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Growing seed

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MANAGEMENT OF HEAT STRESS IN SHEEP

Article Id: AL202069

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Sheep form a crucial component of rural economy, particularly in the arid, semi-arid and mountainous areas of the country because of its multiple utilities for wool, meat, milk, skins and manure. It provides a dependable source of income to the shepherds through sale of wool and animals(NAPS, 2018). They contribute greatly to the agrarian economy, especially in areas where crop and agriculture doesn't seem to be economical. Further, they play a crucial role in the livelihood of an outsized proportion of small and marginal farmers and landless labourers(Acharya, 1982).4.55 million farmers within the country holds about 65 million sheep. Our country has 43 registered breeds of sheep. Tamil Nadu stands fourth in the country with 4.78 million sheep holding about 7.36% of country's sheep population.

Due impacts animals' production and health, climate change is perceived as the most serious long-term challenge faced by small ruminants' farmers all over the world(Silanikoveand Koluman, 2015). Environmental factors like temperature, radiation and humidity have direct and indirect effects on animals (Collier *et al.*, 1982). The high ambient temperature that challenges health and performance of animals also described as the magnitude of forces external to the body that tend to displace its systems from their ground state. Animals undergo various sorts of stressors, i.e. physical, nutritional, chemical, psychological and heat. Among all, heat stress is the utmost concerning issue nowadays in the ever-changing climatic scenario (Silanikoveand Koluman, 2015), and it is one of the most important stressors in the tropical, subtropical (Marai *et al.*, 2007; Nardone *et al.*, 2010), arid (Silanikove, 1992), and semi-arid (Silanikove, 2000; Al-Dawood, 2015) regions of the world. Heat stress is defined as the perceived discomfort and physiological strain associated with exposure to an extreme and hot environment (Gupta *et al.*, 2013).

Identifying heat stress

Heat stress can be identified through many signs exhibited by animals. Some general signs include: huddling in the shade (if it's available), increased water intake, loss of appetite, listless/lethargy, slobbering, high respiratory rates (panting), high body temperature, open mouth breathing. In severe cases of heat stress, lack of coordination, trembling and down animals is also seen (Burton, 2014, Agriculture Victoria, 2017).

Animals in danger (Agriculture victoria, 2017)

Animals at high risk of heat stress are:

- young animals
- dark coloured animals
- animals that are sick or have a previous history of respiratory disease
- animals with other stresses like heavy lactation

Measures to alleviate heat stress

1. Grazing

- Provision of shade and clean water within the grazing area.
- Grazing during the evening or during cool hours.

2. Supplementation

- Strategic supplementation of pregnant, lactating and breeding ewes as mentioned below.
- Feeding of crop residues and high-moisture agro-industrial by-products (ABP), tree fodders, oil cakes etc.,
- Supplementation of buffers to supply the higher dietary Na and K levels needed for lactating ruminants during hot climate.
- Supplementation of fat-enriched rations to raise the energy density of the diet, and to decrease metabolic heat production as metabolizable energy derived from fats are efficiently utilized by ruminants.
- Supplementation of vitamins which are part of the non-enzymatic antioxidant systems especially vitamins A, E, and C to fight oxidative stress. Dietary supplementation with 50 mg/ kg of vitamin E and 0.3 mg/kg of selenium during summer improved sheep reproductive performance and lamb growth. It also had a

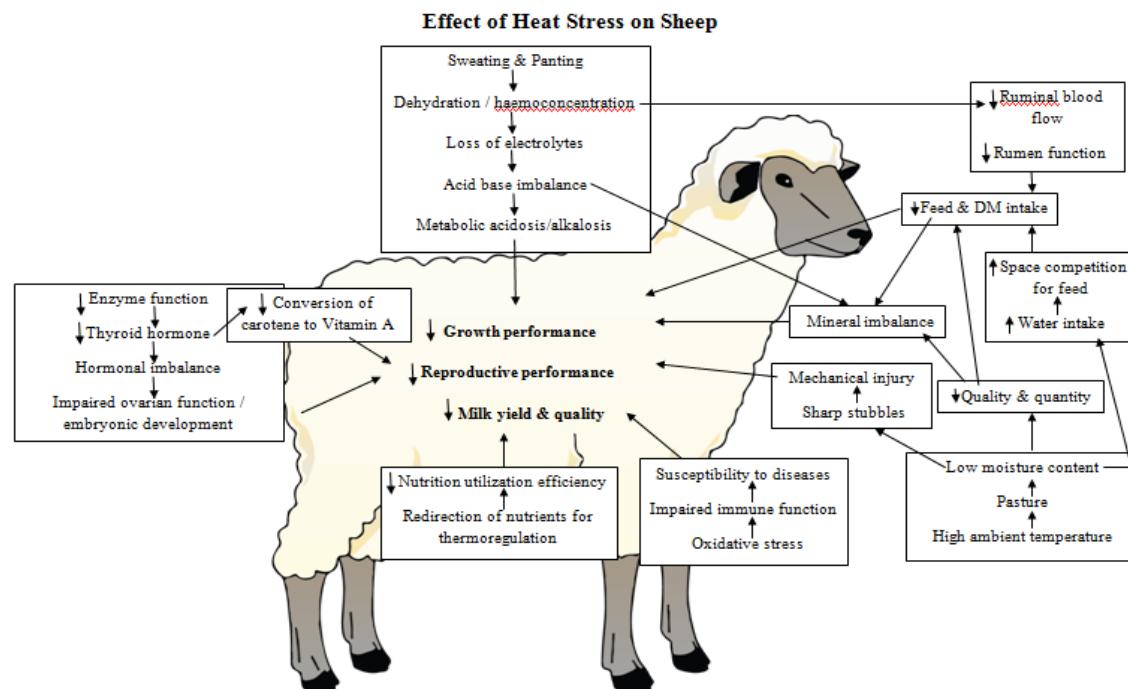
beneficial effect on blood metabolites, protein metabolism and thyroxin concentration.

