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Growing seed

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PRODUCTION ENHANCEMENT IN ANIMALS WITH BYPASS NUTRIENT TECHNOLOGY

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The technology in which feed ingredients are protected from the hydrolysis, allows nutrients to bypass the rumen and get digested in the lower tract of the intestine. Protected nutrients mainly consist of bypass protein, bypass fat, protected starch, chelated minerals and vitamins. The bypass nutrients require animal because of horizontal and vertical growth of livestock for fulfilling future demand for milk. Feeds and forages in tropical countries are of poor quality. Energy and protein requirement for maintenance and growth for high producing animals often exceeds the amount that is available in the feed, which leads to negative energy balance (NEB). Different cereal grains and oils are included in diets to increase the energy density of the feed. But the addition of cereals and oils lead to depressed dry matter intake and fibre digestion which causes low milk fat syndrome in the lactating animals.

Bypass protein

The bypass protein escapes from digestion in the rumen. It passes without damage to the lower digestive tract then digested and finally absorbed in the lower gastrointestinal tract. It provides high-quality dietary amino acids and protein directly to the animal, so it improves the performance of Livestock.

Requirement of bypass protein

When dietary protein amount is low in the diet, less production of microbial protein takes place in the rumen by rumen microbes. The dietary protein is inefficient for the rapid growth and high milk production of animals, so bypass protein provides a source of protein that break free rumen fermentation and directly available to animals. It is also known as rumen undegradable protein, rumen-protected protein and rumen escape protein. Highly degradable proteinous cakes result in more ammonia production so for excretion of excess

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ammonia, animal spent energy to convert ammonia into urea in the liver. To improve the efficiency of utilization of protein from a highly degradable cake, this protein necessary to be protected from excessive degradation in the rumen. So, an amino acid is absorbed intact from the intestine for tissue protein synthesis and gluconeogenesis in the liver.

Sources of bypass protein

Maize gluten meal, cottonseed cake, fish meal, coconut cake and maize grain are a good source of protected proteins. Linseed cake, deoiled rice bran, soybean meal and *Leucaenea* leaf meal are having medium degradable protein. Mustard cake and Groundnut cake are highly degradable cakes. About 50 to 70 per cent of total N in tree forage may be present as protected protein and contains 16- 53 per cent nitrogen as ADIN. It is due to the presence of tannin (condensed) which binds protein and reduces the degradability.

Method of protein protection

- ✓ By esophageal groove closure
- ✓ Post ruminal infusion
- ✓ By heat treatment
- ✓ By formaldehyde treatment
- ✓ Protection of amino acids

1. Use of amino acid analogues
2. Use of encapsulated amino acid

Oesophagal groove closure

The extension of the oesophagus takes place from the cardia to reticulo-omasal orifice. Oesophagus groove closure is a process that occurs by conditional reflex, and it is stimulated by an act of sucking or drinking. It can also occur in adult animals. Copper sulphate use for this purpose, after oesophageal closure any liquid to pass directly through an oesophagal groove into the abomasum.

Post ruminal infusion

Protein or amino acids put directly into duodenum or abomasum. Post ruminal infusion is doing for casein or S-containing amino acids. Casein is (as a source of protein) infused directly into abomasums.

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Heat treatment

Dry heating of feed ingredients is at > 100°C at different exposure time. E.g. heating of groundnut cake and soybean is for 150°C (2 hours) and 100°C (30 seconds) respectively (Walli, 2005). Traditional boiling also protects the crushed maize and wheat protein. Inactivation of several enzymes and inhibiting factors, improve the nutritive value of the feeds, so it enhances the animal performance.

Binding with tannin

Tannin is a naturally occurring phenolic compound. It is two types i.e. hydrolysable and condensed tannin. Tannin- protein complex is not degraded easily in the rumen. This complex degraded in the small intestine. Hydrolysable tannin is used @ 2-4 per cent in animal's feeds.

Formaldehyde treatment

The dose of formaldehyde is 0.5- 1.5 per cent of CP for concentrate and 1.3- 2 per cent of CP for Hay. The feed material is sealed in plastic bags for 4 days so formalin gets adsorbed on the cake particle. It improves pH-dependent protection to proteins against proteolytic enzymes. In the acidic pH (abomasum), the bonds of feeds materials are loosened, and protein is release, so proteins are free for digestion.

Effect of formaldehyde-treated bypass protein

Protect essential amino acids is available for tissue protein synthesis, and formaldehyde is degraded to CO_2 and H_2O in the liver. In the case of milking animal milk safe for human consumption as no trace of formalin detected in milk. Formaldehyde has also checked the growth of moulds and fewer aflatoxins storage. Formaldehyde treatment also reduces the glucosinolate of mustard cake.

Encapsulation

Encapsulation of protein and amino acid provides insoluble polymer bypass in an acidic condition of abomasum, e.g. Kaolin, Tristerene, 2- methyl 5-vinyl styrene etc. Use of amino acid analogues like methionine hydroxy analogue (MHA), N-hydroxymethyl-methionine is beneficial for animals.

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Feeding schedule of rumen bypass protein

Feeding of bypass protein is more beneficial when the animal's need for protein is not fulfilling through microbial protein. Feeding by bypass protein is necessary during the early lactation period of high producers (20 kg/day), rapidly growing (1 kg/day) calves, animals feeding poor quality roughages and stressed animals.

Table 1: Specification for bypass protein feed

Characteristics	Percent DM Basis
Moisture, % by mass, Max.	10
CP (N×6.25), % by mass, Min.	30
EE, % by mass, Min.	3.5
CF, % by mass, Max.	8.0
AIA, % by mass, Max.	2.5
UDP, % by mass, Min.	20
RDP, % by mass, Max.	9

Source: NDDB, Anand

Significance of bypass protein

- ✓ Use of bypass protein reduces dietary amino acid loss as ammonia and urea conserve energy through less urea synthesis in the rumen.
- ✓ Use of bypass protein increases the availability of amino acids supply
- ✓ Enhance efficient protein synthesis
- ✓ The increases growth rate of calves by 25-30 per cent.
- ✓ Early age at first calving of heifers
- ✓ Increases milk yield about 10 per cent.
- ✓ Improve reproductive efficiency

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Rumen protected fat

Fat is a high-density energy source provide 2.25 times more energy than carbohydrate. Feeding rumen-protected fat prevents negative energy balance during early lactation. Feeding is also helpful in "Energy challenged" phase. It prevents acidosis and laminitis, lowering heat production and prevents dustiness of feed. Use of rumen-active oil kills rumen bacteria, reduces fibre digestion and produces *trans*-fatty acids, so milk fat depression.

Limitation

The dairy animal can digest 5-7 per cent of fat in their diet (Palmquist, 1991) and fat in dairy ration should be maximum 6-7 per cent on DMB (NRC, 2001).

Use of excess dietary fat

Due to lower intestinal absorption of fat at high intake, reduces dry matter intake. Excessive fat supplementation can decrease fibre digestion because the coating of fibrous portion of a diet with lipids, modification in the number of cellulose-degrading bacteria, and reduces the availability of essential minerals as it makes complexes with mineral- fatty acids. Rumen bypass fat has a high melting point, insoluble at a temperature of the rumen and no negative effect on rumen fermentation.

Methods of fat protection

- ✓ Natural dietary rumen-protected fat is oils seed due to natural protection due to hard outer seed cover (eg. Cottonseed and full-fat soya)
- ✓ Hydrogenation of fat
- ✓ Formaldehyde treatment of oilseeds
- ✓ The calcium salt of long-chain fatty acids
- ✓ Fusion method
- ✓ Crystalline/ prilled fatty acids (eg. tallow) are made from saturated fat or hydrogenated fatty acids. Due to high melting point, solid at a room to rumen temperature (39 ºC) and melts at above 50 ºC. It remains inert in the rumen and proper digestible in the small intestine.

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Formaldehyde treatment of oilseeds

The crushed oilseeds are treated with formaldehyde (1.2 gram per 100 gram protein) in plastic bags or silo for a week. Internal fatty acids content of oilseeds is protected from lipolysis and biohydrogenation.

Fusion Method

In this method, fatty acids heated with Ca $(OH)_2$ in the presence of catalyst so feeds product has become like a hard mass of calcium saponified salts.

Indigenous Method

Four kg rice bran oil is heated in an aluminium vessel; add 1.6 kg calcium hydroxide dissolved in 10 litres of water, boil for 30 minutes without cover, filter through a cloth and sundried. The product obtained, contains 70-75 per cent fat, 7-8 per cent Ca, 80-85 per cent rumen-protected fat. (Naik, 2013).

Property of Ca soap

The calcium-soap is inert if the pH remains > 5.5. The calcium-soap dissociated and then absorbed efficiently in the small intestine in acidic pH of the abomasum.

Limitation

Due to pungent soapy taste, it has poor palatability and not completely inert in the rumen.

Feeding of Bypass fat

Commercial Preparations like Dairylac, Magnapac and Megalac use as a bypass fat in animals. Dose rate should be 0.4 to 0.8 kg/cow/day after calving diets with gradual adaptation into the feeds for some days**.**

Benefits of feeding Bypass fat

Dairy cattle have a compulsory need for fat that is fulfilled through bypass fat. It Increases energy density of feeds with more-balanced rations. Feeding bypass fat increases milk production and quality, reduced chance of ketosis and fatty liver syndrome, improves

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digestive performance, minimize body weight loss after calving, and improve body condition and reproductive performance of animals.

Conclusion

Dietary fat and proteins are necessary and costly nutrients ingredients in the ration of animals. So these nutrients should be protected from degradation in the rumen to fulfil the high nutritional demand in high producing animals. Thus, bypass protein and bypass fat are essential feeds ingredients to enhance the productivity of animals.

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INSECT AS POLLUTION INDICATORS OF ENVIRONMENT

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Pollution is the definition of contaminations like (solid, liquid, gas, and even light) into their natural environment that causes an adverse change in the environment. These effects are like to be the degradation of natural resources and nature. Many of the ecosystems the insects are responsible for some process in the ecosystem, and the entire communities will be a loss. The insect responses to a strong understanding of their human activity are necessary. Sometimes human also one of the disturbances on ecosystems. Indicator species means which the species are present, absence (or) abundance reflects a specific environmental condition, habitat (or) community. It may provide information on the overall health and ecosystem. When the species is present, it indicates the presence of certain environmental parameters. The species can provide forecasting of environmental changes. They can be used to assess the health of an environment (or) ecosystem- they are often termed as “Bio-indicators”.

