngas.

• Biochar can also provide an extremely powerful means of reversing desertification. In most semi-arid and desert climates the soil is nearly void of soil organic carbon (SOC), and thus has the potential to absorb massive quantities of carbon. Generally, the amount of carbon in the soil is a direct indication of soil quality: the greater the amount of SOC, the higher quality the soil.

• Higher carbon stocks have a direct correlation with increased agricultural yields, higher plant moisture absorption, improved soil tilth, and higher levels of soil biological activity.

Best Management Practices for Biochar Soil Application

The particle size distribution of biochar materials will vary widely depending on the feedstock and the pyrolysis technique used to produce the biochar. With small particles, it is important to apply biochar in ways that minimize loss due to wind or water erosion. Some best management practices are enlisted below to avoid these losses:

• Apply biochar under the right weather conditions when winds are mild. It varies according to general weather conditions and time of day. It may also be helpful to apply biochar during mild rain conditions where light rain will dampen biochar dust and hold it on the soil surface until it can be tilled in.

• Apply moisture to biochar. Water can be applied directly to the biochar, or it can be mixed with moist manure.

• Produce a biochar formulation by pelleting, prilling, and mixing biochar with other types of amendments such as manures or composts. Different biochar formulations will be best suited to different application methods, and very fine biochar may be desirable in certain cases, for example when applying as slurry, by itself or mixed with manure.
Size of Biochar Particles

Ideal particle sizes to improve soil moisture retention have not yet been determined. Handling and applying the biochar will also impact the decision of what particle size is best. Biochar can be finely divided and can be applied to soil as it is, provided care is taken to minimize wind losses. If particle size must be reduced (for example from biochar made from old pallets or larger pieces of wood), it can be hand crushed inside bags using a large pestle. Small amounts can also be crushed by driving over the material with a roller pulled by a tractor. For crushing larger amounts of biochar materials, hammer mills can be used, as well as compost shredders.

Best management practices include moistening the material before crushing it to reduce dust created during the process, and/or crushing the biochar inside closed bags.

Application Rate of Biochar

- Recommended application rates for any soil amendment must be based on extensive field testing, soil types and crops. Also, biochar materials can differ widely in their characteristics, thus the nature of a specific biochar material (e.g. pH, ash content) also influences application rate.

- Application rates of 5-50 tonnes of biochar per hectare (0.5 - 5 kg/m²), with appropriate nutrient management results in better yield of crops. Most biochar materials are not substitutes for fertilizer, so adding biochar without necessary amounts of nitrogen (N) and other nutrients cannot be expected to provide improvements to crop yield.

Frequency of Application

- Due to its recalcitrance to decomposition in soil, single applications of biochar can provide beneficial effects over several growing seasons in the field. Therefore, biochar does not need to be applied with each crop, as is usually the case for manures, compost, and synthetic fertilizers.

- Depending on the target application rate, the availability of the biochar supply, and the soil management system, biochar amendments can be applied in increments. However, it is believed that beneficial effects of applying biochar to soil improve with time, and this may need to be taken into consideration when splitting applications over time.

Methods of Biochar Application under Conventional Field Crop Systems

- Broadcast and incorporate

  Broadcasting can be done by hand on small scales or on larger scales by using lime/solid manure spreaders or broadcast seeders. Moisten biochar materials may be better suited to application with manure spreaders than lime spreaders. Incorporation can be achieved using any ploughing method at any scale, including hand hoes, animal draft ploughs, disc harrows, chisels, rotary hoes, etc.
• Mould board ploughing is not recommended as it is unlikely to mix the biochar into the soil and may result in deep biochar layers.

• **Traditional banding**

  Banding of seeds and fertilizers is a routine operation in mechanized agriculture, and involves applying an amendment in a narrow band, usually using equipment that cuts the soil open, without disturbing the entire soil surface. Banding allows biochar to be placed inside the soil while minimizing soil disturbance, making it possible to apply biochar after crop establishment. However, the amounts of biochar that can be applied in this way are lower than those which can be achieved by broadcast applications. When working by hand, biochar can be applied in furrows opened using a hoe and closed after applying biochar.

• **Mixing biochar with other solid amendments**

  Mixing biochar with other soil amendments such as manure, compost or lime before soil application can improve efficiency by reducing the number of field operations required.

  Since biochar has been shown to sorb nutrients and protect them against leaching, mixing with biochar may improve the efficiency of manure or other amendment application.

• **Mixing biochar with liquid manures**

  Biochar can also be mixed with liquid manures and applied as Fine biochars will likely be best suited to this type of application using existing application equipment, and dust problems associated with these would be addressed. Biochar could also be mixed with manure in holding ponds and could potentially reduce gaseous nitrogen losses as it does when applied to soil.

**Formulated Biochar Products**

Since biochar itself cannot be considered a source of nutrients (unless it has a high ash content), there is interest in blending it with other materials such as synthetic fertilizers, compost and manures to enhance its value as a soil amendment.

Adding biochar to sewage sludge or poultry manure during composting has been shown to reduce N losses and the mobility of some heavy metals was also reduced in sewage sludge compost with biochar. It is also believed that adding biochar to composts and manures can reduce odors.

Another organic fertilizer made by Japan as bokashi, that is a fertilizer combining “effective" microbes, molasses, biochar, bran, and animal manure with water, and incubating under anaerobic or partially anaerobic conditions. Rice hull biochar is often used due to the availability of rice hulls in many regions. However, great care must be exercised while carbonizing rice hulls, as high process temperatures can lead to the production of carcinogenic compounds.
Potential Health Issues of Biochar Application

- Health risks from biochar relate to possible soil and thus food contamination, and to the effects of breathing in small biochar particles. Contamination can come either from contaminated biomass or from the pyrolysis process. For example, trees absorb heavy metals and other air pollutants and when wood is burnt or pyrolysed, those become concentrated in the ash, which forms part of the biochar.

- The ash retained after burning wood from forests well away from any sources of pollution contained so many heavy metals that some of it should have qualified as toxic waste. Depending on the pyrolysis temperature and the original biomass, there is a risk of particles called Polycyclic Aromatic Hydrocarbons (PAHs) forming, some of which are known to cause cancer and birth defects. All of this can be avoided by testing different batches of biochar before they are used. Breathing in small charcoal particles can cause ‘black lung disease’ or pneumoconiosis.

- Furthermore, breathing in ash residues from charred rice husks is linked to a risk of the lung disease silicosis. Both are potentially fatal lung diseases. These risks can be significantly reduced if people who handle and apply biochar wear adequate masks.

CONCLUSION

Biochar has a both positive as well as negative impact on crop growth, yield and human health. This technology involves a large biomass demand for production as well as fine biochar particles are causing severe health hazards thus, it is critical that we address this issue with caution.

However, application of biochar to damaged soils of low fertility seems promising and has a high potential for mitigating climate change and helping to raise soil fertility but not a silver bullet to improve nutrient economy in farming, or to increase crop yields. We need to investigate and utilize it to reduce our emissions and sustain soils, but we cannot rely on it for solving our emerging problems.

REFERENCES


Success Story of Barnyard Millet (Var. PRJ-1)

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The crop improvement programme under All India Coordinated Research Project on Small Millets (ICAR) at Ranichauri Centre resulted in the release of landmark grain smut resistant high yielding barnyard millet variety PRJ-1 by SVRC in 2003 for its cultivation in Uttarakhand hills. The variety PRJ-1 belongs to species, *Echinochloa crusgalli* ssp. *Utilis*, which is known as Japanese barnyard millet. It is different from the commonly grown species viz. *E. frumentacea* and is specifically suited to the temperate conditions. The cultivation of this variety has shown an increasing trend in the productivity of barnyard millet which is hailed as one of the great successes of the project.

Barnyard millet is a crop of mid and high hills of Uttarakhand where it predominately occupies unique position in cropping system. Generally, crop is sown in the month of March-April and harvested in September-October. Crop grown at higher elevation takes more time to mature than mid and lower hills. Sometimes, germination of crop gets affected due to low temperature in March-April and seed filling and maturity is also affected by early onset of winter during September-October. Similarly, crop is severely affected by many diseases and few important are grain smut (c.o.- *Ustilago panicifrumentacei*), head smut (c.o.- *Ustilago crusgalli*) and leaf spot or blight (c.o.- *Helminthosporium crusgalli*). Out of these, grain smut and leaf blight are more important and cause upto 75 % losses. However, this variety PRJ-1 of barnyard millet is completely suitable and capable to overcome all the above-mentioned constraints having early maturity, cold and drought tolerance, high grain and fodder yield, disease resistance and more importantly can be successfully cultivated at higher elevations. The maturity duration of the variety ranged from 73 to 105 days.

This variety is totally resistant to grain and head smut diseases which are responsible for causing severe economic losses to the farmers. In Uttarakhand, the variety PRJ-1 is the only variety which can be cultivated at all elevations from low to mid-high hills (1000-2500 m) under rainfed conditions. Variety gives good yield at higher altitudes (2000-2500 m above
msl) where other varieties show partial seed filling due to cold. This variety is one of the most accepted varieties among the farmers till date and exhibits excellent performance in mid and high hills of Uttarakhand. This single variety occupies maximum area among all the released varieties of barnyard millet and shows 50-150% more grain yield as compared to local cultivars in hills of state Uttarakhand.

In the frontlines demonstrations conducted in two hill districts viz. Tehri Garhwal and Uttarakashi covering 80.6 ha land and encompassing 1,663 farmers’ fields from 2003-04 to 2019-20. The variety exhibited excellent performance in all the demonstrations and showed its overwhelming superiority over the local check variety both in terms of grain and fodder (stover) yields. For the grain yield, the PRJ-1 variety was 22.9 per cent to 61.15 per cent superior compared to local varieties. The average grain yield of the variety PRJ-1 in demonstrations ranged from 14.89 q/ha to 22.60 q/ha as compared to 8.00 q/ha to 14.51 q/ha with local cultivars (Figure 1). The variety has been successful in rekindling the interest of farmers in barnyard millet cultivation. The variety has been remain free from all kinds of diseases and lesser bird attack was also observed in the variety due to its semi-compact earhead with small awns which gives it an added advantage.

**Fig 1: Barnyard millet average grain yield advantage over farmers practices under FLDs**

The growers have appreciated the conducted FLDs and the area under this variety has increased periodically by replacing local low yielding varieties. The FLDs’ beneficiary farmers have received a good grain as well as fodder yield in demonstration plots by the adoption of this variety due to which they have motivated and showed high willingness in continuing the adoption of improved varieties of barnyard millet on a large scale for succeeding years.

**Impact of AICRP on small millets project on Barnyard millet crop in state Uttarakhand**

From the data obtained from Directorate of Agriculture, Uttarakhand, the average barnyard millet productivity from 1986 to 1990 was 10.10 q/ha which increased 23.33 per cent over the years with average productivity of 13.69 q/ha during 2017-18 (Figure 2). The enhancement in average productivity of barnyard millet is due to the development and wider dissemination of high yielding disease resistant varieties, transfer of technologies and package of practices to the end users. i.e. farmers.

Every year a total of twenty-hectare area is covered under small millets in Uttarakhand under the project AICRP on Small Millets funded by ICAR (Indian Council of Agricultural Research) with the thematic area of local seed replacement with high yielding improved varieties.

**Fig 2: Average productivity of barnyard millet over the years in Uttarakhand**

**Farmer’s opinion about variety PRJ-1:**

Shri Pyare Lal Uniyal (Village Tegna) - The 65-year-old farmer, from Tegna village in Tehri District, is a devotee of the ancient grain barnyard millet and is well versed with its
Shri Pyare Lal Uniyal says he has seen his yield increase since he has come in contact with Ranichauri scientists. Before coming in contact with Ranichauri centre, I grew was only for my family. With the increase production, I now have a surplus which I’ am able to sell,” says Shri Uniyalji. This money is very helpful towards meeting our household expenses as well as for our medical and other needs. The scientists of centre has made us aware about its ecological value, reach to government farm machinery schemes in which we have bought a dehusking machine at a subsidized rate from the government. Earlier it took up a lot of time and energy to dehusk the grain manually but now it has become easy after access to these machines. Shri Uniyal emphasized that our farmer’s group is now engaged on seed production also and last year the group harvested between 130-140 kg of seeds, which were distributed to the community. From inspired by our enthusiasm, farmers of nearby villages have now also started growing millets.

Farmers in tegna village and nearby villages have appreciated the conducted FLDs and are showing willingness to continue the cultivation of this crop and variety as the conducted FLDs have made a very positive and significant impact on grain as well as on fodder yield and as a result of which their economy got improved- says Shri Uniyalji.
Farmers’ fields with Barnyard millet
Small millets: Making a Potential Comeback in State Uttarakhand

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ABSTRACT
In India, small millets are grown in diverse soils, varying rainfall regimes and in area widely differing in thermo-and photoperiods. In state Uttarakhand, these crops are being grown by poor, marginal and tribal farmers since time immemorial. The millets are known to be low in dietary bulk, high in nutrient density and known for their good profile of amino acids. Millets are highly nutritious and have antioxidant properties. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and have made them quite indispensable to rainfed, tribal and hill agriculture where crop substitution is difficult. Among the seven small millets that are grown in India, finger millet and barnyard millet are grown extensively in state Uttarakhand whereas foxtail millet and proso millet are grown in some patches as catch crop. At present, several state government initiatives are also being conducted to boost up the production and productivity of these crops in state and creating awareness among the people regarding their nutritional qualities. In times of climate change, millets are often the last crop standing and, thus, are a good risk management strategy for resource-poor marginal farmers. In days to come, we might potentially see millets return on large scale on farms and back of those millets also which have been displaced across Uttarakhand’s hillsides.

INTRODUCTION
The historical argument is that small millets have been successfully cultivated for millennia, which could indicate both their resilience to a variety of conditions, but also some intrinsic qualities that deserved the appreciation of so many generations. We know, for instance, that millets are adapted to a wide range of climates, soils, and altitudes. It can be found in tropical soils by
the sea, as well as in the dry lands at over 2000m in the Himalayas (Seetharam, A, 1998).

Uttarakhand has long been a stronghold of millets. In state Uttarakhand, these crops are being grown by poor, marginal and tribal farmers since time immemorial. Uttarakhand has a distinct range of landforms from hills to plains. Hilly area is characterized by gravel and light textured soils which do not retain water for long time and suits to small millets. These hardy crops are also known to cope up with several biotic and abiotic stresses. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and have made them quite indispensable to rainfed, tribal and hill agriculture where crop substitution is difficult (Rawat et al., 2019).

This is the reason that these crops are being grown in hilly/tribal areas of Uttarakhand. Also, the fact that they are annual grasses, self-pollinated, and require almost no maintenance, is also an advantage for hilly regions and terrace cultivation.

In Uttarakhand, about 30% of area is under small millets cultivation of which >90% is under rainfed conditions. Among the seven small millets that are grown in India, finger millet and barnyard millet are grown extensively in state Uttarakhand at present whereas foxtail millet and proso millet are grown in some patches as catch crop. These crops are cultivated under organic farming framework system in marginal and degraded soils with little cash inputs and chemical fertilizers and pesticides are generally not adopted by small and marginal farmers in hills of Uttarakhand.

Small millet grains as a food resource have been relatively neglected, however, these crops are integral part of hilly agriculture system that provides food, fodder, and nutritional security to the hilly people of Uttarakhand. Mduwa ki roti (made with finger millet flour) and Jhangore ki kheer (made with barnyard millet grain) is considered typical Kumaoni and Garhwali fare. During past few decades, the crop has gained popularity across the world for its health benefits and receiving increasing attention among the farmers due to its low cultivation cost, short duration, and adaptability to varied agro-climatic conditions. Also, as the grains have long storage viability, for regions that are economically weak and where there is little potential for investment in storage facilities, millets present the advantage of preserving very well, without necessitating special conditions. In particular, Finger millet is very resistant to grain mold and insect attack and this provides vulnerable farmers with a certain amount of food security where income or access to other staple foods might be unstable.