3. Watering(Agriculture victoria, 2017)

- Provide ad libitum clean drinking water.
 - Design the water troughs or containers large enough so that all the animals have easy access.
 - If large number of animals is kept together increase the number of watering points and/or water flow.
 - Fix the troughs or containers firmly so they cannot overturn.
 - Troughs should be kept clean and should be designed and maintained to prevent injuries.
 - The location of water should be familiar to animals' days before extreme heat arrives.
 - Animals should not be made to walk long distances for water.

4. Handling (Agriculture victoria, 2017)

- Don't handle animals in extreme heat unless necessary.
 - If necessary, confirm that it is done as early or late in the day as possible when temperatures are lower.



5. Transportation (Agriculture victoria, 2017)

- Transport of animals should be planned in such a way to avoid climatic extremes likely to compromise the animals' welfare.
- If transport is absolutely necessary, plan the journey in such a way to minimize the effects of hot weather on the animals by pre-determining the route, marking out places of shade for a rest stop and perhaps water availability along the route.
- Animals should be transported only during the cooler hours of the day. While resting, park the vehicle in the shade and at right angles to the wind direction to improve wind flow between animals during hot weather. Duration of stops should be kept to a minimum to avoid the build-up of heat within the vehicle while it is stationary.
- Stocking densities should be reduced to 85 per cent of capacity to ensure good airflow between animals, and drivers should have contingency plans in place for the occurrence of adverse weather events.

6. Culling

- Animal stocking density should be reduced based on the availability of feed/fodder resources and to reduce excessive maintenance cost during summer.
- Surplus animals aside from breeding stock such as unproductive animals, animals with chronic ailments, poor milkers, repeat breeders, aged, animals with poor growth rate, animals with vices and leg deformities shall be culled.

7. Health

- Animals should be dewormed using suitable anthelmintics to reduce worm load (especially for flukes).
- Animals should be vaccinated against sheep pox, PPR, anthrax and FMD.
- Footbath with disinfectants may be done routinely to prevent foot rot.
- Potassium permanganate mouth wash can be given to sheep having oral wounds due to browsing of dry stubbles.

Conclusion

Heat stress exerts negative effects on productivity and well-being in sheep. Heat stress negatively affects biological functions, changes antioxidant levels and various hormones which are reflected in the impairment of their health, production and reproduction.

Management strategies mentioned above may be applied to counter hot/humid environmental conditions. For optimal results, the people who care for animals should be educated regarding the effect of heat stress and on animal production and the managemental strategies to alleviate the problems. It is to be noted that awareness of heat stress is the first step towards its management.

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MILK COMPOSITION AND THERAPEUTIC PROPERTIES OF MARE, JENNY, CAMEL AND YAK

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India stands at first position in milk production in the world with 187.75 MT in 2018-19. The major milk-producing animals are buffaloes, cows and does, respectively with 49, 48 and 03 per cent contribution to the country's total milk production (BAHS, 2019). Milk from dairy animals are widely consumed by all the age groups of peoples' but the rising problems of milk indigestion, allergies and lactose intolerance in young and old age peoples and increase in the human population to beyond 1.55 billion in the year 2032-33 with the simultaneous increase in the demand for milk and milk products to 300-355 MT (NITI Aayog, 2018) has major concerns among scientists to identify non-cow milk sources with higher medicinal values, and milk composition identical or near-to-identical to dairy animals. This is in response to reduce health complications and meet the milk demands of the population. So far, non-cow milk sources are identified as the mare, jenny (she-donkey), camel and yak. The milk composition and therapeutic properties of non-cow milk sources have already been established and are reviewed in this article to identify the best possible aid to dairy animals'.

Milk composition

The milk composition is an inherited trait and varies between species and breeds. Among milk constituents, the most variable and costliest constituent are fat, unlike protein, solid-not-fat, lactose, minerals and water. In India, peoples' preference lies in the milk with high fat per cent and is the reason why milk with high fat per cent fetches high prices in the market. The details of average composition per 100g milk of mare, jenny, camel and yak are given in Table 1.