Aquatic insects as Water Pollution Indicators

Insects that live completely (or) carry a major part of their life cycle in water can tell directly about water pollution. Several insects live in freshwaters such as Larvae of Mosquitoes, Odonates, and Neuropterans. The absence of these larvae indicates the presence of Arsenic and Lead concentrations in water.

Dragonflies and Damselflies:

Dragonflies and damselflies are the important predatory group in the quality of biological water monitoring and otherwise are used as particular species also sensitive to pollution.

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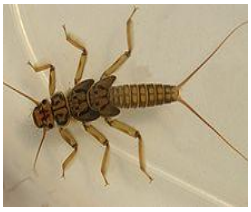
Mayfly

Mayfly larvae are one of the most important for their sensitivity to oxygen depletion in running water and also used as an indicator of water pollution. The larval period of the mayfly life cycle is more than adults. The larvae are sensitive to dissolved oxygen levels in the water.

Caddisflies

These group of insects Caddisflies (Trichoptera), the larvae occurs in freshwater. Only for several species are sensitive to water pollution, and they are also used as bioindicators for the purity of water.

Stone flies



Stonefly (Plecoptera) larvae can live only in the clear water, and these stoneflies prefer well-oxygenated water to survive.

Bugs

Bugs (Hemiptera) of many families like Corixidae, Nepidae, Notonectidae, Belestomatidae, and Gerridae are acting as bio-indicator to determine the purity of water.

Polluted Water Indicators

Many aquatic organisms formation of tolerance to metals has been detailed by the Metallothioneins (MT). MTs means it is a measurement of metal tolerance; this measurement can provide clues about the tolerance in this organism and the possible toxic agents responsible for environmental stress. For the example of genus Halobates (Gerridae) one of the most suitable for bio-indication of Cadmium & Mercury.

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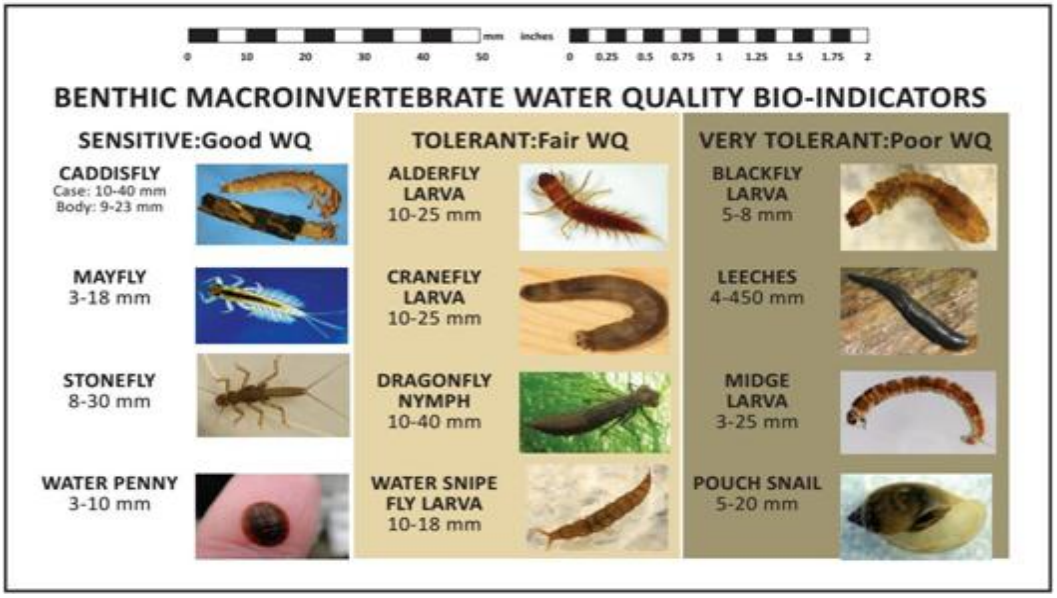

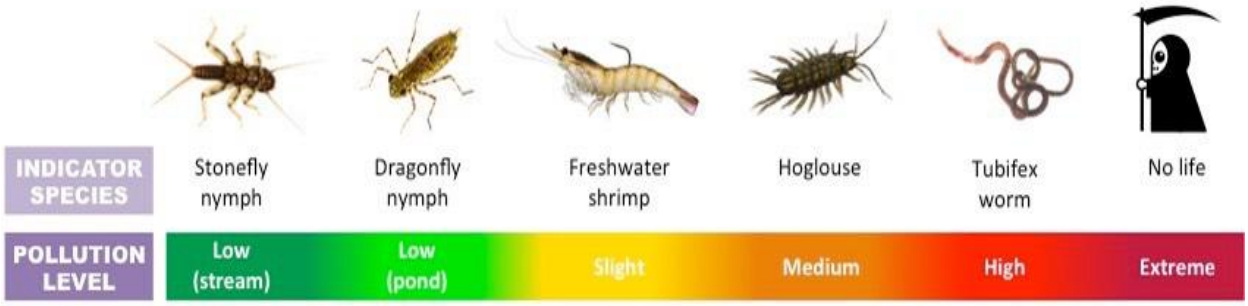

Insects as Terrestrial Pollution indicator

Terrestrial insects are good bio-indicators, and it is used for several types of environmental change. Traditionally soil invertebrates are used to indicate soil fertility and pollutant level. Occurrence of excess acidic (or) alkaline content, fertilizers (or) industrial waste kills larvae, grubs, nymphs and adults of these insects. The insects are not able to lay their eggs on polluted land areas. Several insect groups can be used as terrestrial environment bio-indicator, which are as follows

Coleoptera

Family Carabidae insects are the most important predators in the order Coleoptera. They involved in the monitoring of pollutant from oil, sulfur, herbicides, Co_2, insecticides and radioactive phosphorus.

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Collembola

Apterygote insects that are influencing the soil fertility and stimulation of microbial activity. The inhibition of diseases causing plant-like such as bacteria and fungi. These insects are sensitive to changes in the soil, and reduction in the number of insects to the pollution by heavy metals, usage of pesticides in agricultural soils and soil water acidification by organic pollutants and wastes.

Ants

Ants are used as quality bioindicators of soil and are very sensitive to human impact. Some ant groups have the potential as biological indicators of soil conditions, crop management and assessment systems for plantations in agro-ecosystem.

Insects as Light Pollution indicators

Excess exposure to light disturbs the developmental cycle of many insects. Their daily activity regime (or) biological clock is negatively affected (Eg)- Migration of Monarch butterflies disturbs due to heavy flashlights at night time. Insect species affected by Sound Pollution

- Sounds are an important part of social insects life history. Generally, males are produced advertisement calls to attract females (or) to drive out competitive males out of their territory
- Negative effect of vehicular horns, the noise of moving vehicles and other sources suppress the advertisement call of male insects

Insects as Industrial Pollution indicators

- Pollutes the entire ecosystem and Unprocessed industrial output, when enters ecosystem leads to a phenomenon called “Biomagnification.”
- Biomagnification- Accumulation of insecticides (or) pesticides in an increased amount from one trophic level to other trophic levels

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- Famous example- Industrial revolution (or) Industrial melanism- Peppered moth/ British moth- *Biston betularia*

Mainly the Bees are only the most important pollinators and as well as bioindicators. Several researches were aimed mainly on the hymenopteran insects. The strength of the pollinators and its size of the populations are generally considered the most important features for the reproduction of plants, especially to the agricultural crops. In Recent news mass dying out of honeybee in the United States of America because of fertilizers has brought honeybees to the list of endangered species.

Lepidoptera- Moths & Butterflies The members of this group can be used as pollution indicators via., heavy metals & carbon dioxide in localities near the industrial and within urban areas. Pupae of various species of Geometridae, Noctuidae and Eriocraniidae, are accountable for studying manifestation and concerns of Cu, Fe, Nickel, Cadmium, Sulfuric acid ions and other substances in fertilizers

Other bioindicator insect groups

Termites- Increases soil infiltration capacity, which leads to water retention & soil productivity. In agricultural, pasture and reforestation areas they are not always perceived because its nests are underground and their presence is only noticed by the damage they cause to the plants

Aphids also one of the pollutant indicators. When the hosts are exposed in the aphids, increases the density of the highest population to the higher carbon dioxide in their environment.

Conclusion

According to these changes in the environmental conditions, only several species are responses than the others. Diversity of insect population was more in agricultural and forest ecosystem and better ecology stability in nature. Biodiversity is used to reduces the usage of inorganic compounds in agricultural and horticultural areas. Honey bees are used for

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monitoring the metal trace, pesticide and herbicidal effects in the environmental contamination and Essential for environmental monitoring. “They might be small, but they are the dominant species on the planet in terms of numbers. What happens to them affects whole ecosystems”.

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PLASMA APPLICATION TO SEED AS GERMINATION AND GROWTH ENHANCER

Article Id: AL202086

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Plasma is known as the fourth state of matter after solid, liquid, gas and it is distinguished with several properties like temperature (hot and cold plasma), fluid flow quality due to miscellaneous modules of plasma and particle nature (e.g. electron, neutron, ions) and as a substrate under the influence of external magnetic and electric fields. In earlier researches, plasma was used as an appropriate method for the decontamination of food and prevents food spoilage for food safety but now a day's scientist is working on the application of plasma for seed quality enhancement, sterilization of seed for storage and control the pest and pathogens in storage condition. It was reported by many scientists that plasma treatment for a few minutes or even seconds improves germination, seedling growth, vigour and biochemical properties of subjected seeds. Plasma tends to interfere with the cell membrane, and changes some of its core quality, resulted in high seed quality.

Plasma considered as substance having elevated energy with charged particle and reactive oxygen species which modify the outer surface as well as internal processes of seed after exposure. Plasma alters seed coat properties and makes it more permeable for water imbibition which stimulates hydrolytic enzyme activities, transfer of energy in the form of stored food material from endosperm to embryo which causes quick germination and seedling growth. High metabolic activity of germinating seed under the influence of plasma treatment may be due to the generation of reactive oxygen species. It increases the activity of superoxide dismutase and nitrate reductase, which protects the plant at the time of various stress conditions. Plasma widely used for sterilization and destruction of microflora occurrence on the surface of plant seed. In the case of plasma exposure, intensity and duration play a greater role since too low intensity may not affect the speed up to a level of significant changes while too strong intensity may have a detrimental impact on seedling growth. Numerous studies have shown that plasma enhances the wettability of seeds through

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modification in seed coat structure due to the collision of ions and reactive oxygen species generated through plasma.