**Nutritional Importance**

There are many sources of foods that are known as immunity boosters, and being a staple cereal, millets may prove to be a promising source. Millets (lately known as nutricereals) are nutritionally superior to major cereals (wheat and rice) for carbohydrate and energy, and serve as a healthy balanced diet with good source of protein, high dietary fibre, vitamins, minerals in balanced proportion, antioxidants and micronutrients which helps to maintain our immune system which may act as a crucial shield against any disease (Malleshi, N.G. 2001).
A fair dose of millets intake helps people enhance their immunity levels. Immunity provides protection to life, mediated through cellular response, and humoral immune response. The body promotes systematic immune processes by regulating the formation of T lymphocytes, antibodies, and cytokines. Finger millet grains contain essential minerals such as calcium (Ca), phosphorus (P) and vitamins. Finger millet is rich in calcium (364 mg/100 g), more than double that available in milk. The protein content of proso millet is significantly richer in essential amino acids (leucine, isoleucine, and methionine) than wheat protein (Gopalan et al., 1989). Thus, the presence of all the required nutrients in millets helps to maintain the body’s immune system. Some micronutrients and dietary components of millets have extremely specific roles in the development and maintenance of an effective immune system throughout the course of life. The alkaline nature of millets offers natural protection against many diseases including cancer. Several traditional household food processing and preparation methods, including soaking, fermentation, germination, and malting, can also be used to enhance the bioavailability of micronutrients. The anti-inflammatory property of millets could well be suited to prevent environmental enteropathy and inflammatory bowel disease. They, thus, play a vital possible role in strengthening the immune system and building defenses against pathogens. The high levels of tryptophan in millets produce serotonin, which helps in calming our moods. The strong immune system is required to stand against several emerging diseases in humans and the immune system’s demands for energy and nutrients can be easily met from exogenous sources such as millet diets.

**Present Scenario**

At present, several initiatives are also being conducted to aware farmers to think it is good to eat - which, often has more to do with taste than nutrition. Several NGOs and Government’s schemes are prevailing in state to uplift the area, production, and productivity under millets cultivation. In a “maiden initiative” by the Uttarakhand Government aimed to enhance millets farmers’ income, the State-owned Mandi Parishad (wholesale market) will directly buy farm millet from them. This is the first of its kind initiate, and the move would directly benefit the farmers as they are expected to get adequate price for their farm produce millets. The scheme was initiated with two districts Almora and Chamloi and will be extended to other districts in the next phase. One of these millets food grains have been proposed to be a part of the midday meal scheme meant for schools. Such schemes are motivating farmers to produce more and more millets as without robust policy support, it is no easy task to expect farmers in Uttarakhand-resource poor, marginal, or otherwise-to grow millets. In times of climate change, millets are often the last crop standing and, thus, are a good risk management strategy for resource-poor marginal farmers.

![Fig: Foxtail millet](image)

**Initiative Required**

Despite all the benefits, these millets are encountered with several production constraints. There is need to think as policy makers, and we really need to push the progressive farmers to go for these crops. The area under millets has come down terribly including the production. There is need to address issues of climate change with respect to these crops. It is time to recognize the importance of millets and how they can be popularized. The role of government is especially important and the farmers who are involved in producing these precious seed materials should be rewarded. The millet is not a mere crop, but it is symbol and hope for prosperity.
It is time to seriously think on the initiatives by which we can increase the productivity of small millets. As to be honest, there is no chance for increasing area under small millets cultivation, but new technologies are needed to develop to enhance the productivity levels. Out of total developed technologies, only 30-38% technologies are being taken to the farmers and rests are lying as such. On one side, the area is going down and proportionally the land conditions are totally deteriorated. If we can aware the farmers and take all the technologies in the right order, it is possible to increase the productivity levels in millets systems.

The state contribution of agriculture to the state’s domestic product is about 23.4 per cent and the population dependent on agriculture for their livelihood is about more than 70 per cent. However, underweight and child malnutrition is a major problem in state Uttarakhand. According to the National Family Health Survey (2018), one third (34%) of children under five years age is stunted, or too short for their age which indicated that they have been undernourished from some time. Twenty per cent are wasted, or too thin for their height, which may have resulted from recent inadequate food intake. These two problems can be solved by developing nutria-cereal model villages in hilly tribal areas. There is need to popularize small millets among the people for their nutritive and medicinal benefits and development of remunerative market. To make hilly/tribal villages into self-sufficient units in terms of nutrition and income through utilization of available resources and awareness regarding nutrition education, there is need to establish connection between agriculture, nutrition, and farmers. Institute-farmer partnership (Participatory breeding programme) through development of Nutria-cereal model villages in hilly tribal areas is need of hour for in situ conservation of germplasm and for the development of acceptable crop varieties, improvement of economic as well as health status of poor tribal farmers. At the same time, small millet cultivation can be made sustainable for farming community through the novel approach i.e. “Development of nutria cereal seed villages”.

VCSG Uttarakhand University of Horticulture and Forestry, Bharsar has been working to boost up the production and productivity of small millets through the ongoing All India Coordinated Research Project on Small millets and extending the support to the hilly/tribal community through the distribution of various inputs (high yielding improved varieties small millets seed), transfer of location specific suitable production and protection technologies through front line demonstrations, trainings, conducting of awareness camps (Many people are not aware with valuable knowledge about millets, as the younger generations have simply grown in the times of different food preferences and diets), exhibition centres which can empower the hilly/tribal farmers in adopting the new production technologies and expansion of area under high yielding improved varieties of small millets in state Uttarakhand.

Views of farmers

Shri PyareLal Uniyal (Village Tegan) - The 65-year-old farmer, from Tegna village in Tehri District, is a devotee of the ancient grain barnyard millet and is well versed with its nutritional benefits. He is one of the farmers who has stayed with this crop and growing high yielding variety under FLD given by Ranichauri centre and motivated a number of other farmers of his village for this cause. Shri PyareLal Uniyal and other farmers of his village have been working for long to bring back to those small millets which have been displaced from the region and encourage more people to eat it.
Shri Pyare Lal Uniyal Says: - the seed of variety PRJ 1 is being given to the farmers of our village under front line demonstrations by scientists of Ranichauri since 2003.

In the initial period, seeds were given to us under FLD and later we started seed production at our own village under participatory approach for producing our own quality seeds.

With this variety we have received higher grain yield that ranged from 30.00 kg to 42.0 kg per nail (200 m²) in comparison to the local cultivars that give grain yield in the range of 16 to 22 kg per nail only. With respect to fodder, it is more liked by our cattle in comparison to other cereal stovers. Earlier days we used to sell it in market @ Rs. 20 to 25/ kg but now with the involvement of government schemes and linkage with NGOs by Ranichauri scientists, our farm produce millets are being sold directly to them at adequate price. The market price has also elevated up to Rs.40 to 60/kg due to which the economy of people of our village involved in millets growing has improved. We have made a millet farmers group of 50 farmers and sharing knowledge and accessing new markets. Shri PyareLal Uniyal says he has has seen his yield increase since he has met Ranichauri scientists. Before meeting Ranchauri centre, I grew was only for my family. With the increase production, I now have a surplus which I can sell,” says Shri Uniyalji. This money is extremely helpful towards meeting our household expenses as well as for our medical and other needs. The scientists of centre has made us aware about its ecological value, reach to government farm machinery schemes in which we have bought a dehusking machine at a subsidized rate from the government. Earlier it took up a lot of time and energy to dehusk the grain manually but now it has become easy after access to these machines. Shri Uniyal emphasized that our farmer’s group is now engaged on seed production also and last year the group harvested between 130-140 kg of seeds, which were distributed to the community. From inspired by our enthusiasm, farmers of nearby villages have now also started growing millets.

**Future strategies**

The growing demand for healthier food, effectiveness and quality of consumed product and increased public and healthcare industry awareness are the major factors that have contributed toward the formation of a nutraceutical market that is envisioned to grow many folds in coming years. The Food and Drug Administration has also released regulations that support this emerging industry therefore fostering scientific research. Hence, an immediate goal should be identification of health benefitting factors to enhance the essential nutrient levels in staple crops to significantly impact human nutrition worldwide.

Targeting of nutritionally important genes and proteins through the emerging biotechnology tools and techniques can lead to creation of ‘smart’ biofortified crops. Products from these value-added crops can help to cope with several problems such as protein-energy malnutrition. Research should establish impact of these products on the body’s absorption, defense, regulation of homeostasis and nervous systems, and then delve into hypo-allergenic foods and modern approaches to nutraceutical production. The initial research has shown finger millet to have a bright future in the nutraceutical industry and provides a scientific rationale for its use as an economically viable nutrient store to depreciate chronic pathologies. However, the properties of millets and their potential for agriculture and nutrition remain largely un-researched.
CONCLUSION

From the consumer’s perspective, establishment of finger millet as a nutraceutical can surpass the usual wait, efforts, and cost inputs to bring conventional healthcare to the market and provide “self-care” for their satisfaction. Additionally, for a global scale, exploitation of its rich nutritional value assumes importance to provide food security, agricultural development, self-dependence, and economic enhancement of developing countries. With the increasing knowledge about the nutraceutical properties of finger millet, the day is not far when this crop and its various products will find their place in the day to day menu of every individual. In India, the government is setting in place an Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP), while in the developed world these ancient grains have appeared on the shelves of specialized shops. In days to come we might potentially see millets return on large scale on farmers’ farms of Uttarakhand hills and back of those millets also which have been displaced across Uttarakhand hillsides if we put our heart and soul to rightly design the future programmes to address the problems associated.

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**Success of ICAR-CIWA Technology for Engendering Agriculture**

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Women are the backbone of agricultural work force. They work as farmer, co-farmer, laborer and manager. It is the women who gave birth to art of farming. About 70% farm work is led by women as they are involved in production, processing and marketing. Further, 60% world food volume is grown by women and 78% of India’s employed women work in agriculture. Now, India is able to increase the production of food grains by 5.4 times, since 1951 to 2017.

India is the world’s largest producer of milk, pulses, and spices, and second largest producer of rice, wheat, cotton, sugarcane, farmed fish, sheep & goat meat, fruit, vegetables and tea. But, in spite of their immense contribution, the women face a number of gender issues in agriculture. Even, women are not considered as farmers rather the ‘wife’ of farmer. They have poor access to productive resources, inputs, technology, information and credit. They also lack skill training, mobility, exposure, etc.

Keeping it in view, ICAR-CIWA, Bhubaneswar is committed to empower the farm women with the intervention of new gender friendly farm technologies. The scientists undertake participatory action research with farm women for sustainable agricultural growth and to bring gender mainstreaming in agriculture, and, to achieve gender equality through gender equity. Here are some successful cases of technological interventions made by ICAR-CIWA.

1) Smt. Gauri Priya Mohapatra (38), Secretary, (Om Sai Baba Swayam Sahayak Gosti) Nuasahi, Nimapara, Puri. Her Gosti was given 500 poultry chicks (Vanaraja) by ICAR-CIWA in month of October, 2019. After four months, 200 male birds were sold @ average Rs.500/- per bird totaling Rupees one lakh. However, the existing 300 female birds are laying 300 eggs daily which costs Rs. 90,000/- per month as the local people purchase @ Rs. 10/- per egg (Fig. 1).
2) Smt. Silla Beura (45), a SHG member, Dhiasahi village, Niali block, Cuttack. The group members were intervened with 20 Kagzi lemon seedlings in June, 2017. The first fruiting came in January/February, 2020 with an average of 200/plant totaling 4,000 fruits. It costs Rs. 12,000/- @ Rs 3/- per fruit (Fig. 2).

3) Smt. Arati Yadab (37), a farm woman of Khandagar, Niali, Cuttack was provided IVRI brinjal seeds by ICAR-CIWA which she planted on 10.10.2019 and transplanted on 15.11.2019 covering seven gunths (0.28 ac). The first harvest was on 05.01.2020. Within 20.03.2020 (before lockdown), she sold seven quintals of brinjal @ Rs. 30/- per kg with a profit of Rs. 70,000/-. She met the expenditure during lockdown out of profit (Fig. 3).
Marine habitat destruction: An anthropogenic way towards the end of life in the ocean

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ABSTRACT
Global ecological pressure towards the ocean affects its sensitive habitats such as coral reefs, seagrasses, and mangrove forests and also devastated the associated flora and fauna. The major sources that cause ocean pollution are marine debris and unsustainable anthropogenic activities. Human activities including oil spills from the cargo ships, domestic wastes through sewage, littering and surface runoff degraded many marine lives and so several species are on the verge of extinction. By seeing the consequences on marine life, urgent measures have to be employed to reduce the levels of ocean pollution shortly.

INTRODUCTION
The ecological pressure that affects the ocean and its marine life includes fishing pressure, ocean acidification due to climate change, water pollution, introduction of alien species and habitat destruction. These habitats include coral reefs, seagrasses, and mangrove forests, etc. Pelagic habitat in the ocean has been over-exploited due to high biodiversity. Benthic flora and fauna were devastated due to marine debris, and seabottom organisms were badly exaggerated by ecologically unsustainable anthropogenic activities in the Himalayas (Seetharam, A, 1998).

Sources of ocean pollution
In contemporary, ocean pollution has become an important matter due to increased human activities. Due to this, cleanliness of the oceans, fishing practices, and marine life has been adversely affected also the coastal habitats are increasingly destroyed at an alarming rate. Here are some of the causes of ocean pollution:

• The Oil Industry and Oil Spills

The primary source of ocean pollution is oil spills due to offshore drilling rigs,
ships, and boat leakages. Besides, the oil industry plays a vital role in periodic oil spills which are very catastrophic and even threatened the survival of marine life. Oil spills in the ocean last for years, and it takes a lot of resources and millions of dollars to remove. Ship accidents and leaking of natural oil as well contribute pollution in the ocean, but in later at a very small degree.

- **Industrial Manufacturing Activities**

  The direct dumping of waste liquids, toxic and harmful substances released from the manufacturing industries ultimately find a way to the oceans, thus polluting the oceans in various ways. These pollutants raise ocean water temperatures leading to thermal pollution.

- **Sewage**

  Raw sewage and sludge from sewage treatment plants have been dumped into oceans or waterways that find a way into oceans. This discharge leads to reduced oxygen levels due to the growth of chemical nutrients and adversely affecting aquatic animals and plants.

- **Agricultural and Farming Practices**

  Agricultural pesticides, fungicides, herbicides, chemical fertilizers, farm nutrients among other agricultural chemicals are highly toxic and reach the ocean through surface stormwater runoff, nearby rivers, streams, etc.

- **Littering**

  Inland pollution such as littering is one of the major sources of non-point source of pollution. It includes pieces of plastics, cans, debris, dust, and trash slowly move and eventually reach seas. Also, the above materials take hundreds of years to decompose, and trash may also contain toxic chemicals that contaminate the oceans.

- **Mining Activities in the Ocean**

  Mining activities such as drilling and dredging in the deep sea of the ocean floor for extraction of minerals and metal ores (zinc, cobalt, silver, aluminum, and gold) demolish the oceans and the coastal regions. Also, the mining processes generate scores of sulfide deposit which leads to building up of toxicity levels in the mining areas. It contributes to secondary consequences including leakages, oil spills, and corrosions that further destroy the marine ecosystem.