Table 1: Average composition per 100g milk of Mare, Jenny, Camel and Yak

Component (g)	Mare's milk	Jenny's milk	Camel's milk	Yak's milk
Water	89.50	89.80	87.20	83.10
Fat	1.30	1.10	4.50	6.50
Protein	2.10	1.70	3.50	5.10
Lactose	6.40	6.60	4.40	4.40
Minerals	0.40	0.40	0.70	0.80
Solid-not-fat	9.30	9.20	8.60	10.40
Total solids	10.50	10.20	12.80	16.90
Cholesterol (mg)	4.50	2.20	37.00	22.00
Calcium (mg)	89.00	68.00	143.00	131.00
Phosphorus (mg)	56.00	50.00	116.00	106.00
Saturated FA	0.40	0.40	2.40	3.90
Monounsaturated FA	0.30	0.20	1.40	2.20
Polyunsaturated FA	0.50	0.40	0.50	0.40
Lysozyme	0.055	0.10	0.0003	NA
Lactoferrin	0.082	0.037	0.27	NA

FA: Fatty acids; NA: Literature not available; References: Aspriet *et al.* (2017), Kaskous and Pfaffl (2017), Pieszka *et al.* (2016), Nikkhah(2011)

Therapeutic properties of milk

The search for easily digestible milk with fewer incidences of milk protein allergy and lactose intolerance has led to the discovery of health benefits from non-cow milk sources. The health benefits are due to the numerous bioactive components in milk that function beyond their nutritional value. The antioxidant, anti-inflammatory, anti-bacterial, anti-viral, anti-fungal, anti-diabetic, anti-ageing, immune-stimulant, gut health-promoting properties, etc. of milk make it an extraordinary drink for humans. The details of the therapeutic properties of milk of mare, jenny, camel and yak are given in table 2.

Table 2: Therapeutic properties of milk of Mare, Jenny, Camel and Yak

S. No.	Therapeutic property	Mare's milk	Jenny's milk	Camel's milk	Yak's milk
1.	Ease in digestion	Better Digestibility within 2 hours due to lesser casein proportions, more whey proteins (two times of cow milk) and soft curd formation in stomach.	The β -lactoglobulin in jenny milk is present as a monomer (dimer in other milk's). The monomer proteins are highly digestible thus, facilitates easy digestion of milk.	Better digestion as more lipolytic enzymes have access to small fat globules in milk.	Better digestibility due to balanced omega-3 to omega-6 fatty acid ratio in milk and higher proportions of β -casein, resulting in formation of soft coagulum in stomach.
2.	Anti-cow milk protein allergy	Due to less α S1-casein in milk and better digestibility of β -lactoglobulin.	Due to low milk α S2, κ -casein and β -lactoglobulin in milk.	Due to lack of β -lactoglobulin and A1 β -casein protein in milk.	Due to less α S1-casein in milk and better digestibility of β -lactoglobulin.
3.	Anti-cow milk lactose intolerance	Due to high content of lactose in milk, the milk is prone for lactose intolerances.		Due to low content of lactose in milk, the milk is suitable to people with lactose intolerances.	
4.	Anti-carcinogenic	Conjugated linoleic acid (CLA) in milk exhibits antioxidant and anti-cancer activity.	Milk α S1- and β -caseins, lysozyme, α -lactalbumin, β -lactoglobulin increase interleukin-1 β , 2, 6, interferon- γ , and tumour necrosis factor- α (TNF- α) secretion that suppress tumour proliferation.	The heavy chains of immunoglobulins in milk are used in immune therapy for cancer treatment; Antioxidant activity of milk lactoferrin and control of metastasis of cancer cells by milk peptidoglycan recognition protein exhibits anti-cancer activity.	Greater CLA content in yak cheese exhibits anti-carcinogenic effects. CLA <i>cis</i> -9, <i>trans</i> -11 and <i>trans</i> -11-C18:1 in yak cheese is respectively, 4.2 and 4.6 times greater than cow cheese.
5.	Anti-atherosclerotic	Low milk fat and cholesterol content and higher polyunsaturated fatty acids (PUFA) level prevents atherosclerosis.	Low milk fat and cholesterol content, omega-6 to omega-3 ratio and higher PUFA levels prevent the formation of atherosclerotic plaques.	Low milk fat and cholesterol level prevents atherosclerosis; The heavy chains of immunoglobulins in milk are used in immune therapy for multiple sclerosis treatment.	Richness of CLA (<i>cis</i> -9, <i>trans</i> -11-18:2 isomer), omega-3 fatty acids in milk maintains cholesterol level in blood and prevents atherosclerosis.
6.	Healthy drink	Milk is rich in whey protein and linoleic acid that benefits human health. Humans cannot produce linoleic	Due to low total bacterial count (<250 CFU/ml milk) and somatic cell count (<50x10 ³ cells/ml milk) in	High protein, vitamin-C, linoleic acid and other unsaturated fatty acids levels in milk makes it	Higher β and κ -casein and lower α S-casein in milk make it healthy for infants; Also, higher total essential amino