Role of Plasma in Improvement of Germination

Plasma treated seeds germinate faster and uniformly in comparison to untreated seeds; however, the performance of seed largely depends on dose and duration of plasma exposure. Every crop responds in a dissimilar manner on the exposure of plasma in terms of germination, growth and yield. Under favourable as well as abiotic stress condition plasma treated seeds show improved germination rate. The prime reason behind this betterment may be due to higher water absorptive capacity of treated seeds in comparison to untreated seeds. Plasma exposure modifies seed surface characteristics and leads to higher hydrophilicity and water uptake. Quick and rapid water absorption promotes germination under supporting and antagonistic farm situation too. It was reported that seeds of cotton treated with cold plasma using argon gas for the duration of 3 and 27 minutes resulted in higher water absorption and germination percentage over untreated seeds (Groot *et al.*, 2018). Reports of higher germination due to plasma treatment are reported in many crops included wheat, rice, sunflower, chickpea.

Role of Plasma in Improvement of Seedling Growth

Apart from enhancing germination rate, plasma exposure boosts sprout length, dry mass of sprout and vigour of seedling, which also gives seed an upper hand under lack of resources or stressed conditions. Due to the alteration in cell wall property of seed surface, water absorption increase through seeds which leads to a quick breakdown of a food reserve, rapid germination and extension of radicle and plumule. Through the plasma treatment, both hydrophobic and hydrophilic thin layers of seed get exposed and observe various changes. These changes help the seed in different cultivation conditions. In wet soil, hydrophobic layers delay water uptake while hydrophilicity gives rise to the higher moisture uptake and stimulate germination at a quick rate under dry conditions. They indicated that the composition of gases in plasma treatment does not bring change in the genome structure of seed but modify seed surface characteristics, catalyze enzymes activities of germinating seeds. The soluble protein content, sugar content and dehydrogenase enzyme activity of seeds get modified due to plasma exposure. Reoriented enzymes improve the growth of radicle and plumule, reactive oxygen species emitted during plasma treatment enhance the metabolic

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activity, scavenge damage due to stress condition and boost growth parameters (Randeniya and Groot, 2015).

Role of Plasma in Improvement of Seed Biochemical Activities

Due to plasma treatment, stimulation in enzyme activities inside the seed occurs, which includes the higher activity of α amylase, protease and dehydrogenase etc. These enzymes are known as core hydrolytic enzyme and take part in the breakdown of food material stored in endosperm. This breakdown supplies energy to the embryo and initiates germination. Apart from this, seed surface got softer due to oxidation, and plasma gasses interaction with micro-molecules of seed and reactive species perforated though seed coat easily and alter the biochemical activity of seed. Increment in enzyme activity was reported in case of moong seeds after the application of plasma in comparison to control(Sadhu *et al.*, 2017). This increase encourages higher and speedy germination under both favourable as well as the adverse situation.

Role of Plasma in emergence and establishment of crop

Apart from performing better under the controlled condition of laboratory, plasma-treated seeds show superior results in farm condition as well over untreated seeds. Results collected from various laboratory studies confirm higher uptake of water, advanced enzymatic activity and improved germination in plasma treated seeds which also indicate improved results in the field too. Numerous researches show that pre-sowing plasma treatment to seed resulted in uniform crop stand, better growth and yield of various cereals, pulses and oilseed crops. Wheat yield of plasma-treated seed increased 5.89% higher than control while growth parameters including plant height, root length, leaf area and fresh weight were also recorded higher over untreated seeds (Jiafeng*et al.*, 2014).

Conclusion

Plasma is one of the most advanced and modernized seed treatments for a strengthening of seed and parallel to this; it enhances the quality of seed. However, intensity and duration of plasma exposure to the different crop seeds need to standardize for optimum results. Low power plasma may not affect the seed germination and growth while too strong plasma may also have a detrimental effect on seedling growth, but optimum strength

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significantly influences germination and seedling vigour indices. This technique has the potential to change the crop growth scenario, which needs to be exploring for future vision.

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BOVINE RESPIRATORY DISEASE (BRD) IN CATTLE

Article Id: AL202087

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Cattle are susceptible to various types of infectious agents during their life cycle. Viral and bacterial infections are the most common among these cattle, although it does not always cause clinical symptoms or disease. Most of them affect the respiratory tract, results in bovine respiratory disease complex (BRDC) with varying morbidity and mortality rate and lowered the economic return to the farmers. BRDC caused by the bacteria and viruses including bacterium; *Mannheimia haemolytica* and *P multocida and* viruses; bovine respiratory syncytial, bovine herpesvirus-1, parainfluenza-3 virus, bovine viral diarrhea virus, bovine adenovirus (BAV) and, more recently, bovine coronaviruses (BCV). In addition to this, environmental factors such as transport, adverse weather, co-mingling and stressful events may also enhance the BRD infection. Bovine Respiratory Disease (BRD) is also known as "shipping fever. BRD is most prevalent within the first weeks of arrival to the feedlot, but it can occur later in the feeding period and is also seen in calves on pasture.

The general symptoms of the BRDC

- Fever
- Rapid shallow breathing.
- Coughing
- Nasal and eye discharge.
- Salivation.
- Lack of appetite

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BHV1 (bovine herpesvirus-1)

BHV1 infection leads to a variety of clinical syndromes resulting from infection of the genital, respiratory, or digestive tract: abortion, encephalitis, mastitis, and tracheitis. Endemic infection is more common in most regions of the world. BHV1 infection caused mucosal lesions of the pharyngeal tonsil, which leads to loss of microvilli and goblet cells, resulting in necrosis of the epithelium and adjacent lymphoid tissue and leukocyte exudation. BHV1 infection may affect antigen-specific as well as nonspecific defence mechanisms. It has been reported that mitogenic response of peripheral blood mononuclear cells stimulated by concanavalin A is suppressed during BHV1 infection and a significant decrease in the percentage of T cells and non-T, non-B cells but a significant increase in B cells and monocyte. Both inactivated and live attenuated vaccines are available for the prevention of this disease. The inactivated vaccines are given at 3-week interval, starting from the age of 3-4 months. Live attenuated vaccines are given either once or twice depending on the type of vaccine. Duration of immunity usually lasts from six months to one year

PI-3 (parainfluenza-3) virus

Parainfluenza-3 virus is associated with both acute and chronic pneumonia in cattle. Infection with PI3 is often concurrent with bovine herpesvirus-1. The clinical signs of the infection include fever, cough, and nasal and ocular discharges. The PI3 infection of alveolar macrophages results in decreasing the ability to kill the bacteria. The infected alveolar macrophages inhibit the lymphocyte response to concanavalin A and IL-2 .PI3 infection leads to an increase in the secretion of histamine by mast cells and enhanced ionophore induced release. This reaction is associated with type 1 hypersensitivity responses, which could ultimately have adverse effects on respiratory clearance and which might facilitate pulmonary colonization by bacteria. Both modified live vaccine and killed vaccines are available for the prevention of PI-3 infection.

BVDV (bovine viral diarrhea virus)

BVD infects in a number of ways, either by a congenital infection of the fetus or after birth. This virus to cross the placenta during early pregnancy and may cause abortion and if the calf is born than infected calves will shed BVDV continuously in the farm environment.

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The Symptom in calves is the cerebellar hypoplasia and but in adults, clinical signs are highly variable, which include fever, lethargy, loss of appetite, ocular discharge, nasal dischargem oral lesions, diarrhea and decreasing milk production and in severe cases**,** the calf may die. The vaccines for BVD are available, which include the modified live virus (MLV) vaccines and killed virus (KV) vaccines. The MLV vaccines require only one dose during the initial immunization step; however**,** they are more difficult to handle. KV vaccines are usually more expensive and more than one dose is required during immunization. However, KV vaccines are less susceptible to deactivation by temperature extremes, and they are less susceptible to deactivation by chemicals.

BCV (bovine corona viruses)

Bovine coronaviruses are enveloped viruses. BCV infections in cattle are worldwide. it is pneumoenteric virus that infects the upper and lower respiratory tract, and intestine leads to three distinct clinical syndromes in cattle: (1) calf diarrhea, (2) winter dysentery with hemorrhagic diarrhea in adults, and (3) respiratory infections. No consistent antigenic or genetic markers have been identified to discriminate this virus from different clinical syndromes. The infections can be diagnosed by detection of the virus, viral antigen, or viral RNA in tissues, secretions, or excretions of infected animals. No vaccines have been developed to prevent BCV-associated pneumonia in cattle.

Conclusion

Viral and bacterial infections are the most common, which mostly affect the respiratory tract. The most common respiratory disease is bovine respiratory syncytial, bovine herpesvirus-1, parainfluenza-3 virus, bovine viral diarrhea virus, bovine adenovirus (BAV) and, more recently, bovine coronaviruses (BCV). This bovine respiratory disease complex (BRDC) is most prevalent within the first weeks of arrival to the feedlot, so the recognition and treatment of Bovine Respiratory Disease Complex are very important to prevent the economic loss to the farmers. The BRDC treatment response can be difficult to predict. Most of the focus is on BRD that occurs during the first 30 to 60 days following feedlot arrival and 90% to 95%. Several researches are going on BRD to understand the respiratory microbiome and also looking into antimicrobial resistance, improving, and vaccines as well as getting a better understanding of the disease complex.

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AGROMICROBES POTENTIAL TO ENHANCE SOILS FERTILITY AND YIELD

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Microorganisms are very important components of the ecosystem; played central roles in Earth's climatic, geochemical, geological, and biological evolution (Xu, 2006). They are regulating various biotic activities in the forest, water, as well as soil ecosystem, making it dynamic for nutrient turn over and sustainable for plant growth and crop development. But soil nutrient levels can reduce over time when crop plants are harvested, as nutrients do not come back to the soil. Soil ecosystem diversity is also decreased due to extensive use of the chemical fertilizer, pesticide and herbicides use in the extensive commercial agriculture system. Microorganisms are essential for the majority of soil ecosystem functions and services. In agriculture, the role of microorganism is very important for maintaining the fertility of soils. They play a central and essential role in the biogeochemical cycling of nutrients in soils health.

Agricultural production primarily depends on the health of soils, which is a measure of a complex set of biological, chemical and physical interactions driven by microorganisms. Living microorganisms are an important tool for efficient utilization of solar energy, biogeochemical cycling of nutrients in soils and recycling of organic molecules. Microorganisms are used to promote plants growth and the increasing availability of primary nutrients to the host plant.