- **Land Surface Runoff**

  Almost 80% of the ocean environment is being polluted by land runoff. Numerous sources including trucks, cars, septic tanks, and petroleum find a way into the ocean from the land via stormwater runoff. During rainy seasons, harmful contaminants like pesticides, fertilizers, sewer, and trash from farms and wastelands flow over the land and ultimately reach oceans. The impacts have to lead to dead zones, garbage patches, and the growth of plants and chemical nutrients that suck up oxygen.

**Effects on marine life**

The oceans are vast water resources and consists of millions of plants and organisms. But continuous human-activity has resulted in degradation of marine ecosystem and so several species of organisms are on the verge of extinction. Some of the effects are as follows:

- Dissolved oxygen levels are greatly reduced due to the toxic substances present in the ocean. Pollutants also stimulate the growth of certain organisms that are harmful to marine organisms.

- Hundreds and thousands of marine organisms have been killed by poisonous chemicals and toxin contamination in the ocean, and much more are under the threat
of extinction. The chemicals also have extensive effects on the genetic make-up of organisms and cause various physiological changes. Because of this, around two-thirds of marine life has been declared as 'threatened species.' Thus, decreasing the fish population, which in turn has impacted gulls and pelicans which are dependent on fish for their food.

- Dumping of plastic in oceans on large-scale led to suffocation and death of turtles and the reason behind that they are not able to distinguish between jellyfish and plastic and so after consuming it led to a slow painful death due to choking.

- Impact on coral reefs due to oil spills and toxic chemicals leads to erosion and bleaching respectively.

- The pollutants on the water surface prevent the sunlight for photosynthesis which is inadequately important for marine life as well as for maintaining the ecological balance.

- Apart from innumerable deaths, the chemicals that are dumped in the ocean water are so poisonous which resulted in a host of skin, respiratory and reproductive diseases in marine organisms and the vision problems on exposure to these chemicals.

**Case study**

1) Scientists have been found 30 plastic bags and other plastic wastes in the stomach of a dead whale found along the coast of Norway. They also estimated that in each year 8 million tones of plastic had been deposited inside the sea which will again increase to 10-fold more in 2020. These plastics take more time to degrade, and after degradation, they are converted into micro-plastic which is more harmful to the fishes as it can chock the digestive as well as the respiratory pathway of the fish.

2) In a recent study of plastic pollution and its effects on the ocean, researchers have been found that plastic bags, polymers, food containers and the fishing gears contribute 60-90% of the whole marine litter. For this cause already 1200 species have been severely affected.

3) In India also due to the various cyclones, tonnes of plastic debris has been found all along with the west and east coast states of India.

4) Another important finding that has been found recently by the scientists in the Great Barrier Reef is the entangled plastic on the surface of corals which damage the corals and make them sick. So micro-plastic also leads to coral destruction or ultimately it destroys the oceanic habitat starting from the pelagic fishes to the benthic corals.

5) Science Advances, an international journal of American Association for the Advancement of Science (AAAS), US-based non-profit organization found that about 79% of the plastic waste is accumulated in the landfills or into the natural environment.

6) In Andhra University, K Sujatha, former chairperson, the board of studies, department of marine living resources, found that the pelagic fishes like mackerel, sardines, etc. are contaminated with industrial effluents and smell like diesel. Those fishes have a high mortality rate also.

7) According to a zoological survey of India, the heavy industrial effluent load and the other polluting materials lead to a serious problem in the ocean ie., ocean acidification that leads to fish as well as coral destruction.

**Remedies**

- The most important step in preventing ocean pollution is to reduce the less use of plastic as well as to reduce the plastic sources to be mixed up with the water.

- Nowadays many non-government organizations like five Gyres, Oceanic Society, Plastic Pollution Coalition, Algalita, Plastic Soup Foundation, etc. are working for the safety as well as the cleanliness of the ocean worldwide mainly
to prevent the ocean from the plastic pollution.

- In India, The Union ministry of environment, forests and climate change has taken a new step regarding the eutrophication as well as ocean acidification problem. They have developed a policy that controls the mixing of agricultural runoff to the sea as well as it prevents the raw industrial effluents to mix up with the oceanic water body.

- Lastly, the awareness among the people is the main step in the fight of cleaning the ocean water body from all the pollutants. The anthropogenic activities should be reduced to clean the oceanic habitat.

CONCLUSION

Any sort of interference with the natural cycle has disastrous consequences on life on this planet. The efforts taken by governmental and non-governmental organisations have proven in eradication of air and land pollution, which is sustainably beneficial. It is important that similar measures are to be employed to reduce the levels of ocean pollution in the near future.

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INTRODUCTION

The phased lockdown in India presented a gloomy picture of the mass movement of migrant workers. Everybody is searching a way back home, far away from the dreadful life of stagnant cities. The 2011 census report estimated that about 453.6 million (37 percent of the population) have migrated from rural to urban localities. Economic Migration is triggered by the belief or knowledge that better employment opportunities lie in developed industrial cities. Most of the time social and income inequalities lead to the internal migration of some people. Other factors such as land shortage, poverty, and low living standards are also some of the major contributors. In the case of females, marriage is one of the major factors (Census report, 2011). Education contributes about 2 percent to all migration (Bhagat, 2004). Natural Calamities also lead to the movement of people from vulnerable to a safe area. A research carried out by the Eldis community indicated that from Uttar Pradesh around 41 percent of people migrated to a far-flung state Maharashtra, even though it is not a neighboring state. Similarly, 34 percent of People migrated from Orissa to Gujarat and Maharashtra. Uttar Pradesh and Bihar comprise about 70 percent of the total migrant population in India. The major reason

ABSTRACT

Reverse migration has posed a serious threat to the livelihood of migrant labourers. Around 40 million migrants were directly affected by the lockdown measures. The roots of this problem lie deep in the one-sided development model of urbanization, which affected the sustainable growth of economy. The need of the hour is to address the challenges of rural population and propose village-oriented development models. This article throws light on the current crisis and its mitigation measures. Some of the measures are modification of upliftment schemes like PMs Awas Yojana, MGNREGA, and Employees’ State Insurance schemes, etc. to cope up with these challenges. In future, a serious problem of labour shortage is going to persist in many industries.

INTRODUCTION

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was that Mumbai is the financial capital of India. Since 1990s, it is evident from the mass movement of rural people that development is mainly focussed on a prominent urban sector of society.

Why Reverse Migration Peaked During This COVID 19 Crisis?

Most of the migrants who settle down in cities are employed in the informal sector. The drudgery of job losses, underpayment, and no savings fell heavily on them. Lockdown followed by shutting down of factories left roads flooded with an exodus of migrant workers. The job losses in the industrial sector affected around 40 million migrants. About 30% of migrants who left these big cities will not return to their workplace due to several challenges faced by them and their families (Rajan et al., 2020). The majority of migrant labourers lack social security and insurance covers, which make them one of the most vulnerable sectors of society during such a crisis.

This reverse migration had left a significant impact on the industrial sector. In coming time around 70% of factories are going to face the severe labour crisis, mostly for skilled labours. Reverse migration to rural India will set economy back by 15 years (Mehrotra, 2020). The mini economies of India will also face a major setback as these mainly rely on a web of interdependence between rural and urban society. They ensure demand generation in urban cities. For example, a roadside fast-food seller is catered by the demand created from these migrant labourers, which in turn generates income for the local economy. These ancillary services prove to be an essential division of the employment web. So, this reverse migration is also going to impact the income of many such street vendors.

Due to this pandemic, about 400 million workers of the informal sector are likely to fall deeper into poverty. At least four out of five people in the global workforce of 3.3 billion are partially or fully affected by the closure of workplaces. (ILO report, 2020).

A Way Forward to Deal with the Migration Crisis

1. Ensuring food safety

Many initiatives are adopted by government to mitigate the effect of reverse migration on economy. A total of Rs 11,002 crore was released by centre in advance to all states. 5 kg of grains and 1 kg of gram per family per month for 2 months was provided to migrants in different states. Government spent Rs 3,500 crore under this scheme for 8 crores migrant labours. To ensure 100 percent coverage of PDS by March 2021, government introduced One nation, one ration card scheme.

2. Affordable Houses to Urban poor

Under PMs Awas Yojana government offered an affordable rental housing scheme for urban poor, including migrants. Under this scheme government-funded housing in urban suburbs will be converted into Affordable Rental Housing Complexes (ARHCs) on public-private partnership (PPP) models. This will ensure affordable houses to poor sections of society.

3. Ensuring minimum wages for all workers

A special credit facility of Rs 5000 crore was released to support 50 lakh street vendors. Major changes were bought in labour codes, like Universalization of right of a minimum wage, Social security schemes for platform and gig workers, Re-skilling fund for terminated employees, Compulsory annual health checkups for all employees and Mandatory Employees’ State Insurance Cover (ESIC) for those working in hazardous industries.

4. Support to returning migrants in the form of MGNREGA

A major helping hand was offered by Government to the returning migrants in form of MGNREGA support. Around 2.33 crore wage seekers gained employment in 1.87 lakh Gram Panchayats. Enrollment also increased by 40-50 percent compared to last year and average wage rate rose from Rs 182 to Rs 202. Many states like Uttar Pradesh set a goal to
register all the returning skilled/unskilled labours, so that they can be employed near their home in relevant factories. Government offered training and financial helps in form of Direct Benefit Transfer for their upliftment. Similarly, Orissa government framed a model to provide shelter and schooling for the children of returning migrants both at source and destination. They established migration support centres in Tamil Nadu for their people.

**Conclusion**

Reverse migration posed serious challenges on the robust working of economy. Livelihood was lost at an alarming rate. This serious implication leads to realization of the fact that all pillars of economy are crucial, and we need to take care of every sector to build a sustainable economy. Social security boards, Insurance covers, and better living conditions were enacted for the betterment of migrants. Government should also adopt some measures to address the labour shortage. Thus, a sustainable economy is need of the hour with equal opportunities for all section of society.

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INTRODUCTION

The science of cosmetology dates back to Indus valley civilization where there are pieces of evidence of self-beautification ideas by men and women both. The use of cosmetics is not directed towards only for developing outwardly pleasure but also for achieving longevity and good health. This was termed as kayakalpa, the process by which one could look younger and healthier. Women have been always personified as the most beautiful creature by God, every woman are unique in each or the other way, and anyone who has a beautiful skin that shines, is inflammation free, is acne free, irrespective of the color tone is always a good sign of a healthy body. Skin is the reflection of one’s inner body, irritated, acne-prone skin with patches is always a sign of something wrong inside the body so this mirror should be taken off which most people and especially women skip due to their daily routine and life.

If we recall the yellow paste-like a thing we are directly taken to the former haldi ceremony of Indian marriages by our memory. This paste is nothing else but “Ubtan”. It is an Ayurvedic and pure cosmetic product hand-made by ancient sages and is been in use since time immemorial. It is semi-solid formulation made with the help of various types of herbal ingredients mainly raw milk, saffron, gram flour, sandalwood powder, turmeric, and rose water, etc. All the ingredients are easily available at home. It helps in boosting the skin texture and quality up to a great extent. Shreds of evidence have suggested that used Haldi (Curcuma longa) in the mixture gives radiance to the skin anti-
aging, anti-inflammatory, anti-oxidative properties, and strong antiseptic property. Other ingredients like gram flour work as the exfoliating agent, raw milk helps in clearing aging signs, which helps in boosting the glow of the skin perfectly. It will be moisturized and nourished your skin by the nutrients present in the ubtan. The traditional herbal formulation exfoliates the body of the user and removes the dead skin cells and makes way for the new ones. Ubtan is also called “Ubtvartan” an Ayurvedic treatment in the form of body massage that soothes skin and makes it soft and free of much unwanted micro-flora and dirt on the skin. It has been widely used in India and its subcontinents and is believed to have a long-standing drug regulation concept and values, built for the recovery of body, mind, and soul. The “solah shringar” ritual enclosed 16 ways to embellish the body of a woman. In this era of harmful additives, we all want glowing and shining skin. Ubtan is the oldest and purest that can aid you to achieve your goals. The value system of beauty and beautifying ingredients is ancient as well as a civilization, which adornment women as well as men with their texture and fragrance, etc. Majority of people experience allergies, dirt, dust and unwanted issues like rashes, dark patches, skin blemishes, and pimples, etc in their daily lives on their skin. Ample evidence suggests that skin could be fully protected from various infection-causing elements by using ubtan.

Natural way for glowing skin

For regular care and protection of the face from toxic chemicals, some home remedies can be used such as Ghaaza (Face powder), Ghalliya (Perfumed powder) and Ubtan, etc. Ghaaza is a fine powder having a sweet smell, used on the face for beautifying the skin. It includes Ustukhuddus (Lavandula stoechas Linn.), Limu (Lemon pulp), babchi (Psoralea corylifolia Linn.) and Haldi (Curcuma longa Linn.). Ghalliya sprinkled on the body or rubbed for the embellishment of fragrance and beautification after a cold bath. It includes Methi (Trigonella foenum-graecum Linn.), Kodi (Cowrie), Haldi, and Khira (Cucumis sativus Linn.) Ubtan is prepared in the form of lubdi (Mass) to achieve a homogenous mixture; it was evenly smashed to detoxify the skin. It includes Bengal gram flour (Cicer arietinum Linn.), Sandal safied (Santalum album Linn.), Khas (Vetiveria zizanioides Linn.) and turmeric.

Secrets from Ayurveda are no doubt the one which is always the best thing one can do to without any harm. Today in the era where only artificial beautification is preferred by using lots and lots of chemicals that not only harms the skin showing after side effects but also feel like a burden on the skin and clogs pores inviting more infections. Ubtan is a gift from Ayurveda is also tested by researchers and has been in use since a long time, the ideas should be propagated and understood by us too for achieving healthy skin in the most minimal way.

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Impact of COVID-19 Lockdown on Fodder Crops and Dairypreneurs in Odisha

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The fodder availability of Odisha state is ill matched to the livestock population. The estimated shortfall is around 48.3% for green fodder and 23.5% for dry fodder (Dhal, 2019). The contribution of cultivated green fodder is only 2.83% of total availability where as the rest is made-up through grazing in permanent pasture, forest and cultivable waste land. The dairy entrepreneurs depend on mostly the market available feed for their cattle and small ruminants. Cultivation of forage crops is limited to mainly progressive dairy farmers of milk shed areas.

However the sudden and forced lockdown due to COVID-19 situation not only made the dairy farmers to run out of business but also created feed and fodder shortage to their diary animals. Based on cell phone interaction and advisory service by scientists of All India Coordinated Research Project (AICRP) on Forage Crops, OUAT, Bhubaneswar with the progressive farmers and stake holders of the state, the following constrains were recorded.

1. The perennial crops like hybrid napier bajra, guinea grass, para, stylo and summer legumes like rice bean and cow pea were suffered a lot due to want of intercultural operation and irrigation as a result of non availability of labour and shut down of fertilizer shops. The farmers forced to remain in home and not allowed by the police personnel to go for procurement of diesel from petrol pump; as a result the crop dried due to lack of irrigation.

2. Market availability of dry matter like paddy straw, other crop residues and commercial feed was not practically available due to closure of transport vehicles and feed shop, even though the government has included the feed/fodder in the essential list.

3. Milk sale has been drastically reduced due to shut down of tea shops, sweet shops, hotel and restaurants throughout the state, leading to distress condition of farmers. The dairypreneurs stake holders and officials of line departments also opined the helplessness regarding how to feed their
livestock and sustain their livelihood without daily income.