		acid;Also due to the less total bacterial count (300-58000 CFU/ml milk) and somatic cell count ($10-47 \times 10^3$ /ml milk) in milk among domestic animals.	raw milk;Also, high content of PUFA (linoleic and linolenic acids) makes it healthy drink for humans.	healthy food supplement for humans.	acids in milk, particularly methionine strengthen antioxidant defence system.
7.	Anti-hypertensive/ Reduce blood pressure	Higher levels of potassium in milk act as vasodilators and thus, prevent vasoconstriction and hypertension.	High content of linoleic and linolenic acids in milk prevents hypertension.	Hydrolysis of camel milk release angiotensin-converting enzyme inhibiting peptides. The peptides prevent conversion of angiotensin-I to angiotensin-II and thus, prevent vasoconstriction and hypertension; Also, higher potassium level in milk prevents hypertension.	Milk casein hydrolyses to produce anti-hypertensive peptides and angiotensin-converting enzyme inhibiting peptides that prevents vasoconstriction and hypertension; Higher levels of α -linoleic acids in milk also prevent hypertension.
8.	Cosmetic properties	Anti-bacterial and antioxidant activity of mare's milk makes it an active ingredient to skin creams, body lotions, shampoos and soaps.	Due to strong antioxidant and anti-ageing properties of jenny milk, it is included in the fairness creams, soaps and shampoos.	Milk is rich in α -hydroxy acids and zinc, frequently used in cosmetics for treatment of wrinkles, softening of skin and for overall improvement of skin quality; Also, antibacterial, anti-viral, anti-fungal, anti-inflammatory and antioxidant properties of milk lactoferrin make it an active ingredient in cosmetics preparation.	Milk is rich in zinc, an active ingredient in cosmetics for treatment of skin allergies and ailments and providing glow to the skin; People apply yak butter on face as yak butter is rich in L-tyrosine that converts into melanin by tyrosinase. Melanin facilitates pigment formation in skin and protects skin from UV rays damage.
9.	Immune-stimulant	Milk lactoferrin (10 times higher than cow milk), lysozyme and immunoglobulin-G stimulate immune system.	Donkey milk induces immunoglobulin-G secretion and the release of interleukins (IL12, IL1 β and IL10) and TNF α , important for the treatment of immune related diseases; Milk	Due to richness of milk in zinc, vitamin-C and iron (3 times more vit.-C and 10 times more iron than cow milk); Milk lactoferrin, lysozyme, immunoglobulin-	Richness of CLA (<i>cis</i> -9, <i>trans</i> -11-18:2 isomer) in milk modulates the immune system; Also, consumption of yak yogurt rich in <i>Bifidobacterium</i> and <i>Lactobacillus</i> spp. as probiotic strains enhances the

		<p>lactoferrin, lysozyme, lactoperoxidase and whey protein is also known to boost immunity.</p>	<p>G and A, lactoperoxidase and camel whey protein also boosts immunity; Also, higher levels of magnesium aids biosynthesis of glutathione that enhance antioxidant defence system.</p>	immune response.
10.	Anti-diabetic	Mare's milk reduces the dose of insulin and improves the glycaemic index.	Lysozyme and α -lactalbumin in milk helps in curing type-2 diabetes in humans.	Camel milk contains insulin that acts as anti-hypoglycemic agent and regulates B-cells function.
11.	Anti-dermatitis/eczema	Due to lesser amounts of interleukin-16 in milk, responsible for occurrence of dermatitis; Also lactoferrin, lysozyme and calcium in milk work together as an anti-inflammatory, anti-fungal and anti-bactericidal substance.	NA However, anti-inflammatory property of omega-3 fatty acids, lactoferrin and lysozyme is assumed to exhibit anti-dermatitis effect.	Due to richness of milk in α -hydroxy acids, lysozyme and lactoferrin that exhibits anti-inflammatory property.
12.	Anti-ulcerative	Mare's milk improves the secretory and motor functions of stomach which remarkably declines the size of ulcers.	NA But jenny milk could exhibit anti-ulcerative property as it release high amount of nitric oxide that stimulates mucus production, inhibits the adherence of neutrophils to the endothelial cells, and increases the blood flow to the mucus membrane thus, curing ulcers.	Ability of milk to release more nitric oxide and richness in magnesium and zinc that reduces the oxidative stress, is known to cure ulcers.
13.	Reduce respiratory diseases	Anti-inflammatory and anti-microbial properties of milk reduce problems of asthma, pneumonia and bronchitis.		