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Bioherbicide is another way of controlling weeds without environmental exposure caused by artificial herb killing chemical agent or synthetic herbicides. Bioherbicides are preparing by microorganisms (i.e. viruses, bacteria, fungi) and certain insects like painted lady butterfly and parasitic wasps, which can target particular weeds. The microbes have power over invasive genes that can attack the resistance genes of the weeds, thereby killing it (https://isaaa.org/).

Biopesticides are certain types of pesticides derived from such natural materials such as bacteria, animals, plants, and certain minerals. Microbial pesticides consist of a microorganism, i.e., virus, bacteria, fungi and protozoa, as the active constituent. Microbial pesticides can manage numerous classes of pests, although each separate active ingredient is comparatively specific for its target pest[s]. The most commonly used microbial pesticides are subspecies and strains of *Bacillus thuringiensis*, or Bt. April 2016, there are 299 registered active ingredients of biopesticide and 1401 active biopesticide product registrations (www.epa.gov/).

Agricultural microbiology is concerned with the association between microbes and crops with an emphasis on improving yields and fight against plant diseases. Microorganisms are responsible for maintenance of soil structures, and sustainability of soil quality for efficient plant growth these microorganisms are known as friendly microorganisms or effective microorganism. A concept of "Friendly microorganisms" was proposed by Professor Teruo Higa in 1982 from the University of Ryukyus in Okinawa, Japan. The Dominance principle is classifying the three groups of Effective Microorganism i)—positive microorganisms (regeneration) ii). Negative microorganisms (degeneration) and iii). Opportunist microorganisms" (regeneration or degeneration). Micro-organisms are played a very important role to the processes of regeneration and decomposition required for phosphorus cycle, nitrogen cycle and other elements in the natural environment. Some living microorganism or latent cells are mixed with inert substance as used as the biofertilizers. It increases the nutrients of host plants when applied to their seeds, plant surface or soils by colonizing the rhizosphere of the plant.

Role of microorganisms in soil

Microbial ecology examines the diversity of microorganisms and how micro-organisms interact with each other and with their environment to generate and to maintain

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such diversities. There are five different types of soil microbes such as bacteria, actinomycetes, fungi, Algae and protozoa (Table 1). Each of these microbe types has a different job to boost soil as well as plant health.

Table 1: Microbial diversity present in per gram of soils in natural environments.

S.N.	Microorganism in fertile soils	Number (Millions g^{-1} of soils)
1.	Bacteria	1-100
2.	Actinomycetes	0.1-1.0
3.	Fungi	0.1-1.0
4.	Algae	0.01-0.1
5.	Protozoa	0.01-0.1

Bacteria

Bacteria are microscopic prokaryotes; ubiquitous, single-celled organism, live in soils, wastewater, the ocean as well as the human gut. Bacteria are classified on shape-based of cells such as Round bacteria called cocci, cylindrical, Capsule shaped known as bacilli and spirilla etc. Food and Agriculture Organization (FAO) once said: "Bacteria may well be the most valuable of life forms in the soil." Agriculture has a complex relationship with bacteria and another microorganism (Table 2).

Table 2: Microbial activities influencing plant growth and health

Characteristics	Microorganism
Ammonifying bacteria	Bacillus subtilis, B. mycoides, B. ramosus
Nitrifying bacteria	Nitrosomonas, Nitrosococcus, Nitrobacter Nitrococcus.
Nitrogen-fixing bacteria	Azotobacter, Clostridium, Rhizobium spp. Azospirillum, Blue-green algae (cyanobacteria)
Biopesticides	Bacillus thuringiensis, Agrobacterium radiobacter, Bacillus subtilis var. amyloliquefaciens, Pseudomonas chlororaphis, Hirsutella thompsonii
Bioherbicides	Streptomyces anulatus Xanthomonas and Pseudomonas

Actinomycetes

Actinomycetes are gram-positive microorganism intermediate in form and function between bacteria and fungi. However, some actinomycetes typically form branched

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filamentous network and are capable of decomposing recalcitrant compounds such as cellulose, hemicelluloses and other chemical compounds. Streptomyces is actinomycetes produce antibiotic streptomycin and aureomycin for predators and damage the unwanted plant.

Fungi

Some specialized fungi colonize plant roots and extend far into the soil to acquire resources beyond the nutrient depletion zone that plants cannot access alone. Mycorrhizal fungal filaments in the soil are truly living extensions of plants root systems and are more effective in nutrient and water absorption than the roots themselves. They are u**b**iquitous, occurring in natural ecosystems in most climatic zones throughout the world. *Mycorrhizae* are as follows*:* Vesicular-arbuscular mycorrhizae (VAM), Ectomycorrhizae, Ectendomycorrhizae, Arbutoid, Monotropoid, Ericoid and Orchidioid.

Like bacteria, fungi also live in the root zone and helps make nutrients available to plants. For example, *Mycorrhizae* is a fungus that facilitate water and nutrient like Phosphorus uptake by the roots and plants to provide sugars, amino acids and other nutrients.

Table 3: Role of fungi in nutrient production and pest control

Property	Microorganism
Biofertilizers	Mycorrhizal fungi (ectomycorrhiza e.g. *Pisolithus tinctonus,* Arbuscular mycorrhizae e.g. *Glomus intraradices*
Bioherbicides	*Colletotrichum gloeosporioides f.sp. aeschynomene*, *Phoma herbarum, Sclerotinia minor, Puccinia thlaspes, Alternaria destruens and Phytophthora palmivora*
Biopesticides	*Beauveria bassiana, Trichoderma, Fusarium oxysporum and Metarrhizium spp.*

Protozoa

Protozoa are single-celled eukaryotes either free-living or parasitic larger microbes that love to consume organic matter, either bacteria or fungi or organic tissue and debris.

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Over 250 species of entomophilic protozoa are also known, out of which several show promise for insect pest control: *Malamaba lacustae* was observed to be effective against grasshoppers, and *Lambornella* sp. can control the mosquitoes population (Table 4). Some protozoa have played an important role in the decomposing cycle and plant growth, and are valuable bioindicators for natural and anthropogenic influences.

Table 4: Protozoa are important bioagents with their target

Protozoa	Target
Malameba locustae	Grasshoppers
Mattesia spp.	Lepidoptera, coleopteran
Nosema spp.	Grasshoppers, *Anapheles*
Octosporea muscaedomesticae	Muscoid flies

Beneficial Microbes in Agricultural crop production

The other dominant form of soil degradation is erosion and salinity, where the causative factors for former type include improper agricultural practices, deforestation and overgrazing. These practices degrade 38% of the world agricultural land, 21% permanent pasture and 18% forests and woodlands.

Tables 5: Important agromicrobes used to enhance soil and plant health the fix with primary nutrient

Group of microorganism	Type of association	Example
Nitrogen Fixing Microorganism		
Free-Living	No direct association	*Azotobactor, Clostridium, Nostoc*
Associative symbiotic	Loosely associated with root system	*Azospirillum,*
Symbiotic	Nodule Forming	*Rhizobium Sp., Casuarina alder, Frankia*
	Non-Nodule Forming	*Anabaena azolloe*

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P Solubilizing Biofertilizers		
Bacteria	No direct association	*Bacillus megaterium var phosphaticum Bacillis circulans, Pseudomonas striata*
Fungi	No direct association	*Penicillium sp., Aspergillus awamori*
P Mobilizing Biofertilizers		
Symbiotic	Ectomycorrhiza	*Laccaria sp., Pisolithus sp., Boletus sp. and Amanita sp.*
Symbiotic	Arbuscular mycorrhiza	*Glomus sp., Gigaspora sp., Acaulospora sp., Scutellospora sp. and Sclerocystis sp.*
Symbiotic	Orchid mycorrhiza	*Rhizoctonia solani*
Mocronutrient solubilizers Biofertilizers		
Bacteria	Silicate and Zinc solubilizers	*Bacillus sp.*
Plant Growth Promoting Rhizobacteria		
Pseudomonas		*Pseudomonas fluorescens*

Nitrogen-fixing and phosphate solubilizing bacteria may be considered to be PGPR including *Azotobacter, Azospirillum, Rhizobium* sp. (Fig. 1) other bacterial genera e.g. *Arthrobacter, Bacillus, Burkholderia, Enterobacter, Klebsiella, Pseudomonas* etc. also reported as PGPR (Badoni, *et al*., 2017). Chandra *et al.,* 2005 evaluate field trials, *Frateuria aurentia* also to be considered as PGPR.

Microbes used as Biofertilizers

Rhizospheric microorganisms contribute significantly to fixation of atmospheric nitrogen and solubilization of phosphorous, potassium, iron, as well as zinc from insoluble forms to plant-available forms, in the free-living state or in symbiosis association with plants. Apart from their nutrient-solubilizing abilities, rhizospheric microorganisms have the ability to produce plant growth hormones, ammonia, and siderophores. *Rhizobium* inoculants are used for leguminous crops. *Azatobacter* can be used with crops like wheat, maize, mustard, cotton, potato and other vegetable crops. *Azospirillum* inoculants are recommended mainly for sorghum, millets, maize, rice, sugarcane and wheat.