The only suggestive measure for those dairy farmers to cultivate fodder perennials and legumes in their back yard and adjacent field to the cattle shed so that lifesaving steps can be made for the crops and feed the green fodder to cattle and small ruminants at the time of lock down/ shut down like disaster situation.

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Information and Communication Technology Initiatives in Indian Agriculture

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Communication Technologies, agriculture, Indian economy

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ABSTRACT
In India agricultural households were about 57.8 percent of the total households of the country. With the advent of green revolution, there has been a significant four-fold increase in the food grain production during the last five decades. Lot of are exiting in agriculture such as poor connectivity and disintegration of market, uncertain and delayed information to the farmers, small land holdings, non-adoption or less adoption of improved technology and so on. Information technology revolution is upcoming rapidly in Indian Agriculture. The introduction of Information and Communication Technologies, the traditional agriculture has been regenerate. So Central and State government, agricultural department and other non government organizations developed mobile app for helping of farmer community. In this article we will know about different mobile apps.

INTRODUCTION
Agriculture is a large sector of the Indian economy. The increased demand for food grains can be met only with sincere attempt in agricultural research and extension. In spite of a large of Indian economy, agriculture is lagging behind many features and defined by poor connectivity and disintegration of market, uncertain and delayed information to the farmers, small land holdings, non-adoption or less adoption of improved technology and so on. Information technology revolution is upcoming rapidly in Indian Agriculture. The introduction of Information and
Communication Technologies, the traditional agriculture has been regenerate. Information and Communication are always necessary in agriculture. Since people have started growing crops, raising livestock, and catching the fish, they have hunted information from one another. Hence, ICT in agriculture has become a budding field of research and application related to e-agriculture.

Indian government gives following ICT initiatives for Indian Agriculture:-

1. **AGRISNET**: It is an infrastructure network is existing at block level facilitating agricultural offices, agricultural extension services and agribusiness activities to enhance rural development.

2. **DIGITAL GREEN**: The agricultural information of local relevance is disseminated through digital video. The system consists of a digital video database prepared for farmers by farmers with the help of experts. The recordings are shown to individuals or small groups using laptops, DVD player, and television and to communities through village cable network.

3. **e-SAGU**: eSagu provides personalized expert advice in a timely manner from sowing stage to harvest for small and marginal farmers at their door-step. The farm situation is brought to the expert in the form of digital photographs and text information. The expert advice after analyzing the situation is prepared and is delivered to the concerned farmer on the same day or subsequent day.

4. **IKSL**: The relevant information is delivered to the farmers on mobile phones through five voice message in local language. Customized solutions are provided to the farmers through helpline. The farmers can also speak to the experts on specific subject through special ‘phone-in’ programmers.

5. **AGMARKNET**: This initiative provides daily market price and arrival information in respect of 300 commodities and 2000 varieties in eight local languages. The wide range of information on prices, arrival and other related aspects like grades, standards, packaging, etc. is collected and disseminated by networking major agricultural produce markets operating in the country.

6. **iKISAN**: iKisan is a one-stop solution for farmers in providing information on crops, crop management techniques, fertilizers, pesticides and other related information like market updates and weather forecasts.

7. **DIGITAL MANDI**: Digital Mandi is an electronic trading platform for agri-commodities to bring the benefit of ICT to farmers and traders by eliminating geographical barriers and temporal limitation and removing cash crunch through active participation of various financial institutions. Digital Mandi is inspired by the vision of media labs Asia sustainable village through culturally appropriate use of new technologies.

8. **aAQUA**: aAQUA is a multilingual online problem-solving system that facilitate farmers getting their queries answered by experts. The reply to the queries raised by the farmers is sent in one to three days depending on the nature of the problem.

9. **e-Krishi**: The communication network established under e-Krishi is utilised to educate farmers, provide real time information on prices, arrivals and issue disaster warning and weather forecast. The aim is to enable farmers to take informed decisions on sale of their produce and bring transparency in the working of the Madhya Pradesh State Agricultural Marketing Board Mahindara

10. **Kisan Mitra**: The initiate provide information on daily market prices, weather updates, crop advisories, agri-related news, etc. The information is also available on other sections such as loans, insurance, Mandi database, cold storage and warehouses, etc. The farmers can also get motivated and take benefits from the
success stories of other fellow farmers reported on the website.

11. **Haryali Kisan Bazar:** HKB has set up centre across different states to provide solutions to wide range of problems of farmers under one roof including agri-inputs, financial services, farm-output services and round the clock expert advice. The centres provide information on crops, latest technologies, weather forecast, market prices, customised services based on the farmer database maintained under the initiatives.

12. **Fisher Friend:** The information relevant for fishermen is provided in local language through mobile phones.

13. **Mobile Advisory:** The information covered are wave height, wind speed and director, potential fishing zones, relevant news, government schemes and market price.

14. **Kisan Call Centre (KCC):** The Kisan Call Centre utilises telecom infrastructure to provide customised information on various aspects of agriculture in local language using toll free number 1800-180-1551.

15. **Reuters Market Light:** Reuters Market Light provides mobile phone based customised information according to the individual farmer’s preferences on crops, markets, and location. The information in local language in respect of over 440 crops and varieties, more than 1400 markets and 2800 weather locations are available across 13 states through SMS.

16. **e-Choupal:** An initiative by ITC provides alternative marketing channel, information on weather, agricultural practices, input sales, etc. It is a kiosk located in a village and equipped with computer with internet access managed by trained sanchalak.

17. **e-Agri Kiosk:** An initiative by NABARD and Central Agricultural University. Touch screen kiosk for technology transfer among tribal farmers of Arunachal Pradesh.

18. **MSSRF FFMA:** Fisher Friend is a BREW-based application offered on a low cost CDMA handset with a graphic interface, an icon-based menu and programmable shortcut keys. In addition to safety and weather information, fishermen can receive the locations of fishing areas and real time market prices with one-click in their local language.

19. **Electronic National Agriculture Market (e-NAM):** National Agriculture Market (NAM) is a pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. The NAM Portal provides a single window service for all APMC related information and services.

20. **DD Kisan:** It is an Indian Agriculture 24-hour television channel, which is owned by Doordarshan and was launched on 26 May 2015. The channel has been dedicated to agriculture and related sectors, which disseminates real-time inputs to farmers on new farming techniques, water conservation and organic farming among other information.

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From Waste to Use Journey: Potato Peel as Important Source of Nutraceuticals

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Keywords
Potato peel, processing, antioxidants, nutraceuticals

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ABSTRACT
Potato processing industries generates huge amount of potato peel with no value and lead to disposal related problems. However, potato peel is a good source of nutritional and phytochemical compounds such as phenols, vitamin C and dietary fibre. The present study is conducted to evaluate potato peel nutritive potential. Results revealed high nutraceuticals potential of potato peel compared to potato tuber. Thus, potato processing wastes may be used in food formulations and their extracts could potentially be employed as an effective source of antioxidants in food systems.

INTRODUCTION
Potato is one of the major cash crops in many provinces of India. Besides being a main source of carbohydrates, it is also a good source of vitamin C, protein, phenols, and minerals. Potato is used majorly as vegetable in cooked form either alone or in mixture with the other vegetables. Although, potato consumption in the form of its various processed products such as french fries and chips is blooming currently in the market. Conventionally, potato peel is removed before processing the potatoes. This generates a lot of peel waste with no value (Arapoglou et al., 2010). However, potato peels contain lot of nutritional and bioactive components such as dietary fibre, antioxidants and polyphenols etc. Interestingly, the percent composition of phenols particularly chlorogenic acid is significantly high in potato peels as compared to potato flesh. Chlorogenic acid functions as an antioxidant product (Chaplick et al., 2010). It also reduces blood pressure and improves glucose metabolism. Recent studies have shown that chlorogenic acid possesses anti-
inflammatory property too. In order to utilize potato peel waste as a source of natural antioxidants and nutraceutical in future, an initiative was undertaken by Central Potato Research Institute, Shimla, Himachal Pradesh. Exploring the importance, the potato peels will not only provide a natural source of nutraceuticals, but also help enhancing the income of potato farmers. From this point of view, objective of research was undertaken to evaluate proximate composition of potato peels. The outcome of this study will not only solve the problem of potato peel waste, but also help farmers to increase their income by providing potato to the food and pharma industries for making potato peel extracts. In this endeavour, potato varieties were screened for their nutritive values and three most popular varieties of potato grown in Himachal Pradesh [Kufri Chipsona 1 (processing variety), Kufri Bahar and Kufri Jyoti (table varieties)] were undertaken. Potato were washed in running water, air dried, peeled with kitchen peeler, chopped, and kept in polythene for further analysis of potato peel composition.

Proximate composition of potato peel

Results have shown that potato peel of Kufri Chipsona 1, Kufri Bahar and Kufri Jyoti contained 30-40 mg/100g ascorbic acid; 14-18% total starch, 0.28-0.34% total protein; 98-149 mg/100g reducing sugars, 76-103 mg/100g sucrose and 68-94 mg/100g total phenols on fresh weight basis. Studies were also conducted to estimate the amount of individual phenols in potato peels of these three potato varieties. One of the major phenolic antioxidants found in potato peel was chlorogenic acid that dominated in all the potato varieties followed by rutin and caffeic acid. The chlorogenic acid content was approximately 75-100 µg/g, caffeic acid content was approximately 0.38-3µg/g and rutin content was approximately 5-40 µg/g. Potato peel contained highest concentration of potassium (1823 to 3342 mg/kg DW) followed by iron (43 to 56 mg/kg DW) and zinc (20 to 29 mg/kg DW).

Comparison of potato peel with potato tuber

The potato peel composition of these potato varieties was also compared to potato tuber composition. Potato peels have shown an increase of 12% to 41% in ascorbic acid content, 54% to 98% in total starch, and 39% to 221% in reducing sugar, 54% to 208% in sucrose and 5% to 15% in total phenols when compared with raw potato tuber flesh. Tremendous increase was also observed in chlorogenic acid, caffeic acid and rutin content of potato peel of all the three varieties Kufri Chipsona 1, Kufri Bahar and Kufri Chipsona as compared to raw potato flesh. Increase in chlorogenic acid ranged from 485 to 1940%, caffeic acid from 850 to 7267% and rutin varied from 164 to 1246% respectively. Increase in potassium ranged from 6 to 9%, iron from 28 to 30% and zinc varied from 15 to 24% respectively.

CONCLUSION

Potato peels contain significantly higher levels of bioactive compounds such as ascorbic acid, phenols, individual phenols specially chlorogenic acid than their respective potato tuber flesh. These bioactive compounds are beneficial health promoting compounds in human which play significant role as antioxidants in prevention of many diseases. These results will help to develop the economic value of potato and to improve the utilization of potato peel.

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Soybean: Agribusiness Potential in State of Madhya Pradesh

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Keywords
Value added, Soybean, products

How to cite this article:

ABSTRACT
Soybean is an important oilseed crop in India. It is grown in Indian state of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Andhra Pradesh in the country. Soybean is also called as golden beans and it belongs to legume family. In Kharif season most common time of June to first week of July. Most of the Soybean 85 per cent of the world are processed annually into soybean meal and oil to make various processed items. Madhya Pradesh state is leading in production followed by Maharashtra and Rajasthan. India also export soybean to the other nation in the world. There is huge potential of value addition and export those products to the International market and open scope for the agribusiness avenue for the state as well country. Soybean meal is the primary product of soya bean like soya paneer or tofu, soya milk, cheese, soybean oil, flour etc. All soy foods including soymilk are high in protein, low in fat and contain no cholesterol, it is an excellent and nutritious food choice. It can grow in a wide range of soils, with optimum growth in moist alluvial soils with a good organic content. Soybeans byproducts are found in many of human foods, animal feeds and industrial products. Many value added products are coming in the market which are having high demand and rich in nutrition value

INTRODUCTION
Soybean is an important major Kharif oilseed crop sown by the farmers of Madhya Pradesh state and some other states. The 'Soy State' presently, the crop covers more than 9.67 million hectares in India with major contribution from the states of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Andhra Pradesh in the country. The crop also has a prominent place as the world’s most important seed legume, about two thirds of the world’s protein concentrate for livestock feeding and is a valuable constituent in
formulated feeds for poultry and fishes. The growing demand for healthier food, effectiveness and quality of consumed product and increased public and healthcare industry awareness are the major factors for a global scale, exploitation of its rich nutritional value assumes importance to provide food security, agricultural development, self-dependence, and economic development of developing countries. (Rawat et.al. 2020)

**International Scenario**

In the world's oilseed cultivation scenario soybean has an important place due to its high productivity, profitability and beneficial contribution towards maintaining soil fertility. About 85 per cent of the world's soybeans are processed annually into soybean meal and oil. Approximately 98 per cent of the soybean meal is crushed and further processed into animal feed with the balance used to make soy flour and proteins. 95 per cent is consumed as edible oil the rest is used for industrial products such as fatty acids, soaps and biodiesel etc. The major soybean producing countries are the United States, Brazil and Argentina. The three countries dominate in global production, accounted for 80 per cent of the world's soybean supply. Global production of Soybean has grown at a compound annual growth rate of 2.78 per cent from 215.69 million metric tons in year 2004-05 to 283.79 million metric tons in the year 2013-14 (FICCI). Global soybean production was forecast for 2018-19 raised to 370.5 million tons on higher than expected US soybean yields and expectations of another record-breaking crop in Brazil as per Agricultural Market Information System. Soybean utilization in 2018-19 revised downward, reflecting passive growth in soymeal demand in China and lower than earlier expected crush levels in Brazil and Argentina. Trade lowered as imports by China are now forecast to post a decline from the year 2017-18 (FAO)

**Domestic Scenario**

In the year 1994, Jawaharlal Nehru Krishi Vishva Vidhylaya, Jabalpur released an indigenously variety JS-335. Variety matured in just 95-100 days, and yielded 25-30 quintals per hectare, which was 5-10 quintals more. This variety very rapid occupy around 90 per cent of India’s total soya bean area. The crop has often helped shape poll outcomes in Malwa region of the state. Which accounts for more than half the state’s production. Once thriving, Soyabean has suffered falling prices in the last few years. At current prices, soybeans are profitable than other crops. The western state of Maharashtra and central India's Madhya Pradesh account for more than around 80 percent of the country's total soybean output. Acreage under soybean has increased at an annual compound growth rate of 13.3 per cent for the period from 1970-71 to 2016-17 and 4.5 per cent from 2000-01. Production of soybean in India increased at an annual growth rate of 14.8 per cent for 1970-71 to 2016-17 and 5.5 per cent for 2000-01 to 2016-17.

**Table 1: Area, yield and Production of Soybean in India (2019)**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>State</th>
<th>Sowing Area (Lakh ha)</th>
<th>Estimated Production (million MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Madhya Pradesh</td>
<td>51.952</td>
<td>40.107</td>
</tr>
<tr>
<td>2</td>
<td>Rajasthan</td>
<td>9.627</td>
<td>6.560</td>
</tr>
<tr>
<td>3</td>
<td>Maharashtra</td>
<td>37.365</td>
<td>39.415</td>
</tr>
<tr>
<td>4</td>
<td>Andhra Pradesh</td>
<td>1.783</td>
<td>1.508</td>
</tr>
<tr>
<td>5</td>
<td>Chhattisgarh</td>
<td>0.742</td>
<td>0.539</td>
</tr>
<tr>
<td>6</td>
<td>Gujarat</td>
<td>1.003</td>
<td>0.861</td>
</tr>
<tr>
<td>7</td>
<td>Karnataka</td>
<td>3.302</td>
<td>2.694</td>
</tr>
<tr>
<td>8</td>
<td>Others</td>
<td>1.841</td>
<td>1.377</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>107.615</td>
<td>93.061</td>
</tr>
</tbody>
</table>


**Export from India**

Major export destinations of soybean meal from India are Bangladesh, Japan, France, Nepal Myanmar, Germany, Sri Lanka, USA, etc. The other soybean based products exported from India includes soybean flour, soy sauce, soy milk, soy protein and soy crude and other oil.