14.	Reduce liver diseases	The sublimated mare milk supplement is reported to cure chronic viral hepatitis C.	The antioxidant, anti-bacterial and anti-inflammatory property of milk enables healthy functioning of liver and cures jaundice and the inflammations of liver.	The antioxidant, anti-bacterial and anti-inflammatory property of milk enables healthy functioning of liver and cures jaundice and the inflammations of liver; Also, anti-viral property of milk lactoferrin inhibits hepatitis B and C virus by preventing the entry of the virus into the cells.	Richness of Yak yogurt in probiotic strains (<i>Bifidobacterium</i> spp. and <i>Lactobacillus</i> spp.) prevents hepatic encephalopathy.
15.	Alleviates tuberculosis (TB)	Koumiss, a fermented milk product is reported to cure TB.	Can be due to the immunoglobulins in milk, however, research is still needed.	Milk immunoglobulins acts against TB & paratuberculosis.	Yak is susceptible to bovine TB therefore yak milk is not given to TB patients.
16.	Alleviates anaemia	Due to higher concentrations of iron in milk.	NA	Due to higher concentrations of iron in milk.	Due to higher concentrations of iron in milk.
17.	Promotes gut health	Enzymes (lysozyme and lactoferrin) in milk selectively stimulate the growth of beneficial bacteria (<i>Lactococcus</i> , <i>Leuconostoc</i> , <i>Streptococcus</i> and <i>Enterococcus</i> spp.) in gut that influences the diversification of gut micro flora and limits the growth of unwanted bacteria.	Milk is rich in concentration of lysozyme that shows resistance to the degradation by gastro-intestinal enzymes and exhibits anti-bacterial property against <i>Staphylococcus aureus</i> and <i>Listeria monocytogenes</i> , and promotes multiplication of beneficial bacteria <i>Lactobacillus</i> and <i>Bifidobacterium</i> spp.	Camel milk inhibits growth of <i>Escherichia coli</i> , <i>Klebsiella pneumonia</i> , <i>Clostridium</i> spp., <i>Helicobacter pylori</i> , <i>Staphylococcus aureus</i> , <i>Candida albicans</i> , etc. and promotes gut health.	Milk is rich in probiotic strains (<i>Lactobacillus</i> spp. and <i>Bifidobacterium</i> spp.) that blocks gastro-enteric pathogens and cures intestinal dysfunction.
18.	Cures Crohn's disease	Based on bactericidal and immunological components of mare's milk.	A high level of anti-microbial peptides in milk confers anti-inflammatory property to milk and thus, supports curing of Crohn's disease.	Lactoperoxidase, lysozyme, lactoferrin and peptidoglycan supports curing of Crohn's disease.	NA
19.	Improves bone health	Due to higher mineral concentrations (potassium, iron, calcium and magnesium) in milk, osteoporosis and other bone ailments	High content of lactose in milk facilitates the intestinal absorption of calcium, essential for infant's bone mineralization; Improvement in	Milk lactoferrin has cartilage protective and anti-arthritis activity. The protein is an iron chelating protein that removes free	Richness of CLA (<i>cis</i> -9, <i>trans</i> -11-18:2 isomer), calcium, phosphorus, zinc and iron in milk improves bone mineralization.

		can be prevented.	bone health is also due to the beneficial health effects of omega-3 fatty acids.	iron from the joints of arthritic patients and improves arthritis; Also, bones are supported by high levels of potassium, magnesium, iron and vitamin B in milk.	
20.	Cures Autism	NA	NA However, jenny milk is rich in Taurine (9 times of cow milk), known to promote normal functioning of the nervous system, and therefore, could be of interest in curing autism.	Camel milk strengthens the antioxidant defence by increasing the levels of glutathione, superoxide dismutase and myeloperoxidase in plasma and reduces the effects of oxidative stress to improve the psychological symptoms of autism; Also, milk decrease serum level of 'thymus and activation-regulated chemokine' (TARC) in autistic children.	NA But, the whey proteins in yak milk exhibit psychomodulatory activities and could improve the psychological symptoms of autism.
21.	Cures Alzheimer's disease	Due to the availability of essential fatty acids in milk.	Due to beneficial health effects of omega-3 fatty acids.	The heavy chains of immunoglobulins in milk are used in immune therapy for Alzheimer's treatment.	NA

NA- Literature not available; References: Dorjiet *et al.* (2020), Equilac (2020), Li *et al.* (2020), Galali and Al-Dmoor (2019), Hazraet *et al.* (2019), Anonymous (2018), Li *et al.* (2018), Yvonet *et al.* (2018), Madhusudan *et al.* (2017), Rasheed (2017), Kula (2016), Pieszkaet *et al.* (2016), Zibae (2015), Guoet *et al.* (2014), Li *et al.* (2011), Schubert *et al.* (2009), Anonymous (1999), Sharmanovet *et al.* (1981).

Conclusion

Milk from non-cow milk sources was rarely the preferred choice, but in the last few decades has gained popularity due to their therapeutic properties. The therapeutic properties exhibited by non-cow milk sources are almost similar, and the only difference that exists among the milk sources is the concentration of milk components that exhibit these properties.

In India, milk with high fat per cent is preferred and therefore, camel and yak milk could be a possible aid to the dairy animals', whereas; in other countries, where people prefers milk with less fat per cent, mare and jenny milk could be a possible aid to the dairy animals'.

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GEOGRAPHIC INFORMATION SYSTEM – A NOVEL APPROACH IN AGRICULTURE DEVELOPMENT

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Agriculture is the backbone of the Indian economy, and one of the few countries in the world has started using space technology and land-based observations to produce daily reports on crop production statistics and provides inputs for sustainable farming. While there are recent developments in the field of agriculture, the Geographic Information System (GIS) is fairly new and has vast potential to explore.