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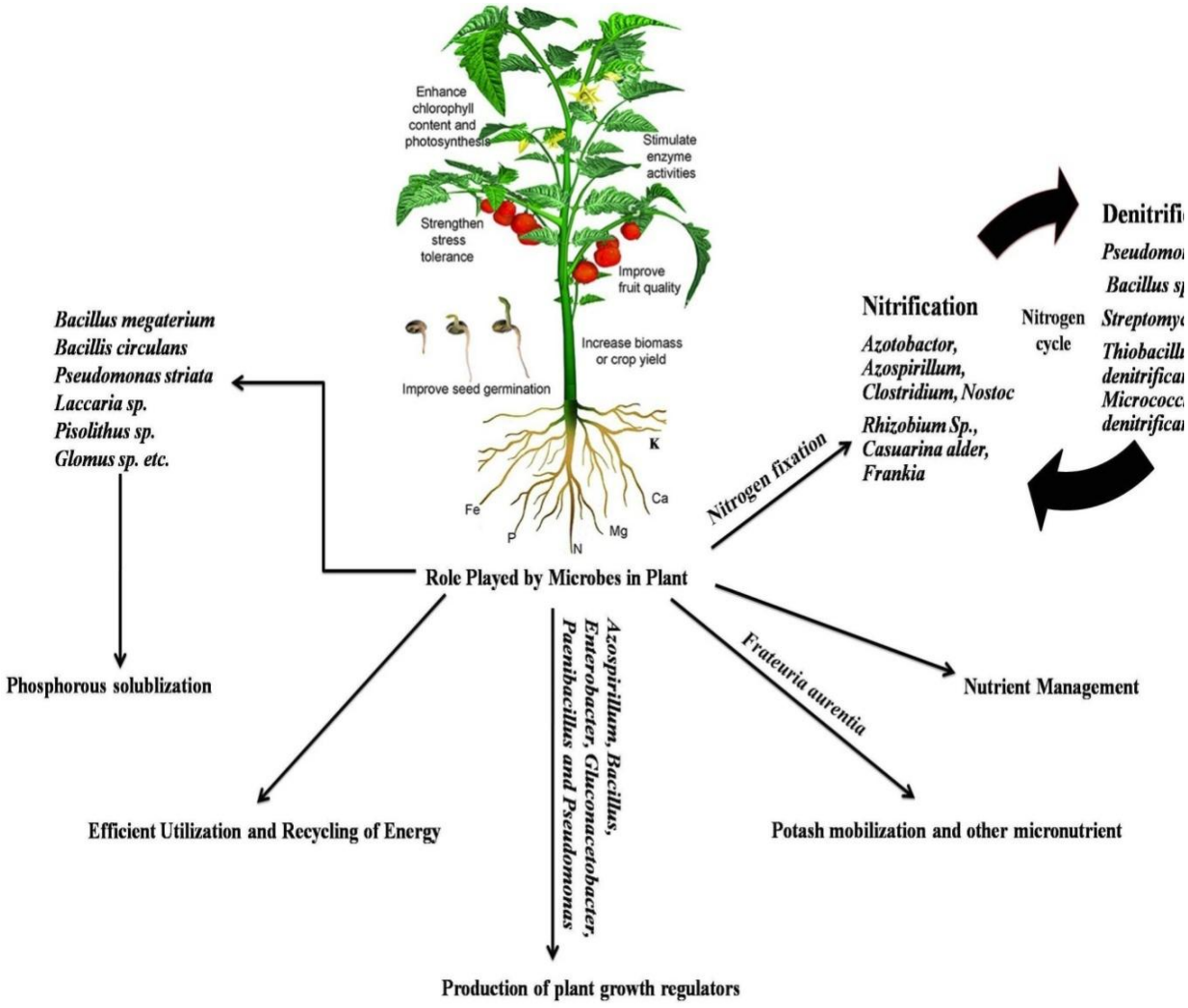

Fig. 1- Role of microorganism in the proper development of the plant. The different function performed such as minerals mobilization, essential elemental cycle regulating, and plant growth regulators for proper development of plant they all activity conducted by the microorganism**.**

Plant growth regulators produced by microbes

PGPB are mostly isolated from natural plant habitats, produced natural phytohormonal substances to promote plant growth. However, the efficacy of the action of plant growth-promoting bacteria depends on plant species, conditions of their growth and other factors (Marulanda *et al.*, 2009), increasing the workload of their testing and developing recommendations for their application.

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Plant Growth Regulators	Microorganism	Reference
Auxins	*Azospirillum, Pseudomonas*	Spaepen *et al.* 2007
Cytokinins	*Azotobacter vinelandii*	Azcon and Barea 1975
	Pantoea agglomerans	Omer *et al.* 2004
	Bacillus subtilis	Arkhipova *et al.* 2007
Gibberellins	*Proteus mirabilis*	Karadeniz *et al.* 2006
	P. vulgaris	
	Klebsiella pneumonia	
Abscisic acid (ABA)	*Azospirillum brasilense*	Cohen *et al*. 2009
Jasmonic acid	*Bacillus pumilus*	Forchetti *et al.* 2007
	Achromobacter xylosoxidans (endophytic bacteria of sunflower)	
Salicylic acid	*Pseudomonas aeruginosa*	De Meyer *et al*. 1999

Advantages of microorganism in agriculture field

1. Application of effective microorganism in the form of biofertilizers are cost-effective relative to chemical fertilizers; they have lower manufacturing cost, especially nitrogen and phosphorous use.

2. Microorganisms have improved the physical and chemical properties of soil and capacity to maintain soil fertility.

3. Use of microorganism as biofertilizers increases the crop yield by 10 – 20 % because it enhances the root proliferation of plants due to the release of growth-promoting hormones and provides against biotic stresses.

4. Biofertilizers are made by easily available natural sources viz. rice husk, leftover vegetables and organic matter, hence they are environment friendly.

5. Microorganism increases the organic matter content of the soil, therefore improving the water holding capacity, cation exchange capacity, soil aggregation and buffering capacity of soil against soil acidity, salinity, alkalinity, pesticides and toxic heavy chemicals.

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6. Biofertilizers supply food and encourage the growth of beneficial microorganism and earthworms.

Conclusion

Agromicrobes are a vital component for sustainable agriculture and the ever-green revolution. Agricultural microorganisms are improved the soil fertility and deliberating the plant nutrition for crop production as well as crop protection. The health of soil has been an indicator of agriculture as well as environmental sustainability. Phytohormones produced by microorganisms may exert beneficial effects on plants by influencing their growth, ability for the uptake of water and mineral nutrients, and by increasing their pathogen tolerance and resistance to abiotic stresses. However, further study of the effect of hormone production by microorganisms and their effect on plants is necessary to enable a stable and reproducible effect that may be used in agriculture for increasing crop yield.

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ORGANIC INPUTS: NUTRITIOUS WAY FOR SUSTAINABLE AGRICULTURE

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Organic inputs products have got more value as compared to inorganic products. Indiscriminate use of chemical fertilizers put onward a serious threat to the environment and creates a health hazard, residue problem in soil health. Organic inputs avoid or largely exclude the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. Organic input can be contributed to meaningful socio-economic and ecologically sustainable agriculture, especially in developing countries.

Without the use of organic input and long-term application of chemical fertilizers could lead to serious problems for soil quality, nutritional imbalance, and deterioration of the rhizosphere micro-ecological environment further increased the activity of heavy metal ions in the soil. However, the excessive use of inorganic fertilizers worldwide is associated with the accumulation of contaminants, e.g. arsenic (As), cadmium (Cd), fluorine (F), lead (Pb) and mercury (Hg) in agricultural soils which are very chronic for the environment and human health (Udeigwe *et al*, 2015). Many countries have reported alarming residues of agricultural chemicals in soil, water, air, agricultural products, and even in human blood and adipose tissue (Alvarez *et al*., 2017). This is an unavoidable condition. If the farmer does not stop excessive use of chemicals, many losses occur in future such as soils are barren, difficult to breathe in a polluted environment and soon. Organic nutritious is a way to correct answer for the problems being faced by agriculture in India today.

Organic input has several benefits for farmers, including cheaper inputs, using domestic materials for making nutritious, rich organic manure. Organic cash crop production is, however, also associated with problems, including potentially reduced yields, compared to intensive conventional methods, the costs of certification and high labour requirements. Now time to aware the farmers about side effects of agrochemicals and convince them to reduce

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the use of these chemical and adopt chemical-free inputs for sustainable production. Furthermore, systematically describe organic input such as Sanjivak, Jivamrut, Bijamrut, Panchagavya and Neemmastra methods and applications. Organic input is one of the several approaches found to meet the objectives of sustainable agriculture. Ecological friendly and environmental sustainability are closely intertwined and necessary components for truly sustainable agriculture. Hence discuss some important inputs which are farmers friendly and helpful to maximize crop productivity, improve soil fertility and environment.

Organic Inputs Procedure and Application

Organic inputs are the nutrient-rich substances, act as a growth promoter and protect the crop from pest and disease, without any residual effect on soil and environment. They contain all the properties like agrochemicals. Formulations of organic inputs are very easy and handy to use. They are eco friendly to nature. Some of the organic inputs as follows-

1. Sanjivak: Sanjivak solution has been prepared by mixing thorough of fresh cow dung- up to (400kg), fresh cow urine (200 lit), jaggary (1 kg), and water (600 lit). Take all the ingredients mix in a closed drum. Put it for ten days for fermentation. Dilute the solution 20 times with water. Ready Sanjivak solution was applied as soil spray or through irrigation. Three applications are needed one before sowing, second at 20 days after sowing and third at 45 days after sowing.

2. Jivamrut: Jivamrut solution has been prepared by mixing thorough of fresh cow dung (20 kg), fresh cow urine (20 lit), jaggary (1 kg), any pulse flour (4 kg) and water (200 lit). Take all the ingredients mix in a barrel. Put the solution for 5-10 days for fermentation. Shake the solution regularly three times a day after a fermentation solution is ready to use. The prepared solution has been applied through sprinkle on the soil or use with irrigation water. Apply the solution before sowing, second at 20 days after sowing and third at 45 days after sowing.

3. Bijamrut: Bijamrut solution has been prepared by mixing thorough of fresh cow dung (10 kg), fresh cow urine (10 lit), lime (500 gm), cow milk (1 lit) and water (200 lit). Mix cow dung, cow urine, cow milk and 500 gm lime in a drum. Add 200 lit water and mix thoroughly. Keep the solution overnight. Sprinkle the prepared solution over the seeds for treatment.

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4. Panchagavya: Panchagavya solution has been prepared by mixing thorough of fresh cow dung slurry (4 kg), fresh cow dung (1 kg), fresh cow urine (3 lit), deshi ghee (1 kg), cow milk (2 lit) and water (100 lit). Take all the ingredients in a drum. Put the solution of 7-10 days for fermentation. Stir the solution 2-3 times per day. Dilute the 3 lit of panchgavya in 100 lit of water. Spray the solution over soil.

5. Neemmastra: Neemmastra solution has been prepared by mixing thorough of fresh cow dung (5 kg), fresh cow urine (12.5 lit), neem leaves (12.5 kg) and water (250 lit). Take 12.5 kg neem leaves and crush them in water. Add 5 kg fresh cow dung and 12.5 lit cow urine. Put the solution for 24 hr for fermentation. Stir the solution at regular interval. Filter the Extract and dilute to 250 litres. Use as a foliar spray for one hectare.

Benefits of Organic Inputs

- All organic input enriches microorganisms' population and activity in the soil
- Improve soil quality and fertility. It provides nutrient to plants and increase growth.
- Reduced the toxicity of heavy metal and decompose the residue quickly.
- It is used for seed treatment as protects the crop from seed-borne and soil-borne diseases. It improves seed germination.
- Panchagavya contains macro and micronutrients, many vitamins, essential amino acids, growth-promoting hormone-like IAA, GA, which may provide nutrition to rhizosphere microorganisms and thus help to enhance their population.
- It is useful against sucking pests and mealy bugs.