**Future prospects**

It is assessed that above 75 per cent of the world output is crushed. A very small proportion of the crop seed is consumed directly by humans,
soybean products appear in a large variety of processed foods. So huge business opportunities are in processing and value addition of the crop. The cultivation of soybean crop is fruitful in climates with hot summers, with temperatures between 20°C to 30°C being optimum. In a wide range of soils, it can be grow with optimum growth in moist alluvial soils with a good organic content. Soybeans derivatives are found in many of human foods, animal feeds and industrial products. Many value added products are coming in the market which are having high demand and rich in nutrition value.

**Factor influencing price**

Good quality of seed of soybean fetch good price in the market. Some factor which influence the quality production and price of the crop in the market. Weather condition during harvesting of crop play important role in maintaining quality of the crop. The pod bearing period, being the most crucial at the time insect are damaged the crop. The area planted, determined by the price of soybean against that of competitive crops used for animal feed, viz., Maize, Jowar, Bajra etc. Government policies and prices such as Minimum Support Price (MSP) fixed for the crop, import duty. Damage of crop by pests and diseases. Demand for Soybean from oil extractors and farmers. The supply-demand and price scenario of competitive oils, viz. palm oil also influence the price of the crop and International market price for soy meal export etc. to be considered.

**Table 2: Value added products of soybean**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Soya food product</th>
<th>Food recipe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soya Nuts</td>
<td>Clean soybean by removing all unnecessary matter followed by washing and boiling for 10 minutes. Keep boiled soybean away for soaking until 2-3 hours. Then soak all water and sundry soaked beans for 1 hour. Fry or roast soybean and use after mixing with salt, spices and condiments.</td>
</tr>
<tr>
<td>2</td>
<td>Soya Milk</td>
<td>To make 1 liter soybean milk you need 125 gms soybean. Soymilk is hot water extract of soybeans. Soymilk can be handled and used in much the same way as dairy milk. It is rich in (1) protein (2) vitamins (3) minerals. Soymilk is lactose free, cholesterol free and low in saturated fat.</td>
</tr>
<tr>
<td>3</td>
<td>Soy Curd</td>
<td>Mix soy milk and dairy milk in half- half ratio and add dahi culture in hand-hot milk. Mix it well and keep aside for setting of dahi. Keep it in refrigerator after setting. Soydahi or soycurd will be ready. It is high in nutritious value.</td>
</tr>
<tr>
<td>4</td>
<td>Soy Flour</td>
<td>Soy flour can be processed by various methods full fatted, partially defatted. Full fatted soy flour can be prepared easily at home. For preparing at home, wash cleaned soybean with water. Boil for 20 minutes and sundry for 2-3 days and mix in mixer and grinder. Add soy flour in wheat flour to prepare chapatti. For 9 kg wheat flour add 1 kg soy flour for fortification.</td>
</tr>
<tr>
<td>5</td>
<td>Tofu</td>
<td>Paneer prepared from soymilk is called Tofu. 2 liter milk is required to make 400 grams of Tofu. Let the soybean milk's temperature come to 80 degree. Now add and mix lemon juice with soybean milk and mixing 1-2 times. Do not mixing continuously. See milk coagulating and water separating from it. Filter the coagulated milk promptly through clean muslin cloth and then place a heavy object on it.</td>
</tr>
</tbody>
</table>

(Source: ICAR-IISR, [https://iisrindore.icar.gov.in](https://iisrindore.icar.gov.in))
CONCLUSION

Higher production of soybean in the state open opportunities for processing and value addition. The demand of soy products in the other nation increasing due to its nutritious benefit. Good quality seeds fetch higher price in the market. The byproducts after processing of soybean is also used. India also export soybean to other nation. The soybean crop also helps in improving soil fertility. Value added products are available in the market which are having high demand and rich in nutrition value.

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Human Mineral Malnutrition: Impact on Growth and Development

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Malnutrition, Human body immunity, Minerals, Vitamins

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ABSTRACT
Vitamins and minerals play an important role in health during aging, and deficiencies can affect both physical and mental functioning. Consuming enough micronutrients can be a challenge for some population, especially the elderly, as a host of physiological and cognitive age-related changes can affect intake, digestion, absorption, and metabolism of these nutrients. Many micronutrient deficiencies can result in impairment of physical and cognitive functions, which can then cause further nutritional decline.

INTRODUCTION
Micronutrients ("micro" means "small amount" and "nutrients" means "a substance, require by living things to keep them alive") which means, small number of components are needed that include vitamins and minerals to keep a body healthy and maintain a lifestyle. When there is lack of adequate nourishment and have imbalances in person’s intake of energy that person suffers with malnutrition that can be of any age as shown in fig. 1.

Fig. 1: Malnutrition: Overview
Mineral malnutrition affects two-thirds of the world’s population. For a good and balanced nutrition, different plants (vegetables and fruits) and animal sources can be consumed to receive a number of important minerals. Although the needed amounts of minerals in the body are not a sign of their significance, less amount of trace minerals for the body is needed compared with major ones. As a result, a balanced diet can commonly support all essential minerals for the body.

**Vitamins and Minerals**

Vitamins are organic compounds required in limited amounts for normal growth and metabolism, and are typically categorized as fat soluble or water soluble. Vitamins are necessary for a wide variety of biochemical functions; they function as antioxidants and as cofactors for many enzymatic reactions and serve as regulators of mineral metabolism. Most vitamins are actually groups of structurally related compounds called vitamers that have similar activities.

The term mineral is a “misnomer”, dietary minerals are actually chemical elements. The four most common elements serve organic functions are hydrogen (H), carbon (C), nitrogen (N), and oxygen (O). Other necessary human elements include sodium, magnesium, phosphorus, sulfur, chloride, potassium, and calcium. Trace elements that are essential in much smaller amounts include iodine, iron, manganese, cobalt, copper, nickel, zinc, selenium, molybdenum, bromine, and chromium. See a list for common mineral function in Table 1.

**Causes of deficiency:**

Micronutrient deficiencies can generally be categorized as primary (caused by inadequate intake) or secondary (caused by a medical condition or medication that interferes with the absorption or metabolism of the vitamin or mineral). However, the origin of deficiency is often multifactorial; a specific disease or host of medical problems can reduce food intake, increase needs, decrease absorption and impair metabolism, all of which can contribute to the development of micronutrient deficiencies that leads to malnutrition, as shown in Fig. 2.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Symbol</th>
<th>Common functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>Ca</td>
<td>Blood coagulation, maintenance of structural component of bones and teeth.</td>
</tr>
<tr>
<td>Copper</td>
<td>Cu</td>
<td>Formation of red blood cell, energy production</td>
</tr>
<tr>
<td>Iodine</td>
<td>I</td>
<td>Nutrient metabolism, Thyroid hormone synthesis</td>
</tr>
<tr>
<td>Iron</td>
<td>Fe</td>
<td>Hemoglobin formation</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Mn</td>
<td>Enzyme activation for glucose and DNA</td>
</tr>
<tr>
<td>Potassium</td>
<td>K</td>
<td>Protein and glycogen synthesis</td>
</tr>
<tr>
<td>Zinc</td>
<td>Zn</td>
<td>Protein synthesis, immunity</td>
</tr>
</tbody>
</table>

Fig. 2: Factors associated with fight infection and malnutrition

**Risk factors for mineral deficiencies:**

- **Calcium** - Glucocorticoids
- **Copper** - Excess iron and zinc supplementation in human body, it may cause chronic diarrhea
- **Iodine** - Goitrogenic
- **Iron** - Decreased gastric acid production, blood loss
- **Magnesium** - Acute hypo - magnesemia
• Selenium - HIV disease
• Zinc - Trauma, chronic alcoholism

Diagnosis of deficiency by physical signs:
• Vitamin A - Poor wound healing, Poor blanching nails, night blindness, dry skin.
• Vitamin D - Swollen painful joints
• Vitamin K - Ecchymosis
• Vitamin B₁₂ - Motor weakness
• Vitamin B₁ - Angular stomatitis, Cheilosis
• Vitamin B₆ - Glossitis
• Vitamin B₃ - Angular stomatitis, Cheilosis
• Vitamin C - Poor wound healing, bleeding spongy gums
• Biotin - Hair loss
• Copper - Depigmentation of hair
• Iodine - Goiter or enlarged thyroid
• Zinc - Impaired night vision

Possible treatment
• Identification and treatment of the underlying cause of the deficiency.
• Education and counseling
• Appropriate treatment regimen
• Appropriate supplements, dose, route of administration during treatment.

Relationship of mineral nutrients to human nutrition
Mineral nutrients are absolutely essential for good health. They are even more important than vitamins. Lacking vitamins, the body can make some use of minerals, but lacking minerals, vitamins are useless. Mineral nutrition in humans is defined as the process by which substances in foods are transformed into body tissues and provide energy for the full range of physical and mental activities that make up human life.

Interventions against mineral malnutrition

Possible treatment

Fig. 3: Flowchart- different interventions against mineral malnutrition

There are different types of interventions that needs to be taken care by a person against the mineral malnutrition. Basically, there are 5 types of intervention and their sub-types: Dietary and medical supplements- the person needs to take different types of supplements that can be in either of the source. Nutrition education is very important for a person to maintain a complete balance diet. Different types of fortification methods are there to take different types of genetically modified food to make for a rich source of nutrient. Dietary diversification and infant feeding are very important interventions as a person can have a proper diet since childhood with micronutrients that are essential for its complete growth and development.

CONCLUSION

There is a considerable amount of variation in the daily recommended dose of mineral nutrients, such as B, Cr, Mn, Na and V. This will require a multidisciplinary approach in the solution of the discrepancy. To overcome the deficiency of mineral nutrients, the key is to consume a variety of foods in modest quantities, including low fat dairy foods, lean meats, leguminous grains, other grains, and a
variety of vegetables and fruits, to provide our body all necessary mineral nutrients. To ensure sufficient mineral intake, the diet could be supplemented with a multivitamin-mineral tablets.

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Raw materials, Poverty alleviation, Agro-value chain, Policy makers

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ABSTRACT

Industry dealing with the supply, processing, and distribution of farm products and mainly depends on agricultural products as raw materials are called agro based industries. Raw material is the main basis for the establishment of agro-based industries. It also provides rural population an opportunity for employment, generate income and thereby improve economic condition of people, avoid wastage of perishable agricultural products and help to develop backward areas based on their suitability for setting up agro-industries. Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agro-industry, i.e. the processing, preservation and preparation of agricultural production for intermediate and final consumption, performs a number of crucial functions that support development and poverty alleviation. Agriculture in connection with industry needs to be recognized by senior-level policy makers and industry leaders as a competitive, value-adding business sector that has a positive development impact and contributes to economic growth. Rather than focusing on agricultural productivity only, policy makers must consider the competitiveness of the entire agro-value chain. A comprehensive approach could include e.g. supporting small agro-producers and SMEs, enabling market access and developing a supportive institutional environment.
INTRODUCTION

Agro industries are those units which add value to agriculture products/residues, both food and non-food, by processing into products which are marketable or usable or edible, improving storability, providing the link from farm to the market. It includes Hi-Tech and Biotechnology based agriculture. “Agricultural Product” means produce of agriculture, horticulture, sericulture, floriculture, fisheries and includes minor forest produce and livestock-based products. It transforms raw material into finished products for consumption, it constitutes a significant proportion of the developing countries production and exports and develops food system that provides the nutrients which are critical for wellbeing of the expanding population.

Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agriculture has been considered the hallmark of the first stage of development, while the degree of industrialization has been taken to be the most relevant indicator of a country’s progress along the development path. Moreover, the proper strategy for growth has often been conceived as one of a more or less gradual shift from agriculture to industry, with the onus on agriculture to finance the shift in the first stage.

This view, however, no longer appears to be appropriate. On the one hand, the role of agriculture in the process of development has been reappraised and re-valued from the point of view of its contribution to industrialization and its importance for harmonious development and political and economic stability. On the other hand, agriculture itself has become a form of industry, as technology, vertical integration, marketing and consumer preferences have evolved along lines that closely follow the profile of comparable industrial sectors, often of notable complexity and richness of variety and scope. This has meant that the deployment of resources in agriculture has become increasingly responsive to market forces and increasingly integrated in the network of industrial interdependencies. Agricultural products are shaped by technologies of growing complexity, and they incorporate the results of major research and development efforts as well as increasingly sophisticated individual and collective preferences regarding nutrition, health and the environment. While one can still distinguish the phase of production of raw materials from the processing and transformation phase, often this distinction is blurred by the complexity of technology and the extent of vertical integration: the industrialization of agriculture and development of agro processing industries is thus a joint process which is generating an entirely new type of industrial sector.

Approaches to Agro-Industry Development in India:

- Between 1950 and 1980 agro-industry policy was dominated by Prime Minister Nehru and his economic think-tank led by Mahanalobis.

- They argued that India needed larger capital goods industries for the capital goods sector, while the consumer goods sector was primarily for small scale rural agro industries which are labor intensive and capital saving.

- This was consistent with the need to reduce demands on limited capital and savings, and to expand employment. However, such small-scale agro industries, because of old technology, inadequate management and weak capacity to invest, often failed to meet the expanding and changing market demands for quality goods, coming from the rapid production and rising incomes.

- Starting in 1980s, there has been a new effort for promotion of agro industries in India with emphasis on market demand, state of the art technology and efficient management of the supply chain.
Classification of agro-based industries

- Large scale industries involving large investment and high level of automation. It includes sugar, jute, cotton industries etc.
- Small scale industries are those who have medium investment and semi-automation. It includes edible oil mills, rice mills etc.
- Village and cottage industries are found in villages and run by rural households with very little capital investment and a high level of manual labour for Gul (Jaggery) and khandsari, pickles, papad etc.

Nature and scope of agro-based industries

- Agro industries depend not only on the outputs of agricultural and allied activities but also on the inputs in agriculture, like agriculture equipment, fertilizers and pesticides, agro industries are industries which encourage greater input into agriculture,
- It leads to better processing and conversion of agricultural commodities,
- Ensure with returns of processed goods,
- Increase agricultural production.

Importance

- Establishment of agro-based industries is based on the availability of raw material.
- Provide rural population an opportunity for employment.
- Generate income and thereby improve economic condition of people.
- Avoid wastage of perishable agricultural products.
- Help to develop backward areas based on their suitability for setting up agro-industries.

Agro based industries in India

- India is one of the world’s largest producers of food, and is the largest producer of milk, sugarcane and tea, as well as the second largest producer of rice, wheat, fruits, and vegetables.
- Nearly 70% of the population depends on agriculture and agro-based industries. The agro industry is regarded as an extended arm of agriculture.
- The development of the agro industry can help stabilize and make agriculture more lucrative and create employment opportunities both at the production and marketing stages.
- The broad-based development of the agro-products industry will improve both the social and physical infrastructure of India. Since it would cause diversification and commercialization of agriculture, it will thus enhance the incomes of farmers and create food surpluses.
- It is a well-recognized fact across the world, particularly in the context of industrial development that the importance of agro-industries is relative to agriculture increases as economies develop.
- It should be emphasized that ‘food’ is not just produce. Food also encompasses a wide variety of processed products. It is in this sense that the agro-industry is an important and vital part of the manufacturing sector in developing countries and the means for building industrial capacities.