GIS in agriculture is not a new phenomenon anymore. The agricultural sector is the cornerstone of the rural Indian economy, around which socio-economic privileges and deprivations revolve, and any changes in its structure are likely to have a corresponding effect on the current social equality pattern. No economic reform strategy will succeed without sustained and broad-based agricultural production, which is critical to increasing living standards, alleviating poverty, ensuring food security, creating a thriving market for industrial and service expansion and making a major contribution to national economic growth. Future growth in agriculture will come from new technologies that are not only cost-effective but also consistent with the country's natural environment regime; technologies that are directly applicable to rain-fed areas; ongoing genetic improvements for better seeds and yields; data improvements for better study, better results and sustainable planning; bridging the gap between information and practice; and responsive surveys of land use, good management practices and sustainable use of natural resources.

Sustainable agricultural production depends on the sensible use of natural resources (soil, water, livestock, plant genetics, fisheries, forests, environment, rainfall and topography) inappropriate management of technology under the prevailing socio-economic infrastructure. In developed countries, technology plays a significant role in the rapid economic growth and social change.

Response towards geospatial technology

Technology plays a significant part in developed countries' rapid economic growth and social change. Although it supported approximately Rs 66 billion for the use of different types of technology under different ministries, it also mandated the use of geospatial technologies in some of the mission projects such as the National Land Records Management Programme (NLRMP), Restructured Accelerated Power Development and Reform Programme (RAPDRP), Jawaharlal Nehru National Urban Renewal Mission (JNNURM), National Rural Employment Guarantee Act (NREGA). Though recognizing that “location-specific planning using spatial information systems helps in sustainable development planning”.

Agricultural mapping

Technological advances and geospatial technology help to create a dynamic and efficient farm that protects the environment and provides people with excellent nutrition. Though natural inputs cannot be regulated in agriculture, they can be better understood and managed with GIS applications. GIS can contribute significantly to accurate estimates of crop yields, analyzes of soil modifications and detection and remediation of erosions. More specific, reliable crop estimates help to reduce uncertainty.

A key problem for agricultural growth is the need to increase the production, employment and income of poor segments of the agricultural population and this situation can be resolved by applying GIS in agriculture. GIS software and online web services enable farmers to forecast crops and control their production through the use of multi-spectral satellite imagery. GIS 'ability to evaluate and envision agricultural environments and workflows has proven to be very useful for those working in the agricultural sector. GIS is capable of analyzing soil data and deciding which crops should be planted where and how to maintain soil nutrition in order to best support the plants. GIS in agriculture helps farmers achieve higher production and cost savings through better use of land resources. This also decreases the risk of marginalization and insecurity of small and marginal farmers, who account about 85 percent of farmers worldwide.

Agricultural geographic information systems using geomatic technology allow farmers to monitor current and future variations in precipitation, temperature, crop production, etc. Agricultural mapping is becoming day by day critical to the control and

management of soil and farmland irrigation. It supports agricultural production and rural growth. Precise mapping of the geographic and geological features of farmland enables scientists and farmers to establish more productive and successful farming techniques as farmers are able to take more corrective action in the form of better fertilizer use, the management of infestations of pests and weeds, the conservation of natural resources, etc..

Smart farming

The data are continuously collected by sensors in fields and on satellites high above farms. Advanced technologies can transform these data into information that can be used by farmers and land managers to make more informed and timely decisions. This, in effect, improves productivity and reduces impacts on the environment. With the introduction of advanced technologies such as precision equipment, the Internet of Things (IoT), sensors and actuators, geo-positioning systems, big data, unmanned aerial vehicles, robotics etc., farming is becoming smarter.

A term in agriculture which is gaining broad popularity because of the multitude of benefits it provides is precision agriculture. It helps farmers to collect geospatial information on soil requirements in a timely manner, and to prescribe and apply site-specific treatments to increase agricultural production and protect the environment. Precision agriculture is tied to more reliable, cost-effective, and user-friendly high-tech devices.

Application of GIS Data in Watershed Management

Over the years, water as a tool has diminished. In all developing and developed countries, there has always been a limited supply of clean water. Hence, water supply became a concern in developed countries. Using satellite data, water bodies such as rivers, lakes, dams and reservoirs can, however, be mapped in 3D using GIS technology. These data can be used to manage water bodies sustainably because the respective authorities will determine which regions require effective security and management. At the same time, decisions can always be made about the most successful means of the utilization of these regions.

Prospective of GIS

- GIS can visualize spatial information.
- It can be used for a large array of geographical tasks
- It provides the remedies for the disaster, and it provides the model of natural disaster as well as for the predicted it accurately

- Its serves time management
- It emphasis faster data collection
- It provides a catalogue of database
- It shows spatial information (Spatial = Graphics + Tables)
- It is highly predictive and offers better forecasts and review
- Has the potential to strengthen the organizational alignment that allows the program to talk to each other
- GIS will also allow data to be viewed, challenged, understood, visualized and interpreted in a variety of ways revealing relationships, trends and patterns in globes, maps, charts and reports.
- A GIS lets you answer questions and solve problems by quickly and meaningfully evaluating the data and outputting it
- GIS data is used to manage natural resources which may include hill slope gradients, dimension, stream network, stream gradient, slope, catchment area, etc.

Conclusion

The application of GIS provides us with the capability to identify high priority areas which need maternal care. Through the result of the GIS, it is wise to plan proper schedules to improve the efficiency and accurate application based on the prediction.