Impact of Organic Inputs on Crop Yield and Soil Health

S.No.	Organic Input	Findings	References
1.	Panchagavya	**1.** Panchagavya contains primary macronutrients such as N, P and K, micronutrients, several vitamins, important amino acids and plant growth hormones like IAA, GA, which may provide nutrition to rhizosphere microorganisms and enhance their population. **2.** Foliar application of 3% panchagavya at 10 days intervals increases growth and yield attributes of chilli.	Natarajan (2007) Swain *et al.*, (2015)

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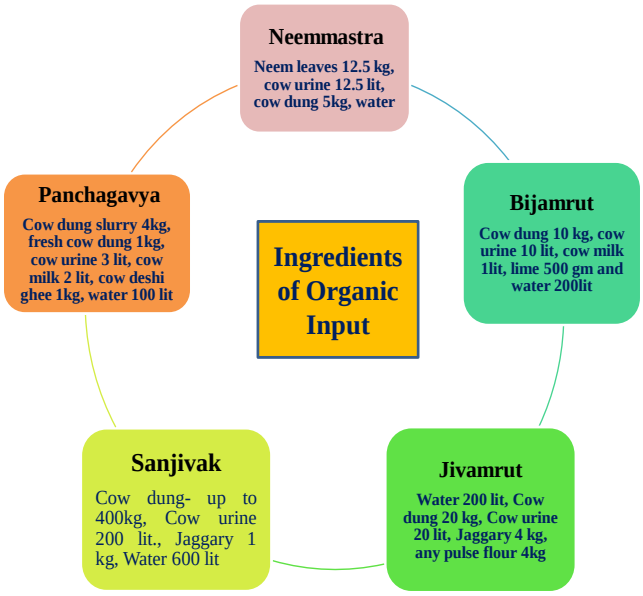
2.	Jivamruth	Jeevamruth contains huge amount of microbes which increases the microbial activity in soil.	Palekar, (2006)
3.	Bijamruth	Bijamiruth protect the crops from harmful soil and seed borne pathogens	Sreenivasa *et al.* (2009)
4.	Neemastra	20% neemastra found more effective against aphid, leafhopper, thrips and whitefly population in cotton.	Patel *et al*, (2017)

Conclusion

Organic inputs are rich in quality properties. They have the potential of sustainable crop production, improve soil health and maintain the environmental quality. They provide healthy and nutritious food to human. The uses of these formulations proved beneficial in several crops and boosted the yield. Application of organic inputs based on soil test report and optimum use of water can help to increase productivity. An integrated approach is necessary to promote the highly valuable virtues and wide applications of organic inputs. These organic inputs are a new version of ancient science. These inputs are definitely a promising formulation in the years to come. This is a new concept to the scientific community for further validation and refinement of these practices in the present scenario to boost food and nutritional security as well as save the soil health and environment.



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IMPACT ON INDIAN DAIRY SECTOR DURING COVID-19: CHALLENGES & OPPORTUNITIES

Article Id: AL202090

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Honourable prime minister of India announced lockdown on 25th march after 1-day Janata curfew due to the situation occurs from the global pandemic. All country, including India, was not knowing this type of situation. Meanwhile, this virus transmitted from human to human through coughing, sneezing like any other viral fever. For the reason of avoiding close contact with human to human lockdown leaves the only option for India. We have completed lockdown 4.0 wherewith allowing some sort of transportation and other economic activity. As of now, unlock is going on with all sort of activity by maintaining social distancing and avoiding any kind of public gathering. This has hit the most severely the informal economy, of which agriculture and the rest of the rural economy are a part. People's suffering and the economic crisis have been exacerbated by the central government 's stubborn refusal to acknowledge a crisis, take responsibility for its mismanagement and provide relief to the people. Indian dairy sector was facing challenges during that period but now on dairy sector overcome critical challenges slowly but steadily. According to CRISIL report Sales of value-added goods account for more than a third of the revenues of the consolidated dairy industry, which is expected to contract 2-3 per cent of this levy. Hereabout I want to add my view of the impact on the dairy sector amidst COVID-19 or better to say lockdown.

Effect on Indian dairy sector

Globally, the Association for Food and Agriculture (FAO) predicts changes in food supply and demand. It warns of a worldwide "food crisis" unless countries protect vulnerable people from hunger and malnutrition, and de-clog chains of the food supply. Similarly, the UN has warned that the Covid-19 crisis could trigger "food shortages" worldwide.

The spread of the Covid-19 forced the country to shut down. All the companies in India have been affected, including the dairy industry. Just important goods, including milk,

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are permitted to be delivered at home. However, the curfew in India has disrupted domestic consumption of milk. Mainly due to the closing of commercial outlets, there has been a sharp decline in demand for milk. The dairy industry was double hit by lockdown along with supply chain breakdown. Door to door selling of milk was totally disrupted as locale people did not allow milk salesman it was leading to the breakdown of the milk supply chain.

Sink in demand

After the country shut down for the COVID-19 lockdown about two weeks ago, the Rs 100,000 Crore Indian Milk Industry experienced a 25-30 per cent decline in demand. Although demand grew 15-20 per cent in the first two days with consumers hoarding milk, demand gradually decreased from the third day on. A significant proportion of the drop in demand is attributed to out-of-home consumption, resulting in 15 per cent of milk intake, resulting in a grinding halt.However, given the decrease in demand, the milk procurement is not reduced because the dairy cooperatives must abide by the notice from the government not to interfere with the livelihoods of the farmers. But all businesses, cooperatives, were slowly coping with initial damages. RS: R.S. Sodhi chairman and MD, Amul, says things average slowly. Now demand has risen between 10% and 12%, which was originally about 35%. Although out-of-home consumption is now zero, consumers buy products such as paneer, ghee and cheese in huge quantities from retail outlets.

Wastage of milk

More than 70 per cent of milk is supplied by small farmers; milk provides instant cash for their livelihood. Such small farmers are hardest hit due to lower demand and thus no partial recruitment. Much of the unorganized dairy sector, including milk workers, milk companies, creamers / urban-specific private dairy shops, etc., are managed, and only 30% are managed by the organized industry — dairy cooperatives and private Milk plants. Milk is a perishable product, so it cannot be processed without sufficient preparation. This is why farmers claim fresh milk dumping from different parts of the country. As thousands of sweet shops stay shut down during lockout, the small and medium dairies suffer tremendous losses, and daily gallons of milk get wasted. Dozens of dairy owners, who were suppliers of milk to the sweet shops, now only milk the bovines once a day, and since there are no buyers on the market, gallons of milk gets wasted.

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Challenges due to COVID-19 on Dairy sector

COVID-19 has changed millions of lives and livelihoods around the world. The virus has levied a variety of taxes on dairy farmers. Here I will discuss some of the big issues that occur in the dairy industry because of COVID-19:

Firstly, dairy animal care, and secondly, the distribution and selling of milk and other by-products. Both grocery stores and sweet shops are closed as a result of the lockout, which leads to low demand for milk and other dairy products.

Milk prices have dropped, putting greater pressure on the farmers. Every new challenge teaches us something and COVID-19 has offered the dairy farmers a range of lessons and new perspectives on future management and growth.

On the webinar organised by N.D.D.B chairman Dilip Rath said, during this pandemic milch animal has been faced feeding and healthcare problem along with fodder availability that would impact the reproductive efficiency and productivity of the milch animal.

Price of milk is drastically reduced due to less household consumption and surpluses. Supply of milk is way more than the demand for milk that leads shift of both supply and demand curve. For that reason, the price-determining equilibrium point is to switch its position from the previous one, and the price got reduced.

Organised cooperatives and individual dairy farmers have laid off employees to cut the cost due to drastic fall in sales and at times threw away milk on roads and rivers as they could not sell it due to lack of transportation and closure of markets.

Milk collection centres were shut, and milkmen were barred from entering villages in several states, affecting supply.

Co-operative units — that opened with the help of the administration — suffered from a lack of labour supply, as fears of unemployment led migrant workers to go back to their native villages.

Opportunity arises

As a result of the Covid-19 pandemic, our dairy industry has proved to be more resilient than many other sectors in terms of the extent of supply chain disruption. Millions of

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our animal-owned households, the majority of which are smallholders, particularly those linked to producer-centric institutions, continued to milk their cows and buffaloes and sold surpluses to village milk collection centers. Milk was then pooled, cooled and transported to processing centers where it was pasteurized, packaged and shipped to thousands of marketing outlets, finally finding its way to millions of homes.

The New White Revolution: How COVID-19 could benefit the dairy sector

Of note, both milk production and milk prices in several parts of the world were hit by shortages in the supply chain during the initial phases of the lockdown. The information gathered by the National Dairy Development Board (NDDB) from the dairy cooperatives shows that the daily sales of liquid milk by the dairy cooperatives fell by about 15 per cent during the Covid-19 lock-up period from 1-15 March to 8-14 April and that the share of sales to the dairy cooperatives fell by about 8.8 per cent during the same period. Liquid milk sales are showing signs of steady growth, thanks to central and state policies and strong support, as well as measures are taken by producer-qualified organizations to resolve supply chain challenges. Disruption appears to have had a major impact on unorganized private players, as they have a higher share of goods in their sales portfolio than dairy cooperatives. It was therefore very reasonable for milk to be diverted to dairy cooperatives in areas/milk sheds where there was a stronger presence of private players, as a consequence of which product prices were also reduced due to the disparity between demand and supply.

To boost the selling of milk and milk products, a number of dairy organizations have introduced home delivery of milk and milk products, including mobile carts, buses, e-commerce, etc. All of these programs have helped improve the milk market and open up e-commerce opportunities. Many smart and progressive dairy farmers have made their surplus milk into khoa, paneer, ghee, and so on and sold it through informal networks to the markets in the neighbourhoods. Both of these actions supported the dairy industry. In the present context, the supply of milk to SMP to meet the rising demand for milk and milk products makes smart business sense for our dairy industry. Following market disruptions, milk procurement during the Covid-19 lockdown suggests that the dairy sector has started building up commodity stocks to meet lean season requirements.