Potential of Indian agriculture for agro processing

- India is a major producer and consumer of a wide range of farm and marine products.
- It is the second largest producer of fruits and vegetables, but only 2% of the produce is processed.
- It is the land of spices contributing about 25% of the world population worth US $ 900 million
- It is the world’s largest producer of milk and about 15% of milk is processed in the organized sector.
- Despite, it has largest livestock population in the world just 1% of meat production is converted to value added products
- Agro-processing sector thus, has immense potential to contribute to growth of our economy.
Government Policy for Agro based Industries

In food processing sector the MFPI has been implementing several schemes for the development of food processing in the country which are as follows:

- Scheme for Infrastructure Development
- Scheme for Technology Upgradation /Establishment /Modernization of Food Processing Industries
- Scheme for Quality Assurance, Codex Standards and Research & Development
- Scheme for Human Resource Development Scheme for Strengthening of Nodal Agencies
- Scheme for Backward and Forward Integration and other Promotional Activities.

Role of agro-based industries

- For the balanced economic growth of agriculture and industry the proper emphasis should laid on both the sectors.

- Development of industries cannot progress beyond a certain stage without the assistance of agriculture likewise; agriculture development beyond a certain stage is subject to industrial development.

- Industries depend on the agriculture for labour force, raw material and foreign exchange required to import industrial machinery through agricultural exports.

- A prosperous agricultural sector provides market for industrial products industry, in its turn, fosters agricultural growth by providing fertilizers, pesticides, various agricultural implements, tractors etc.

- Agriculture and industry are complementary to each other, industrial expansion depends on the increase in agricultural production and agricultural improvements depend on industrial development.

- The concept of agro based industries signifies the proximity and affinity between agriculture and industry and highlights the interdependence of industry and agriculture.

- In other words agro-industries must pave the way for the centralization of industries, wealth and power etc. We can use agro-industries to utilize our own men and material.

Export trends and opportunities

India has been a traditional exporter of raw agricultural products like spices. Export of raw products has resulted in huge loss to Indian economy. After GATT agreement and WTO membership, processed products manufactured as per international norms only offered at competitive prices, can be exported. However, our processed products mostly do not meet the international standards. India’s share in over US$ 300 billion world trade in agricultural commodities is less than 1%. Agricultural exports used to be of the order of 30.6% of the total exports during 2008-09, which came down to 19.4% by 2009-10. Processed fruit and vegetable products have considerable export potentials and if it is properly utilized, growers, processors, traders as well as national economy will benefit. It requires correct assessment of world market, high quality of raw produce, high quality of processed product and competitive production cost.

Recent trends in agro processing technologies

1. Rice- Fully automatic modern rice mills Partially cooked/quick cooking rice Breakfast cereals and value-added products Attractive packaging and branding

2. Wheat- Fully automatic roller flour mills Whole bran wheat flour Fortified wheat flour Attractive packaging and branding Large number of baked products Automatic chapatti making machines

3. Maize Corn flour-packaged and branded Corn flakes and value-added products including ready-to-eat snacks (salted & sweetened) Starch material, corn oil with specific consumer desired attributes Cattle feed Baby corn Large, automatic corn processing plants

5. Pulses Automatic processing units for pulses with driers, colour sorters and packaging unit Attractive consumer packaging with branding Cold storing of processed pulses Snack foods and other value-added products

6. Soybean Production of full fat soy flour/enzyme active soy flour for bakery and fortified foods Ready-to-eat snack foods.

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Has Lockdown Locked Down the Happiness of Punjab Farmers?

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ABSTRACT
COVID-19 is an unprecedented challenge for India as well as for the whole world and its impact on the economy is undoubtedly catastrophic. The nationwide lockdown has lead to shutting the economy and bringing life to a halt. The agriculture sector got a severe blow when the lockdown stopped transportation, thereby stagnating the whole process of harvesting in India. This is wheat harvesting time and yield from Punjab and Haryana makes up around 70 per cent of the wheat central pool which is distributed through the public distribution system (PDS) in India. This article discusses all the grassroot problems that Punjab’s farmers are facing during COVID-19 lockdown like labour scarcity, machinery usage, difficulties in procurement process, etc. along with some suggestions.

INTRODUCTION
COVID-19 is an unprecedented challenge for India as well as for the whole world and its impact on the economy is undoubtedly catastrophic. The nationwide lockdown has lead to shutting the economy and bringing life to a halt. No sector has escaped from the impact of this world pandemic. The agriculture sector got a severe blow when the lockdown stopped transportation, thereby stagnating the whole process of harvesting in India. The impact on agriculture is complicated and distributed among the different segments that form the agricultural supply chain. Even among discrete segments, its impact differs widely among different regions, producers and agricultural wage labourers. This lockdown has affected the livelihood of millions of people but for farmers whose high-valued perishable crops are standing in the field, it is a hit below the belt. But he is the one working in the field without sick leave, health insurance or excuses and harvesting the nation’s food supply. The farmer
is bewildered and hit by bad weather, a world pandemic and with little help. Punjab whose major sector is agriculture is worst hit as the farmers are facing huge problems amidst lockdown. This is wheat harvesting time and yield from Punjab and Haryana makes up around 70 per cent of the wheat central pool which is distributed through the public distribution system (PDS) in India. Farm activity in Punjab is at a peak during April to June because Rabi crop is harvested and sold on the other hand, farmers begin sowing the next crop such as cotton, paddy, etc. Thus, this lockdown has hit both the farming seasons and may have robbed the farmers of the chance to reap profits. Though the government is trying its best, the farmer is the one who’s confused, helpless and bearing losses.

Apart from COVID-19 the untimely rain is another problem for the farmers as they have allegedly caused a reduction in crop yield. Rain near harvesting time delayed the harvesting by at least 2 to 3 days as agricultural machinery cannot function properly on wet soil. Since all do not have enough space for storing the harvested produce safely, rains are increasing the moisture content of harvested wheat, thus delaying its selling in mandis as wheat having more than 12% moisture content is not being procured by the mandis.

The problems faced by wheat cultivators are as follows:

1. **Labour scarcity**
   - The migrant labour has moved back to their home states thus leading to a shortage of manual labour in Punjab.
   - Non-availability of migrant labourers has interrupted the harvest and post-harvest operations of the wheat crop.
   - Labour harvested wheat gives more amount and better quality of husk than machine harvested wheat. Later on this husk is used as animal fodder thus fodder scarcity is obvious this year.
   - The available local labourers are charging a higher amount than usual, which the small and marginal farmers cannot afford as it will increase their cost of production.

2. **Machinery**
   - Since the Agricultural machines cannot go to other states this time, the owners are charging more than the usual price. Rent rate of combine harvester has increased to Rupees 1600 per Kila from 1300 rupees per Kila last year thus decreasing the farmer’s profit margin.
   - Restricted timings of use of agricultural machinery form 7 a.m. to 7 p.m. have added to the farmer’s difficulties.
   - Generally heavy agricultural machinery needs servicing before use, as it has been not in use for the past several months. Due to lockdown repair shops were shut and also spare parts of the machinery were not available.
   - Joint hiring of machines in groups by the farmers has also become difficult.
   - Due to the high demand for rented agriculture machinery, some farmers are not able to get machines for harvesting on time, thus increasing the chances of standing crop getting damaged either by rain or fire incidence.

3. **Mandi**
   - The pass/coupon system was introduced to maintain social distancing norms in the mandis for the safety of the farmer as well as the government officials during the wheat procurement process in lockdown. According to the govt. guidelines, only 50-70 quintals or one trolley of wheat is allowed to be procured per coupon. This poses a problem to the farmers who have more than one trolley to sell, as this increases the frequency of mandi visits, labour cost and also the chances of getting affected by the corona virus.
• Farmers cannot stagger crop procurement as a majority of them don't have storage space and also it would lead to incurring labour and transportation costs. A better alternative to this would be to procure all the produce of a farmer at one go, thus relieving him of visiting the mandi again and again.

• Uncertainty in the minds of farmers regarding timely payment of procured wheat is also there, as they need to pay for the hired machines and other expenses.

Problems faced by vegetable growers

• Vegetable growers are in stress-selling mode looking at the downward price trend as the vegetables are not going the markets of other states.

• Due to perishable nature of vegetables the farmers had no choice but to sell their vegetables at a very low price. Prices of capsicum have steeped to as low as 1.5 Rs/kg and 10-15 Rs/kg in case of tomato.

• Labour cost for picking vegetable has also increased thus decreasing the profit.

• There are no buyers-big retailers, restaurants, hotels are closed. Household demand has dipped drastically because many people fear that vegetables are handled by too many people.

• Commercial vegetable farmers are having a hard time as high labour cost (in plucking and transport) and low selling prices are leading to a loss.

• Some of them have even left their vegetable to rot in the fields as spending on harvesting them will lead to more loss than income.

Problems faced by flower growers

• Temples are closed, Gurudwaras are not fully functional and weddings are on hold due to which flower sales have hit rock bottom.

• The farmers who have adopted floriculture leaving the wheat-paddy cycle now stand discouraged and hopeless.

• Flower growers are worst affected as flowers are neither an essential commodity nor edible.

Dairy and poultry owner

• In dairy cattle rearing is a regular source of income, unlike farming in which crops are sold only twice a year.

• Sale of dairy products (like sweets, ice cream, cottage cheese) has also decreased significantly and people are preferring only packed and pasteurized milk over the one which is coming directly from dairy units.

• Poultry product such as eggs, chicken, etc are also facing problems due to various operational and transportation restrictions.

• There is a sudden decline in demand of poultry products due to fake news linking chickens to COVID-19, thus creating fear in the minds of customers.

• Movement of both dairy and poultry products is restricted due to the lockdown leading to a dip in sales.

• Demand for both dairy and poultry products has also significantly reduced as hotels and restaurants are closed and if the prices fall any further, the owners will have to bear heavy losses.

Problems the farmers may face in next the crop season

The authorities are holding up the payment of the previous crop which is leading to delay in the sowing of the next crop. Paddy is the major kharif crop in Punjab and it is likely to face a huge labour crisis in transplanting period. The local labour available is charging heftily, thus leaving no option for paddy growers but to go
for DSR (Direct Seeded Rice). The big farmers have already bought large rice seed lots for preparing nursery as back up along with DSR sowing, thus increasing the seed demand. It has created problems for small and marginal farmers who are paying higher than usual for the rice seeds. Availability is of DSR machines is limited and a long waiting period for renting them is expected that may delay sowing for some farmers. Higher prices are being charged for its rental use. Also adopting DSR will probably increase the weed infestation in the rice field, thus also increasing the cost of cultivation as more weedicides need to be applied for weed management. Though the seed, fertilizer and pesticide companies have been allowed to function but they are still facing problems due to constraints in workforce availability.

SUGGESTIONS

Direct and immediate cash transfer for the procured wheat crop by the government should be done. Flexible electricity timings during rice transplanting period should be given so that more time will be available for transplanting, thus reducing the load on the limited machines. Direct compensation to farmers who have suffered losses should be given. Farmers should be incentivised to move away from cash crops (say for a year or so) and towards food crops (like grains, pulses, cereals, legumes). Thus, increasing the MSP of food crops will help the farmers to shift their cultivation pattern. Fixing of MSP for vegetables and incentives for commercial vegetable farmers should also be given as they are facing a huge crisis. FPOs (Farmer Producer Organization) can be used to aggregate the harvest of farmers which could then be lifted by the centre or state procurement agencies or the FPOs and cooperatives can help the farmers in direct selling of their produce. Apps for procurement or selling of produce (like e-NAM and Kisan rath) and getting solutions for farming related problem should be promoted. Punjab Agricultural University also has its own app called PAU Kisan for providing online guidance to the farmers. Since labour shortage is the major obstacle right now, crops like maize should be promoted by increasing its MSP instead of paddy as it is less labour intensive. Large entities like Verka and AMUL should come forward to procure additional milk from local vendors and help revive the dairy industry. Promotion of contract farming will give assured income to the farmers.

Agriculture is the mainstay of the Indian economy so it is very crucial to lessen the impact of this lockdown on the agriculture sector and thus ultimately on the economy. This lockdown may worsen this agrarian crisis if the government does not take proper steps to help the farmers at this hard time. Though this situation is new for everyone, it needs to be handled well as it may have long term implications.

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Rising Benefits, Issues and Challenges of Zero Budget Natural Farming (ZBNF)

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ABSTRACT
The present article discusses about the various aspects of ZBNF. It is a type of farming which involves zero cost of production of all crops and use natural ingredients like bio fertilizers and no use of chemicals which needs almost no monetary investment. It is surely a boom to the farmers and this boom consists of four core principles and is a “zero budget” exercise which can break the debt cycle for several small farmers. Also, Government has launched Rashtriya Krishi Vikas Yojana, with an allocation of Rs 3,745 crore for the year 2019-20. But still it is a host of structural marketing issues which must be addressed first before going to achieve its ambitious goal of helping the farmers and increasing the productivity. So, Government should take more initiatives to deal with issues related to ZBNF and should also increase its involvement in marketing structures so that the role of middleman can be reduced, and farmers can get their original prices. Also, awareness camps should be conducted among farmers to raise the importance of ZBNF. Hence, by doing that the ZBNF can be emerged as best form of natural farming

INTRODUCTION
ZBNF, a brilliant idea of Mr. Subhash Palekar (Father of ZBNF), which is also named in his honour as the “Subhash Palekar Natural Farming” (SPNF), is a type of farming model which believes in natural growth of crops without using any chemical fertilizers, pesticides or any other kind of foreign elements. It is basically a chemical-free agriculture which needs almost no monetary investment, and the chemicals are replaced with biological pesticides like cowdung, cow urine, jaggery and pulse flour for crop protection (InsightsIAS, 2019). It implies that farmers must not purchase fertilizers and
pesticides to make sure the robust growth of crop plants. Hence, we can say that

\[ ZBNF = \text{Net zero cost of production for all crops} \]

The main aim of ZBNF is to make sure that the farming is economically viable by enhancing biodiversity of farms and various other services which can also contribute in maintaining the ecological balance (Chowdhry P., 2019). Hence, it helps in reducing farmers’ costs through eliminating the external inputs and by using in-situ resources, it helps in rejuvenating ecosystem’s health through diverse and multi-layered cropping systems.

**Origin and background**

ZBNF was originally promoted by Maharashtrian Agriculturist Mr. Subhash Palekar, as mentioned earlier, who has developed this model during mid-1990s as an alternative to the Green Revolution’s methods that are mostly performed by using chemical fertilizers, pesticides and intensive irrigation (DrishtiIAS, 2019). He argued that the rising cost of these external inputs was the strongest reason behind the indebtedness, poor standard of living and suicide among the farmers, while the impact of those chemicals on the environment is a separate devastating issue. He is also not in the favour of vermi-composting which is the focus of typical organic farming because it introduces the foremost common composting worm, *Eisenia fetida*, commonly known as tiger worm to Indian soils. He claims that these worms absorb toxic metals, poison the groundwater and the soil.

Further, when he researched the dung and urine of local cow and western cow breeds, he found that the microbial count in local breed’s cow dung, was as high as 300-500 crores in one gram compared to about 70 lakh in the case of a Jersey cow breed, which also had significant number of various pathogen bacteria (Madhvan N., 2019).

Further, in recognition of his work and therefore the impact he was creating on farmers, the Govt. of India conferred him with the distinguished Padma Shri Award in 2016. He also made history for being the 1st active farmer to receive this award and hence, also named as the “Krishi ka Rishi”.