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iTEAMS: BRIDGING FARM TO FORK DURING COVID-19

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The world is suffering due to global pandemic Covid-19. As the disease first appeared in the Wuhan city of China, which took millions of life globally. To spread the disease and further, more death, the lockdown of many nations has been done. The lockdown means restriction in moving of people and goods with an exception in essential produce. However, this restriction in moving brought difficulty in the food supply chain. As the people need foodstuff at their doorstep, food supply is restricted, so what options remain with the citizen? Yes, the only option remain is home delivery of food items by the central and state government. For that systematic delivery, a mechanism is needed. Fortunate that the Agriculture Department, Government of Meghalaya worked on that much before the Covid-19. The iTEAMS (Integrated Technology Enabled Agricultural System) which is playing a noble role to deliver the foodstuff to the doorstep of people living in hilly terrain region. The iTEAMS launched a toll-free number 1917 through which they connected with different stakeholders for agricultural operations.

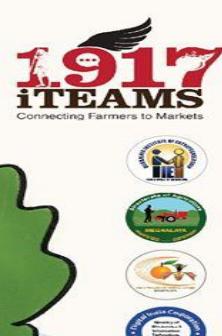
How iTEAMS Bridging Farm to Fork during Covid-19

The World Health Organization (2020) has announced that the Covid-19 (Coronavirus Disease 2019) it's a global pandemic due to widespread of the disease in the world. The disease first appeared in Wuhan city of China. It claims millions of lives and breakdown of the economy. The biggest threat faced by the people in India due to lockdown as India is the 2nd populous and underdeveloped country. In this situation, food supply to ensure no one asleep empty stomach is the biggest challenge for the central/state government. However, the Meghalaya, a small state with undulating topography set up a model for the entire nation through the agri-innovation supply mechanism. iTEAMS is an innovation stand for the Integrated Technology Enabled Agri-Management System which ensures the supply of

Connecting Farmers to Markets

Do you require advice on crops, livestock or transporting your agricultural produce to market?





WHAT 1917iTEAMS DOES

1. Gives Advisories on growing crops & rearing livestock
2. Provides Agri Response Vehicles (ARVs) for transportation of goods.
3. Connect the Sellers and Buyers

* In the current situation and because of shortage of ARVs, 1917iTEAMS may cancel booked services but will try to arrange commercial vehicles outside the system to meet the demand.

WHAT 1917iTEAMS DOES NOT DO

1. Participate in Seller-Buyer Negotiations on Price, Quality and Quantity
2. Determine pickup and drop schedule with seller or buyer
3. Take responsibility for any loss, theft or damage to goods during transportation.
4. Packaging, Loading and Unloading is the responsibility of the party booking the Vehicle.

CALL TOLL FREE 1917 MONDAY - SATURDAY
7AM - 7PM ADVISORY | TRANSPORTATION | MARKET CONNECT

locally produced agricultural foodstuff to the doorstep of consumers. The innovation released a toll-free number 1917 where buyers or sellers can register their-self to take benefits of iTEAMS.

Photo Source: Department of Agriculture, Government of Meghalaya

The iTEAMS operate in three features

- **Agri-Response Vehicle:** the lockdown was imposed just before harvesting of crops which have a great impact on the selling of crops. The iTEAMS Agri Response Vehicle component played a rescue entity for the farmers. The vehicle needs to be booked advance by calling to 1917 for the transportation of goods to the local market. However, during this global pandemic, the vehicle is not only transporting goods to the local market but also the doorstep of the consumer. The agricultural goods collected from the remote hilly areas directly from the producer farmer and providing vital links to the cities, towns, and markets. The transportation of goods includes banana, colocasia, peas, pumpkins, cabbage, cauliflower, brinjal, etc.

The vehicle also used for essential supplies of essential items such as milk as well as the Public Distribution System and Anganwadi materials such as Gram, Pulses, Rice, Sugar, Edible oil, Salts, etc.



Photo Source: Agri-Response Team

- **e-Marketing:** getting a good market and profitable price for the agricultural produce of the farmer is challenging. This challenges shortened by iTEAMS successfully by providing linkage between the buyer and sellers. The buyer and seller need to register for getting the advantages.
- **Agri-Advisory Services:** after registration, the stakeholders can access the Advisory-Services from the concerned department of Agriculture and all allied fields. The advisory services include plant protection, soil fertility, diseases, animal rearing, market intelligence, pricing, skill development programmes, subsidies, etc.

Conclusion

Covid-19 hampering globally in terms of economy, food supply, and loss of lives, jobs, etc. However, some of the government sectors such as banking, agriculture & allied, health, and defence personnel are working hard to minimize the loss at greater extend. Ensuring delivery of money, foodstuff, transporting migrants, side by side testing positive cases, supplying of protection kits for health workers, etc. In line with the delivery of foodstuff and linking farmers to market, the Integrated Technology Enabled Agri Management System is effectively bridging the gap between farm to fork. Nevertheless, this

is the battle to save humanity; therefore, we all the stakeholder should come forward and do their best.