Ensuring uninterrupted supply of milk: Milk cooperatives such as Mother Dairy, Amul, Nandini, Parag and many others travelled an extra mile to supply the surplus milk to farmers,

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while hundreds of milk plants across the country produced skimmed milk powder to supply the surplus milk. But despite these odds, there was no way to protect the dairy farmers from India 's cooperative model. In the United States, the broken supply chains forced the dairy farmers to dump their milk. The different situation occurred in parts of Europe where fresh produce had been wasted. "But our cooperatives decided to stand by the farmers; we didn't discourage supply despite a drop in sales. We continued to supply the farmers with milk that resulted in surplus milk. We used this 'extra' milk in skimmed milk powder production," said Dilip Rath, NDDB Chairman.

Bio-security & Hygiene: There seems to be a lot of news about milk adulteration as it impedes nation credibility on the global market. Milk has been mishandled, malpractices that decrease consumer confidence in the enterprise. Now this situation gives producer, cooperative, corporation, middleman the opportunity to regain customer confidence by maintaining hygienic farm condition, bio-safety etc. Pathogens management, bio-safety, and sanitation are vital to animal welfare. The main gate to the Farm remains closed. One individual can be given the job of a watchman checking stray animals for trespassing and entering. Due consideration should be given to farmworkers for their cleanliness and hygiene.

Feed availability: Commercial farms must have stored/preserved fodder stocks (silage or hay) that can last for 2 to 3 months or longer. Small farms may have wheat/paddy straw or maize. A farmer has to be conscious of the method that enriches wheat straw with urea. Animals fed with this enriched wheat straw would have a greater protein content. Most growing non-fodders faced fodder shortages in the middle of the crisis in order to feed the livestock. Businessmen meanwhile have the opportunity to start a new business connected to the supply of food.

Value Addition: It will open up a new company path to added value. Milk processing-paneer or curd can be made for sale at the farm gate. This can be processed into products like ghee, or milk powder which have a longer shelf life because selling or disposing of milk is a serious issue.

Conclusion

COVID-19 is an enormous problem for India; its vast population and the reliance of the economy on illicit labour make lockdowns and other steps of social isolation highly

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destructive. The central and state governments acknowledged the threat and reacted aggressively — but it should be only the beginning of this response. India has to be prepared to step it up as things unfold, alleviating the economic impacts by much stronger funding for public services and policies that keep economies running. Dairy industry overcoming its challenges slowly, and we believe this will back into the right track. We will come back stronger than ever.

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RECIRCULATING AQUACULTURE SYSTEM: A HIGHLY PRODUCTIVE CLOSED FISH FARMING METHOD

Article Id: AL202091

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India is the second-largest aquaculture fish producer and third largest fish producing country in the world. Fish and fisheries product accounts 10% of total production and 20% of agriculture products, contribute 1.24% of the national GVA and 7.28% to the agriculture GVA (Gross value added) of the country (2018-19). This sector emerged as the largest group in agriculture product, its product account 13.93 lakh metric tons in terms of quantity and Rs. Forty-six thousand five hundred eighty-nine crores in value during 2018-19.

This sector has vast potential to enhance fisheries and fish farmer income. Because of this, the Government of India launched a scheme "**Pradhan Mantri Matsya Sampada Yojana (PMMSY)**" that approved a total estimated investment of **Rs 20,050** crores in the fisheries sector to enhance blue revolution. To gets the benefits of this scheme, and for enhancing the income, farmers have to adopt the best techniques and method for fish production. Aquaculture, which contributes 65% of inland fish production, can increase the income of farmers. Different type of aquaculture system, such as cage culture, pen culture, irrigated or flow-through systems, tanks and raceways, etc., have been adopted by farmers. Nevertheless, these systems and methods required a larger land area, so, the farmer who does not have a larger land area is incapable of adopting this farming system. To solve this problem, scientist developed a closed fish farming system, which occupies the lesser area in comparison to other farming systems, known as Recirculatory aquaculture system. RAS system uses only a limited amount of water and reuses it if any farmer lives in limited water resources area can adopt this system. This system is ecofriendly because of low waste production, efficient utilization of feed and reuse of water.

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What is RAS

Recirculation aquaculture system is a technology for farming of fish and other aquatic organisms, in which different type of mechanical and biological filters are used to remove the waste component from water, and after some treatment, water is reused again for culture the organism.

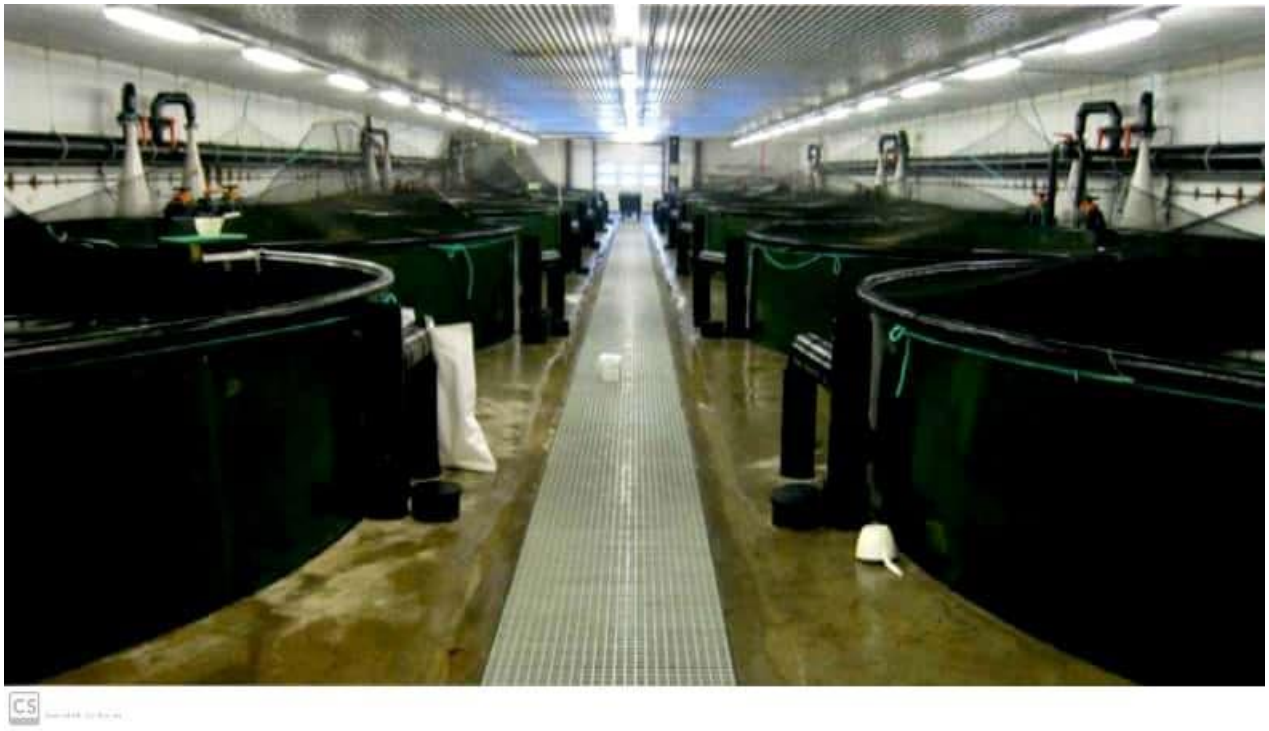

Fig.1: An Indoor recirculatory system.

Equipment of RAS

A)Tanks:- Fish density determines the sizing of the fish tank. Three types of tanks commonly used for RAS.

I) **circular tank**:- fingerling and broodstock culture is dominate in a circular design. The inherent structure and hydrodynamic nature dominate the circular tank in ras industry. The walls of this tank are constructed by thin polyethene plastic or sturdier fibreglass materials. Solids waste eas remove due to its sloping centre bottom.

II) **Rectangular tank**: - In compare to circular tank, rectangular tanks are 20% more efficient in space utilization and easily harvested. However, solid waste movement is

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poor in this tank. Water quality problem rises if waste particle accumulated on the floor of the tank. So, the aeration system is used to clear these waste particles.

III) **Raceway tanks**: -This type of tank often seen in marine culture. To facilitate the control of water's circulation, a third wall is situated along the length of the tank. It is the best tank in all the three tanks.

B) **Circulation units**: - Major source of energy consumption in the RAS system is water pump or air blower which circulate the water in tanks. Failure of this unit creates severe water problems. Mainly three types of pumping system used in tanks are centrifugal, axial flow and airlift pumps.

C) **Carbon Dioxide Removal unit**: - carbon dioxide is highly soluble in compare to oxygen a tremendous amount of carbon dioxide gas produce by fish and bacteria in poorly managed RAS system. Due to the high level of CO_2, pH level decrease and functioning of nitrifying bacteria are reduced; resulting in a rise in ammonia level. For better production removal of CO2 is very necessary and it is done by blown air system or by unpressurized packed columns (spray tower).

D) **Solids removal**: - Fish, crustacean and other aquatic organism excrete faeces in the form of solid, after feeding. These solid materials break down into excellent particles that promote bacterial growth which interferes with water quality and odour of water. Waste solid is removed by Sedimentation, Swirl separators, Screen filters, Bead filters, Double drain.

E) **Biological filters unit**: - this unit help in the removal of solid waste by the help of bacterial action. The essential function of biofilters unit is the removal of dissolved organic material such as sugar, starches, fat, protein, which is excreted by aquatic culture organism. Nitrification process, conversion of ammonia (toxic nitrogen form) into nitrate (a nontoxic form), in the water is done by the bacteria which is cultured on the filters in suspension or fixed-film attached form. Different type of filters such as Fluidized bed filters, Mixed bed filters, Trickling filters, Rotating bio contactor, etc. are used to remove waste from water.

F) **Aeration (oxygen addition) unit**: - this unit transfers the oxygen into the water. Oxygen is a limiting factor in culturing of species because it is low solubility in water. Warm water RAS system is operating at 5 to 6 ppm, and cooler RAS system is operating at eight ppm of oxygen concentration. It is a most critical unit of RAS system because fish and bacterial

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organism continually consume oxygen, a sho term of interference with this unit lead a complete loss of cultured fish. Aeration in the tanks in done by Airstone diffuser, Packed column, Down-flow contactor, Low head oxygenator, U-tube, etc.

G) **Disinfection unit**: - It is a necessary process in recirculation. This unit is mainly required when stock is highly valuable, and the threat of disease is high. Many time water source and fingerling or new stock are infected with bacteria or other microorganisms which leads to severe loss in production. So, disinfection of water is necessary which is done by UV light and ozone treatment, due to its easy installation and operation UV light mostly used as a disinfectant.