**Core principles of ZBNF**

It is a farming model that relies on Agro-ecology and bring down the input cost to almost zero and return to a pre-green revolution form of farming. Hence, ZBNF is surely a boom to the farmers and this boom consists of four core principles:

- **Jeevamrutha**: It is a blend of fresh cow dung and aged cow urine (both from India's indigenous cow breed), jaggery, pulse flour, water, and soil; to be applied on farmland.
- **Bijamrita**: It is a concoction of neem leaves & pulp, tobacco and green chilies prepared for insect and pest management, which will be accustomed for treatment of seeds.
- **Acchadana** (Mulching): It protects topsoil during cultivation and does not destroy it by tillage operations.
- **Whapasa**: It is the condition where there are both air and water molecules present within the soil; thereby helping in reducing irrigation requirement.

![Core Principles of ZBNF](image)

**Fig 1**: Core principles of ZBNF

**Benefits of ZBNF**

Since in ZBNF, there is a great potential in not spending money or take loans for external inputs, and farming can also be made into a “zero budget” exercise. This can break the debt cycle for several small farmers and help to envisage the doubling of farmer’s income by 2022 (FAO, 2016). The ZBNF method also favours soil aeration, intercropping, bunds and topsoil mulching, minimal watering to plants and discourages intensive irrigation in the soil. It is applicable for all crops in all agro-climatic zones. Also, with the rising cost of external inputs (fertilizers and pesticides), which is the leading reason behind indebtedness and suicide
among farmers and at such a time when chemical-intensive farming is leading reason behind the soil and environmental degradation, a zero-cost environmentally-friendly farming method is certainly a timely initiative. Further, with the rising benefits of ZBNF, Andhra Pradesh made a pioneering commitment in 2018, to practice 100% natural farming by 2024.

**Government initiatives for ZBNF**

By reviewing the benefits of ZBNF, our Government has also taken initiatives in favour of ZBNF as devoting schemes of **Paramparagat Krishi Vikas Yojana (PKVY)** since 2015-16 (Also, within the revised guidelines of it during the year 2018, various organic farming models like Natural farming, Rishi farming, Vedic farming, Cow farming, Home farming and ZBNF are included and farmers includes an option to adopt anyone of them) and also through **Rashtriya Krishi Vikas Yojana (RKVY)**, under which organic/natural farming projects are taken by the respective State Level Sanctioning Committees (SLSCs). Further, the Government also sees this ZBNF as an answer to the farming crisis. Also, while addressing the International Organization Conference on Desertification (COP-14), Prime Minister Narendra Modi told the world community that India is also specializing in Zero-Budget Natural Farming (ZBNF). Finance minister N. Sitharaman in her speech of Budget 2019-20 also emphasized the practices of ZBNF, a sort of farming which involves elimination of chemical pesticides, sustaining agriculture with eco-friendly processes and restoring soil fertility and organic matter within the bid to double farmer's income by 2022 (Jebaraj, 2019).

**Current issues related to ZBNF**

There are some issues residing among farmers while moving towards ZBNF which deserve our attention e.g. Sikkim (India's first organic state), has suffered some decline in crop yields following its conversion to the organic farming (DrishtiIAS, 2019). Also, ZBNF advocates the requirement of an Indian breed cow, whose numbers are declining at a quick pace. According to Livestock Census 2011, the country’s total population of indigenous and non-descript cattle has dropped by 8.1%. While ZBNF has helped in maintaining soil fertility, its target of boosting its productivity and farmers’ income is not achieved completely yet. Similarly, last year, the Government has launched Rashtriya Krishi Vikas Yojana, a flagship revolution scheme with an allocation of Rs 3,745 crore for the year 2019-20. Whereas the Paramparagat Krishi Vikas Yojana (2015-16), which was meant to market organic farming and soil health has been allocated Rs 325 crore only, which is a very less amount. Also, many farmers have reverted to traditional farming after seeing their ZBNF returns drop after some years.

**Challenges lying ahead for ZBNF**

ZBNF may be a holistic alternative to this paradigm of high-cost chemical input-based agriculture. But still it is a host of structural marketing issues which must be addressed first before going to achieve its ambitious goal of helping the farmers and increasing the productivity. There is also a need for strengthening of agricultural market infrastructure. Extending the procurement mechanism to any or all food grain and non-food grain crops to any or all States and fixing minimum support prices (MSP) in consonance with the price of cultivation of crops is still a plunging issue. Abolishing minimum export price for agricultural commodities and enacting legislation on ‘right to sell at MSP’ needs immediate attention by the Government. MGNREGS (Mahatma Gandhi National Rural Employment Guarantee Scheme) must even be linked with farm to scale back the price of cultivation which has escalated at a faster pace over the past few years. So, unless these issues are resolved, the target of doubling the farmers’ income by 2022 will remain a dreamy reality. So, farmers’ easy doing business and standard of living should also be taken into consideration while dealing with ZBNF’s challenges.
CONCLUSION

The present article has led to the conclusion that ZBNF plays an important role in reducing the cost of production of various crops. It also encourages the farmers in using natural resources and helps in reducing the pollution especially groundwater pollution. Further, it also helps in breaking the debt cycle of the farmers in which they are tangled for long periods and helps them to earn some benefits too. Also, it increases the value of local cow as they are required in preparation of some formulations for ZBNF. So, people get motivated in their proper rearing. Also, some state governments are participating well in this initiative and are going well. But, still there are some challenges as mentioned earlier that we must overcome, and Government can also play important role in dealing with these challenges. They can help farmers by providing sufficient subsidies in inputs, other farm machineries and can also increase the MSP to some extent. It should also increase its involvement in marketing structures so that the role of middleman can be reduced, and farmers can get their original prices. Also, awareness camps should be conducted among farmers to raise the importance of ZBNF. Hence, by doing that the ZBNF can be emerged as best form of natural farming.

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Challenges in Forensic Veterinary Pathology

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Forensic science, veterinary pathologist, violence, necropsy

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ABSTRACT
Forensic veterinary science is an upcoming developing discipline that is still in its early phase of development and veterinary pathologists are responsible for holding its position upright in global perspective. Veterinary pathologists who are working on disease diagnosis sector have been forced to work on forensic sciences due to significant rise of crime against animals. Unlike human forensics, it has yet to establish its framework due to wide array of species diversity and pathophysiology of their disease process. But veterinary pathologists have come up with some excellent work in recent times based on their broad spectrum of knowledge along with proper documentation at each step of necropsy. Some common challenges include estimation of age at death, estimation of age of bruising, drowning, poisoning, death due to ballistics, trafficking violations etc. and it needs to be overcome in near future on the basis of sufficient amount of veterinary specific reference data on forensic analysis.

INTRODUCTION
New challenges always demand new approaches. The role of a veterinary pathologist is always demanding and exciting as he must keep a broad spectrum of knowledge of disease progression in an array of species with variable physiology. So, veterinary pathology acts as the substratum upon which animal health and welfare resides. The proactive involvement of veterinary pathologists has led us to sub-specialise in particular species, various infectious agents, different organ systems or different sub-disciplines like drug discovery, toxico-pathological research, basic and clinically
applied research, disease diagnosis and quality assurance, and forensic science (Stokol, 2016)

In recent days, veterinary pathologists working on disease diagnosis and herd health have been continuously encouraged to work on forensic cases. Before entering the subject, we should have a crystal-clear understanding about the term “forensics” as it has been used both in “everyday language” as well as in “medical terminology”. Although it has its original meaning “relating to law” has widened over the recent years to implicating ‘a thorough investigation and collection of evidence irrespective of specific legal case’. Further there are different disciplines like “forensic medicine” and “forensic pathology” that constitutes a broader department known as “forensic science”. However, forensic science is commonly understood as investigation of crime scenes with the help of different ballistic tests, DNA analysis, toxicological studies etc. Forensic medicine refers to the application of both medical and veterinary knowledge for elucidation of evidence in front of court. Some authors recognised “forensic pathology” and “forensic medicine as separate entities but technically they are strongly associated with each other. Unlike diagnostic pathology, history and necropsy findings constitute essential component of forensic pathology followed by detail documentation and proper explanation at each site to assist court to reach a decision (Munro and Munro, 2013).

Overview of Veterinary Forensics

Veterinary forensics is relatively new and rapidly developing field yet to get recognition in international forum. However, keeping aside, the complexity of multispecies variation, forensic veterinary pathologists are working tirelessly to establish this discipline in global sector. The job of forensic veterinary pathologists is very confusing as it comprises of multispecies variation ranging from tiny and timid companion animals to large and ferocious wildlife creatures. For this reason, present write-up concentrates on 4 selected aspects of forensic veterinary pathology (Ottinger et al., 2014).

A. Estimation of the age of skin wounds
B. Estimation of the age of bruising
C. Diagnosis of drowning
D. Estimation of the time since death.

A. Estimation of the age of skin wounds

Wound examination is the toughest job for a veterinary forensic pathologist as it acts as substantial evidential interest to determine whether the wound has occurred before or after death. A well-developed wheal type response around the wound margin and leucocytic infiltration upon microscopical examination is a clear guide to anti-mortem injury. As certain leucocytes are also found after death, so, the significant period elapsed between time of injury and death of animal acts as the vital cog in determining the anti-mortem nature of wound.

Ideally forensic veterinary pathologists should have a crystal-clear understanding of the pathophysiology of wound healing process in the animal under investigation. The healing process is basically divided into 3 phases: - inflammatory, proliferative and maturation. Inflammatory phase is marked by events like early blood clotting and development of extracellular matrix followed by proliferative phase that is characterised by shifting of neutrophil predomination in early inflammatory response to macrophage invasion in older lesions, angiogenesis, fibroplasia (myofibroblasts synthesise glycoproteins) and epithelisation (formation of vascular network and collagen synthesis) which ultimately leads to maturation or remodelling. These observations facilitate forensic veterinary pathologists to develop evidence against time that has been elapsed since injury (Hosgood, 2006).

B. Estimation of age of bruising

Scientifically bruise can be defined as “hematoma of tissue”. In a broader sense, it can be defined as the crushing of cells and blood vessels in the injured area resulting into extravasation of blood and cellular fluids. On later stages, it may involve degeneration, inflammation of muscle and adipose tissue. Age of bruise can be calculated based on intensity of
trauma which is the primary focus of forensic investigation. There are 2 types of trauma –

- Blunt force trauma which includes lacerations, abrasions, and contusions. Lacerations mainly affect collagen fibres of body that leads to loosening of elasticity. Abrasions result from rough force applied over skin which results in scraping of epidermis leading to hyperemic epidermal layer. Contusions are simple extravasations of RBC into tissue that is manifested by petechiae, ecchymoses, and hematomas.

- Sharp force trauma includes incisions that arises due to application of sharp objects like scalpel, knives, scissors, ice pack, nails which sometimes lead to bone fracture (Viner and Kagan, 2018)

Gross examination of bruises leads to estimation of ages based on the time duration and gradation of lesions (Munro and Munro, 2013).

- 0 – 10 h post injury – Red and haemorrhagic.
- 24h – Dark red
- 24 -38h – watery in consistency.
- Over 3 days – rusty orange and soapy touch.

Microbiological examination includes Fouchet’s test with the help of Fouchet’s reagent which involves bilirubin estimation that is formed by haemoglobin degradation (Munro and Munro, 2013)

- Until 50 – 60 h post injury – no colour development
- 60 – 72 h – very light to blue colour
- 3 – 5-day old bruises – diffuse dark green at periphery with brown centre
- 5 – 8-day old bruises – little or no blue colour

C. Diagnosis of drowning

Exploration of drowning cases in domestic and companion animals serve as the most challenging job for a forensic pathologist. Detailed gross and microscopical examinations are required to establish the conformation regarding death outside or inside water. Further, taphonomonic changes due to maceration, decomposition, and scavenging must be differentiated from antemortem lesions that may indicate struggling or entrapment. Microscopic changes may include alveolar overdistension, alveolar septa attenuation, narrowing of alveolar capillaries, haemorrhagic oedema within the alveoli and aspirated foreign material in bronchi. Swallowing of excess amount of water leads to tear in stomach wall which acts as pathognomonic lesion of drowning (Viner and Kagan, 2018).

D. Estimation of the time since death

Estimation of time since death seems to be a routine affair in human forensic cases but in veterinary perspective, matter is relatively complex as it is driven by multiple factors depending upon the category and species involved. But usually 2 basic approaches are essential to estimate the time of death –

- Measurement of changes that took place at a known rate (Rigor mortis, Algor mortis, Putrefaction).
- Measurement of changes that took place at an unknown rate (extent of digestion of last meal etc.).

There are certain methods adopted in veterinary forensics investigation to demonstrate the time elapsed since death like

- Temperature based methods
- Postmortem chemistry
- Gross appearance of body based on rigor mortis, eye shape, colour, luminosity, decomposition etc.
- Histopathology and electron microscopy
- Radiology
- DNA and RNA analyses
- Environmental and associated evidence

CONCLUSION

As veterinary forensics field is expanding, continued research in this area will boost up the knowledge level of veterinarians and paraveterinarians who are investigating these
cases involving animals. The biggest challenge in this field is cognitive biases which are inherent human factors that cannot be wiped off. But the role of veterinary pathologists is crucial as they should provide a balanced and factual interpretation of autopsy findings based on the history and evidence not on preconceived assumptions. Currently veterinary forensics field laid exciting possibilities of expansion and refinement when it would be collaborated with specialists of other disciplines including those of diverse subjects like DNA technology, forensic entomology, electron microscopy and ballistics to arrive at a certain investigative conclusion.

REFERENCES


Nutritional Strategies to Ameliorate the Impact of Heat Stress in Pigs

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ABSTRACT

Heat stress (HS) is a multi-factorial problem that negatively impacts the pig’s performance. The effects of HS on swine productivity range from reduced feed intake and body weight gain to reduced reproductive efficiency and altered carcass composition and meat quality. Management of HS requires multiple strategies and nutritional interventions represent a practical guide to ameliorate the negative impacts of heat stress in the pigs. Nutritional strategies for controlling HS include adjusting the dietary levels of protein and fiber. Increasing energy density by replacing fiber with fat sources can reduce the impact of HS on growing pigs and increase the amount of energy received per kg of feed intake. Some micronutrients addition is also helpful in boosting immunity and correction of acid-base balance and thus contributes to HS management in pigs.

INTRODUCTION

Heat stress (HS) can negatively impact animal health, and extreme cases may result in reduced animal welfare and mortality depending on the severity of the heat load. Livestock primarily use non-evaporative cooling (radiation, convection, and conduction) to exchange heat with their environment. However, when the ambient temperature rises to an animal’s upper critical limit, non-evaporative cooling is no longer efficient and animals rely more on evaporative cooling from the skin (e.g., sweating) and upper respiratory tract (e.g., panting). Unfortunately, swine do not possess functional sweat glands and their lungs are relatively small, thus increasing pig’s susceptibility to HS. Under heat stress, pigs lower their appetite due to the thermal effect of feed (TEF) to reduce their heat output. This reduction of feed intake is dependent on animal-related factors such as body weight, breed, and sexual type and environmental factors such as housing, feeding, and the
climatic conditions. Decreased feed consumption results in decreased growth of the pigs and reproductive performance of sows which affects the profitability of the swine producers. Therefore, it is important to maintain the ambient temperature at the appropriate level based on the production stage and avoid rapid temperature fluctuations to improve the productivity and health of swine. According to the fact that management strategies (fan, evaporative cooling system, floor cooling, drip cooling, snout cooling etc.) are usually expensive, not economically feasible in most cases particularly in many tropical small scale producers. Therefore, nutritional strategies are the alternative techniques that can be recommended to minimize the negative impact of heat stress in pig production.

Nutritional strategies to alleviate the heat stress

Reduction of dietary heat increment

The depressed feed intake in hot weather is commonly considered as an adaptation to reduce metabolic heat production. Heat increment because of the metabolic utilization of crude protein (CP) or fiber is higher than for starch or fat. The higher heat increment of CP is partly related to the deamination of the excess of amino acids (AA) for urea synthesis and a higher protein turnover which enhances heat production. According to Le Bellego et al. (2001), a reduction of dietary CP content from 18.9 to 12.3 % in 35 kg pigs resulted in a reduction of 7% of total heat production attributed to a decrease of the thermic effect of feed (TEF) component of energy expenditure. Practically, CP is partially replaced by starch and/or fat and industrial amino acids to meet the protein requirement for optimal performance. A decrease of dietary CP content without a synthetic AA supplementation results in a strong reduction in growth performance due to AA imbalance. It can also be suggested that the benefit of using low increment diets should be increased in commercial conditions, in particular those found in tropical humid areas.

Increase of dietary nutrient density

The increase of the dietary nutrient density in the diet could also be a good alternative for alleviating the depressed feed consumption and performance in pigs maintained in hot conditions. The increase of dietary energy and/or protein contents can compensate for the reduced feed intake in pigs reared under hot conditions. According to their high energy density, fat products can be added to increase the energetic content of the diet. Moreover, energy from fat is more efficiently used for production than starch purposes which reduces dietary heat increment and the heat burden of the pig during heat stress. It has been reported that feeding high-fat diets to heat-stressed finishing pigs positively affected growth performance. It appeared that, for these animals, the adjustment of intake in response to changes in nutrient density was not complete. In other words, the increase of body weight and the related increase of gastrointestinal capacity might play a large role in the ability of the pig to adjust its feed intake to energy density.

Changes in micronutrient composition

The development of nutritional strategies to cope with heat stress must also address metabolic, physiological, and immunological disturbances induced by heat stress. As a result of sweating and/or panting, the blood acid-base balance is disturbed by hyperventilation and results in respiratory alkalosis in heat-stressed animals. The alteration in electrolyte status and the detrimental effect of respiratory alkalosis on performance must be corrected by mineral supplementation. In addition, according to the fact that heat stress could induce oxidative injuries, a supplementation of vitamins could have beneficial effects on the performance of heat-stressed animals. Zhao and Guo (2005) showed that selenium and vitamin E supplementation improved the resistance of pigs against heat stress. More generally, the ability of micronutrients in addition to enhance performance under hot conditions depends on the physiological stage of the animals (growing vs. reproductive animals).
Use of water

Water intake during heat stress is a limiting factor for survival and performance since water has a fundamental role in the heat exchange system for temperature regulation and maintenance of hydric balance. High environmental temperatures increase the water requirements for pigs. The increased consumption combined with increased urinary water losses is an effective mechanism for pigs to lose body heat. In lactating sows, a reduced water intake as a result of a restricted water flow through nipple drinkers decreased the voluntary feed intake and increased the body weight loss. In addition, in many high temperatures regions, drinking water provided to pigs is often warm. According to Jeon et al. (2006), supplying water at 15°C instead of 22°C improved the performance of both lactating sows and their litters during the summer period. As a result, chilled water will provide adequate cooling to enable the lactating sows to increase their intake of feed and milk output during heat stress.

CONCLUSION

Heat stress is a key limiting factor to efficient swine production and has a negative impact on the health and well-being of swine if inappropriately managed. However, research to develop nutritional strategies have provided producers with tools to reduce or promote recovery from heat stress and improve the overall health and productivity of swine. The use of low increment diets or high-density diets can effectively attenuate the effect of heat stress in particular in finishing pigs or in lactating sows but only when diets are correctly balanced for AA to energy ratio.

Despite these advances, pigs still succumb to the negative effects of heat stress and this can reduce animal welfare, and cause economic losses for the producer. Therefore, there is an urgent need for research to enhance swine heat stress resilience while improving both productivity and animal welfare.

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Utilization Patterns of Livestock Waste: Waste is Wealth!!!

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ABSTRACT
India has about 535.78 million livestock population and the amount of livestock waste produces is about 3 million tonnes annually. Common livestock waste at the farm level includes dung, urine, placenta, bedding, feed wastage, milk-house wastes, etc. These livestock wastes are the major source of noxious gases, harmful pathogens and odour, hence, it has public health and environmental concern. Livestock waste contains many beneficial constituents that if recycled effectively, can be used as fertilizer for crops, fodder for animals. Economic savings is the major benefit of waste management achieving by improvements in human health and the environment, leading to higher productivity, lower medical costs, and ultimate increase in farmer’s income.

INTRODUCTION
"Here are few things certain in life - one is death, second is change and the other is waste." No one can stop these things to take place in our lives. But with better management, we can prepare ourselves. This study is dealing with livestock waste and turning of livestock waste into valuable products. India has about 535.78 million livestock population and the amount of livestock waste produces is about 3 million tonnes annually. Common livestock wastes at the farm level are dung, urine, placenta, bedding, feed wastage, milk-house wastes, etc. (Sweta et al., 2018). The livestock waste is major source of noxious gases, harmful pathogens and odour; hence, it has public health and environmental concern. Hence, livestock waste is to be managed properly to mitigate production of these pollutants to protect the environment. About 40% of global methane is produced by agriculture and livestock by-products followed by 18% from waste disposal globally (Sorathiya et al. 2014). One of the
most common practices of livestock waste utilization is usually collected at the end of the day, shaped into cakes, and used primarily as fuel. This practice is unhygienic and can spread the diseases in addition to the practice being environmentally unfriendly at the same time (Ghatoura and Fattah, 2015). According to World Health Organization, about 1.6 million people, mostly women and children, die each year due to cooking and heating with wood, dung, coal, or crop waste.

**Different utilization pattern of livestock wastes**

livestock waste contains many beneficial constituents that if recycled effectively, can be used as fertilizer for crops, fodder for animals and to produce energy.

1. **Manure used as fertilizer**

Manure contains nitrogen, phosphorus, and other nutrients that plants need to grow. Farmers can often save money by effectively use manure as a fertilizer. Manure can be applied on land in its raw form, or after processing (for example, composting, pelletizing, and nutrient extraction). Manure nutrients can also be used to grow worms, insect larvae, algae, or other living organisms. Through “biomass conversion,” these organisms transfer manure nutrients to their bodies or castings, which can then be harvested and used as fertilizer, animal feeds, or soil amendments.

2. **Biogas**

Manure contains a lot of carbon and other elements that can be used to generate biogas. Anaerobic digestion is a technology that uses microbes to process manure into biogas. Biogas can be used to generate heat or electricity for the use on the farm or sale to the local power grid.

3. **Bio-oil**

Thermal processes of manure can produce liquid bio-oil fuels, including biodiesel, and useful byproducts like biochar. Bio-oils can be used for heating or generating electricity. Biodiesel can be used just like petroleum diesel.

4. **Special fiber products**

Manure fiber has been used to produce several specialty consumer products like plant growth medium (like peat moss), seed starter pots, fertilizer garden sculptures, paper, and building materials. Consumer products help turn manure from a potential environmental liability to a commodity.

5. **Animal house bedding**

Many dairy farms use separated manure solids for bedding which saves money.

6. **Panchagavya**

*Panchagavya* or *panchakavyam* is a mixture that is prepared by mixing five ingredients. The three direct constituents are cow dung, urine, and milk; the two derived products are curd and ghee. These are mixed in proper ratio and then allowed to ferment. When it used in Ayurvedic medicine also called cowpathy.

7. **Algal cultivation**

The carbon dioxide is a major component in the product gases from anaerobic digestion and thermo-chemical conversion processes from livestock waste which can be used for production of algal biomass.

8. **Livestock fish integration**

Integration of fish with livestock farming is the best method for recycling of organic wastes. Cattle manure has been used extensively in India as a source of manure in carp polyculture.

9. **Biodegradable plastic**

Poultry feathers are also converted into biodegradable plastic by a process called polymerization. In this process, feathers that contain keratin protein are pulverized into fine dust.
10. Electricity generation

The energetic potential of poultry litter is high. Several types of technologies are being implemented for conversion of this type of biomass to electrical energy. Anaerobic digestion and biomethanation of poultry litter results in methane (biogas) production which are used to run turbine to generate power.

11. Technical textiles

The nonwoven is prepared by using low-cost chicken feathers. The advantage of application of chicken feathers in textile field is wide. The nonwoven textile materials prepared by chicken feathers are very versatile and have a wide application in the field of technical textiles.

Benefits of livestock waste management:

- Prevents the hazardous environmental impacts on air, water, soil, wildlife, and the marine.
- Protects human health in communities and at waste management facilities.
- Minimizes the risks associated with the waste.
- Increases business opportunities.
- Achieves economic savings by improvements in human health and the environment, leading to higher productivity, lower medical costs.
- Creates employment, including low, medium, and high-skilled jobs.
- Delivers more attractive and pleasant human settlements and better social amenity.
- Encourages changes in community attitudes and behaviours.

CONCLUSION

Livestock waste can be recycled by many modern ways to combat rising energy prices, sustainable agricultural and reduce the environmental threats from traditional livestock waste management practices. These eco-friendly utilization patterns would be the source of additional income for farmers with ecological development of agriculture and animal husbandry.

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Lumpy Skin Disease (LSD): An Economic Crisis Among Farmers

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ABSTRACT

Lumpy skin disease (LSD) is a contagious, vector-borne, highly infectious, eruptive, and occasionally lethal disease of indigenous cattle, exotic cattle and water buffaloes caused by a virus of the genus Capripox (family Poxviridae), which is also known as Neethling virus. LSD has a low mortality rate, usually less than 10-13%. LSD has an economical role because of cessation of milk production in cattle and buffaloes and permanent damage to hides in buffaloes, the prolonged debilitating and wasting effect, especially in severely affected animals resulting in reduced weight gain, cessation of milk production as a result of thelitis & mastitis, temporary or permanent infertility or even sterility, impotency in bulls as a consequence of orchitis, and abortion in approximately 8-10% of infected pregnant cows.

INTRODUCTION

Lumpy skin disease (LSD) is contagious and arthropod-borne, pox disease of both indigenous & exotic domestic cattle and Asian water buffalo, and is characterized by the eruption of skin nodules caused by lumpy skin disease virus (LSDV), a virus from the genus Capripox virus, family Poxviridae. The more susceptible breeds to LSD infection are exotic breeds of cattle such as Holstein Friesian (HF), Jersey breeds, and Water Buffaloes while indigenous cattle breeds are less susceptible. The Incubation period is of 3-5 weeks, the disease is characterized by chronic debility in infected animals, reduced milk production, poor growth, infertility, abortion in cows & buffaloes while, sterility & impotency in bulls and sometimes death. Moreover, permanent and severe damage can occur to hides, reducing their commercial value. Transmission mainly occurs by the mosquito species like...
Aedes aegypti, biting flies like Stable fly (Stomoxys calcitrans), and some African tick species of the Rhipicephalus, and through ingestion of contaminated feed or water, direct contact, natural mating or artificial insemination by contaminated equipment.

LSD outbreaks occur in epidemics in several years span. Outbreaks are seasonal but may occur at any season because in many affected regions no season is completely vector-free. Host susceptibility, dose, and route of inoculation affect the pathogenicity of the virus which in turn decides the severity of diseases. Morbidity rate varies between 10 and 20% while, mortality rates of 1 to 5% are observed.

Geo distribution

“LSD was first described in Zambia in 1929”. “Lumpy skin disease is widespread and endemic throughout Africa, excluding Algeria, Morocco, and Tunisia”. “Since 2014, LSD has advanced into the northern part of Cyprus, Greece (2015), Bulgaria, the Former Yugoslav Republic of Macedonia, Serbia, Montenegro, Albania and Kosovo (2016)”. Currently, there is an increased risk of LSD reaching Central Asia, Southern Asia (India, Pakistan 2019 & 2020), Western Europe, and Central-Eastern Europe.

LSD outbreaks in India

Lumpy skin disease is an emerging and transboundary disease. LSD being contagious and arthropod transmitted in origin led to severe and great damage to cattle & buffalo population in India. After the arrival of monsoon in India particularly in the Chhotanagpur plateau region which covers parts of Odissa, Jharkhand, West-Bengal, and Chhattisgarh, the level of moisture become very high during wet weather leading to flourishing vector population, which served the main source for disease origin. Three outbreaks were reported 2 being in Mayurbhanj district and 1 in Bhadrak district of Odissa and Skin scabs samples were sent to the National Institute of High-Security Animal Diseases (NISHAD) in Bhopal. They confirmed cases of LSD among cattle by isolating viruses. It was found that 79 out of 932 samples were positive with an apparent morbidity rate of 8.48% (Dept of Animal Husbandry and Dairying, 2019). In January 2020, cases of lumpy skin disease were noted in Palakkad, Thrissur and Malappuram districts of Kerala (Department of Animal husbandry, Kerala). However, the disease was controlled by proper preventive measures. Hyderabad, Telangana has also faced LSD outbreaks recently in February and March 2020 in which all the infected animals succumbed to death.

![Fig. A diseased cattle in Bhadrak district of Odissa (pashudhanpraharee.com)](image)

The main symptoms include skin or subcutaneous nodules (0.5-5cm in diameter) and swollen superficial lymph nodes. These nodules can also affect the nasal, oral, ocular, and genital mucosa. Skin lesions may persist as hard lumps or deep ulcers comprise granulation tissue which often suppurates.

Papules are most easily seen in hairless areas of perineum, udder, inner ear, muzzle, and eyelids, which lead to the development of ulcerative lesions with excessive salivation, lacrimation and nasal discharge that may contain LSD virus. This virus infection is more severe in cows at the peak of lactation and causes a sharp
drop in milk production due to high fever (40-
41°C) and secondary bacterial mastitis.

Diagnosis

Diagnosis (tentative) of the virus mainly
depends on clinical signs, differential
diagnosis, and laboratory tests using PCR. PCR
test can be said as a confirmatory test using
specific primers for capripox. Direct Immuno-
Fluorescence, Virus Neutralization Test,
Enzyme-Linked Immuno-Sorbent Assay
(ELISA), and Immune Blotting can be used for
the identification of LSD virus antigens in
infected animals.

Approaches for prevention and control

In Infected countries, avoid movement of
infected animals and proper disinfection should
be after proper disposal of dead carcass
followed by check on potential vectors. Anti-
mosquito nets can be considered in cases when
cattle are permanently kept indoors. Only live
vaccines are currently available against
LSDV. Calves vaccinated at 3 to 6 months of
age followed by Annual vaccination are
recommended. Live attenuated LSDV
vaccines provide good protection in cattle if 80
percent vaccination coverage is attained.
Regional vaccination campaigns should be
preferred to ring vaccination. Attenuated Sheep
poxvirus vaccines are very common to be used
in regions where both LSD and sheep pox are
prevalent.

Treatment

No specific antiviral treatment for this virus has
been found yet. Isolation of sick animals along
with supportive treatment is practiced e.g.
antibiotics, anti-inflammatory drugs, and
vitamin supplements are given.

CONCLUSION

Dairy farming and Leather industry are one of
the largest sources of economy in the Northeast
& Southern states of India. The estimated
annual income of Orissa and Jharkhand state
from Dairy farming of about INR 250-350 and
180-220 billion respectively and Hide business
of about INR 10-12 and 8-10 billion respectively. The current outbreak of LSD led
to serious losses to the farmers and
entrepreneurs engaged in the Dairy farming and
Leather industry sector. Proper management
and preventive measures need to gear up to
reduce the financial viability of farmers and
save them from the economic crisis.

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