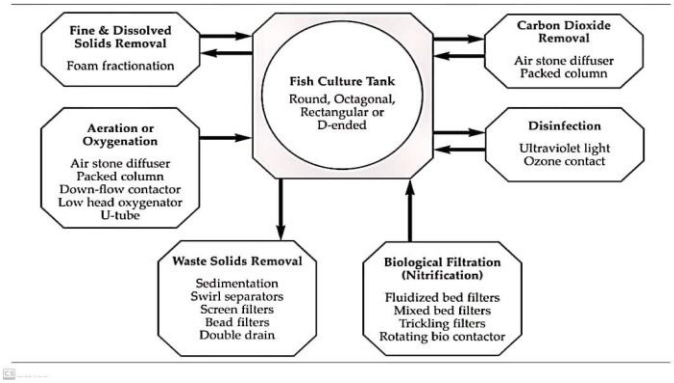

Fig 2: Required unit processes and some typical components used in recirculating aquaculture production systems.

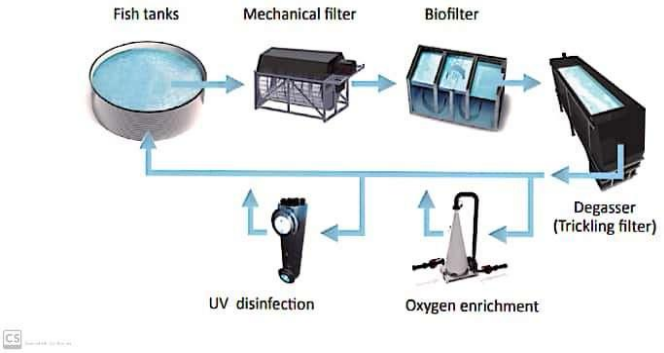

Fig 3: Recirculatory system with required units.

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Water quality management

In the recirculatory system, water quality management is essential because of better fish production and for active growth of bacteria in biofilters. Water quality parameter, which is essential, is described below.

A) **Temperature**: -Each species has its optimum range of temperature for growth. So, the temperature of water in the RAS system should be maintained according to species. At optimum temperature, fishes convert feed efficiently and show resistance to many diseases. Biofilters also affected by water temperature.

B) **Dissolved oxygen**:- for optimum fish growth, should be maintained at 5ppm in the fish tank. In biofilters, maintain of DO is necessary so that it can remove maximum ammonia and nitrite from the tank. Nitrifying bacteria become inefficient at or below two ppm level of DO. High feeding rate increase the respiration in fish which leads to high CO2 in tank decrease the DO level. So, a small amount of feeding at an interval of time is beneficial in the fish tank. To maintain all of this things aeration system should be work efficiently at 24 hrs.

C)**pH**:- Fish can tolerate a ph range from 6 to 9.5, but sudden change up to 2 unit in ph can be fatal for fish, especially fry. The optimum range of ph for biofilter bacteria is from 7 to 8. Bacteria in biofilters produce acid and CO2, which leads to a decline in ph. Nitrifying bacteria are inefficient below ph 6.8 and not able to remove toxic nitrogenous substances from the water below 6.8. this condition creates stress for fish culture and leads to death. So, the optimum range of ph in RAS tanks can be maintained by adding alkaline buffers, which are sodium bicarbonate, calcium carbonate, calcium hydroxide, calcium oxide etc.

D) **Solids**:- un-eaten feed particles and faeces are suspended down at the bottom of the tank in the form of solid waste. It should be removed quickly because it starts to decompose, which consume oxygen and produce ammonia and harmful gases(hydrogen sulphide). It can be removed by screen filters or settling.

E) **Water exchange**:- in RAS system, 5 to 10% should exchange each day so that water quality remained at the optimum level. It prevents the build-up of nitrogenous and soluble organic waste in tanks. Water should be exchanged entirely after each production cycle to reduce the build-up of wastes in tanks.

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A unit of water reserve should be made nearby tanks so that during emergency situation whole water of tanks can be flush and freshwater supplied for fish culture. Temperature and water quality should be maintained at the optimum level of this reservoir tank.

Guidelines for recommended water quality requirements of recirculating systems.	
Component	Recommended value or range
Temperature	the optimum range for species cultured – less than 5°F as a rapid change
Dissolved oxygen	60% or more of saturation usually five ppm or more for warmwater fish – >2ppm in biofilter effluent
Carbon dioxide	less than 20 ppm
pH	7.0 to 8.0
Total alkalinity	50 ppm or more
Total hardness	50 ppm or more
Un-ionized ammonia	less than 0.05 ppm
Nitrite	less than 0.05 ppm
Salt	0.02 to 0.2 %

Suitable species

Selectivity of species for culture in RAS tanks depends on several factors, such as the profitability, environmental concerns, biological suitability. Small fish always recommended for RAS, because small fish grow at a faster rate, and environmental condition can be controlled easily until they reach optimum size.

It depends upon the commercial feasibility of growth, fish species grouped into different categories which are described below:

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Following fish have excellent biological performance and acceptable market condition		
Common name	**Scientific name**	**Optimum temperature for survival**
Arctic char	*Salvelinus alpines*	14 °C
Atlantic salmon, smolt	*Salmo salar*	14 °C
Eel	*Anguilla Anguilla*	24 °C
Grouper	*Epinephelus spp*	28 °C
Rainbow trout	*Oncorhynchus mykiss*	16 °C
Seabass/ Seabream	*Dicentrarchus labrax / Sparus aurata*	24 °C
Sturgeon	*Acipenser spp.*	22 °C
Turbot	*Scophthalmus maximus*	17 °C
Whiteleg shrimp	*Penaeus vannamei*	30 °C
Yellowtail amberjack	*Seriola lalandi*	22 °C

The following fish have a low market price(good marketing and sales efforts are essential)		
Common name	**Scientific name**	**Optimum temperature**
African catfish	*Clarias gariepinus*	28 °C
Barramundi	*Lates calcarifer*	28 °C
Carps	*Cyprinus carpio*	26 °C
Pangasius	*Pangasius bocourti*	28 °C
Perch	*Perca fluviatilis*	17 °C
Tilapia	*Oreochromis niloticus*	28 °C
Whitefish	*Coregonus lavaretus*	15 °C

Comparison between RAS and traditional culture

The water source of traditional culture system is mainly river, lakes or canals, which may contain harmful bacteria which can affect the production. Nevertheless, in the case of ras system, water sources are mainly borehole in which chances of bacterial contamination is very less. Traditional culture system mainly depends on natural foods so that production is deficient, and all water parameters can be affected by the natural condition. However, in the case of ras system, artificial feed is provided to the fish and all the parameter controlled

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artificially, so the impact of natural conditions is negligible. So, in all point of view, ras system has benefits over traditional culture system.

Diseases control

Fish is a susceptible animal; a little change in water quality and temperature leads to stress in fish. The productivity of the farm can lose if stress condition remained for a long time and leads to diseases on the farm. Poor handling and water quality management lead many diseases on the farm. Before stocking of fish, it should be confirmed that eggs are diseases free. Otherwise, it leads to a significant loss of culture. There will always be the risk of diseases, such as IPN (Infectious Pancreas Necrosis), BKD (Bacterial Kidney Disease) and possibly herpes virus, that living inside the egg and cannot be eliminated even after disinfecting the eggs.

Most of the parasite diseases, even bacterial gill disease in the freshwater system can be kill by using ordinary salts. If any parasitic organism remains in tanks even after application of salt, then you can use formalin (HCHO) or hydrogen peroxide (H2O2). To cure ectoparasitic diseases, bathing of fish in the solution of praziquantel and flubendazole is efficient. Mechanical filters reduce the chances the spreading of ectoparasite in tanks, use of 70-micron filter cloth remove certain stages of Gyrodactylus, and 40-micron cloth remove different stages of the parasite in the tanks. Dipping techniques of eggs disinfect the eggs in a large amount within a short period, for example, a dipping solution of salt (7%) for 20 minutes is required to disinfect the eggs from fungus (Saprolegnia).

It is not always easy to find out the recommendation and exact amount of chemicals for treatment in recirculation. The application does vary according to the species, size, water quality, amount of organic matter, water exchange ration, etc. The guideline below is, therefore, very approximate.

- **Salt:-** In freshwater culture uses of salt is safe to treat diseases, such as Ich (Ichthyophthirius multiplies or white spot disease) and the common fungus Saprolegnia. Ich in pelagic phase can be killed at 10% and bottom-living stages at 15%. A concentration of 3-5 % of salt in hatcheries prevent infection with fungus.
- **Formalin(HCHO):-** For the treatment of following disease Ichthyobodo necator (Costia), Trichodina sp., Gyrodactylus sp., sessile ciliates, and Ich, low

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concentration of formalin(15mg/L) for an extended period (4-6 hrs.) is recommended. It also affects the working efficiency of biofilters and degraded fast at the rate of 8mg/h/m2 in biofilters.

- **Hydrogen peroxide(H_2O_2)**: - It is not widely used but shows promising result in the substitute of formalin at the rate of 8-15mg/ml for 4-6 hrs. The biofilters efficiency decreases for 24 hrs. After the application of hydrogen peroxide, but it gains its working performance after some time.
- Use of other chemicals such as chloramine-t and copper sulphate are not recommended, these promising chemical result in the treatment of bacterial gill disease but this chemical severely affect the biofilter and damage all the recirculation process and production.
- The use of antibiotics to cure the bacterial infectious disease, such as furunculosis, vibriosis or BKD, is the only way in recirculation. Antibiotics are mixed with feed and fed for several days, for example,7-10 days.
- Treatment against IPN, VHS (Viral Hemorrhagic Septicemia) or any other virus is not possible. The only way to get rid of viruses is to empty the whole fish farm, disinfect the system and start all over again.

Advantages and disadvantages of the RAS system

- Requires less water amount in comparison to ponds
- Can be located in more areas
- Its intensity is high (culturing more fishes in the lesser area)
- High environmentally compatible
- It is expandable (we can add new units on the bases of demand)
- In poorly managed RAS system, component failure, poor water quality, stress, diseases are common. Experts are required to maintain all of these things.
- An electrical failure can lead to catastrophic loss of fish in RAS.
- Biological filters can be damaged due to application of chemicals for disease treatment.
- High initial capital investment investments required for set up new RAS technology.

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Conclusion

Pisciculture holds an immense potential, especially for the marginal farmers, to improve their financial condition. RAS system which has less area requirement at the same time higher monetary can be a good fantastic option for future fish farming.

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