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NUTRIENTS AFFECTING REPRODUCTION OF ANIMALS

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The relationship between various nutrients and reproduction of animal is a topic of concern among dairy farmer, veterinarians, feed manufacturers and extension workers. The researchers have made progressive work for finding the factors that are responsible for the proper reproduction in dairy animals. The deficiency of various nutrients causes the loss of body weight and so body condition, delayed onset of puberty increases the postpartum time interval to conception, hampers the normal ovarian cyclicity by decreasing gonadotropin hormone secretion and so, increases infertility in animals. It has been seen anestrus condition with anovulation or ovulation without estrus sign due to inadequate nutritional of animals because inadequate nutrition leads to negative energy balance in animals. Due to poor -nutrition is more number of services for conception required which ultimately decreases the production performance of the animal. Infertility of animals cases the huge economic loss of the dairy farmers. So to make dairy farming profitable optimum nutrition is necessary for reproduction and health of animals as proper nutrition increases the production and immunity of the body.

Different Nutrients and Their Role in Reproduction

Energy

Energy balance is maybe the most important nutritional issue associated with the poor performance of animals. Restricting energy intake during late pregnancy increases the length of postpartum anestrous and decreases subsequent pregnancy rate. But, more intake of energy during late lactation stage and the non-lactation stage can cause “fatty cow” condition, which ultimately reduces reproductive performance in the next lactation stage. The heifers fed insufficient amounts of energy, their sexual maturity delayed. If animals are over-conditioned, during calving, they have a higher risk of various health disorders like retention

of placenta, different uterine infections and cystic ovaries. Fatty acids and cholesterol are substrates for many hormone syntheses so, increasing fat level in the diet may increase levels of various reproductive hormones (progesterone, prostaglandins). Ruminant's ration should be less than 3-4 per cent fat. Lactating animals are to be supplemented adequate amount of as they have more energy requirements.

Protein

Inadequate intake of protein can reduce the reproductive performance of animals. However, excessive intake of protein or urea has been associated with low pregnancy rates in female dairy animals. Overfeeding during the breeding time interval and early gestation may be linked with decreased fertility rate in animals. Animals fed excess protein (more than 10-15% on top of requirements) required more services per conception and have longer birth intervals. Feeding urea and protein during early lactation with a diet containing 16 % protein and late wet animals with a diet containing 12 % protein should maintain the reproductive efficiency of the animals.

Minerals

Minerals are necessary for different physiological processes in animals. Reduced fertility, intake of feed, milk yield, reduced ovarian activity, discontinuous oestrous cycles, increased risk of cystic ovaries and delay of sexual maturity may be due to low phosphorus intake. The diet with 0.45 - 0.50 % phosphorus on a DM basis should be provided to high milking animals. Lactating animals must always be being provided proper amounts of calcium (Ca) for optimum production and reduces health problems. Reduction in a muscle contraction may lead to a decrease in dry matter intake as so it leads to severe negative energy balance (NEB). The major issue in the mineral nutrition of non-lactating animals is to provide an optimum concentration of calcium and phosphorus to decrease the risk of milk fever. The diet with 0.75 - 0.80 per cent calcium on a DM basis should be given to high producing dairy animals. Selenium is important for normal spermatogenesis and a component of various enzymes like selenoproteins phospholipid hydroperoxide glutathione peroxidase and Selenoprotein. Diets should contain at least 0.1 ppm selenium on a dry matter basis. Zinc is necessary for proper maintaining sexual maturity, reproductive performance, and the onset of estrus. Zinc has a role for the repair and maintenance of the lining of the uterus following parturition. Recommended dietary concentration of zinc for dairy cows is between 18 to 73ppm. Copper is an essential component of several enzymes including superoxide

dismutase, lysyl oxidase and thiol oxidase. Early embryonic death, Retained placenta and necrosis of the placenta are the symptoms of copper deficiency. Manganese has an important role in cholesterol synthesis, which is required for the synthesis of the steroids, estrogen, progesterone and testosterone hormone. Insufficient steroid production results in reduced concentrations of these hormones causing abnormal sperm in males and discontinuous estrus cycles in females.

Vitamins

Proper vitamin level must be provided in dry cow rations when feed intake is restricted, or low-quality forage is fed to animals. To ensure proper intake of vitamins should be fed in small amounts of low energy concentrates or mixed in a complete dry cow ration. Vitamin A is required for maintaining healthy tissue in the reproductive tract. In deficient animals may have a delay in sexual maturity, birth of the dead or weak newborn calves, and retention of placenta, metritis and abortion. So, supplementation before and after calving can increase conception rate. Daily supplementation of vitamin A for farm cattle is 30,000-50,000 units. Vitamin E acts as antioxidant reducing the different free radicals and converts them into non-reactive forms. The harmful effect of vitamin E and selenium deficiencies have been noticed on various components of the reproductive capacity, including ovulation rate, sperm movement and transport, conception rate, expulsion fetal membrane, milk yield and post-natal growth.

Conclusion

Nutrients are directly related to reproduction in the dairy animals. Nutrient either in deficient amount or excessive amount is capable of altering the reproduction of animals. The improvement of the reproductive performance will result in higher profitability, so both nutrition and reproductive management system is a better method for the better economic efficiency of animal husbandry.

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CONSUMER BEHAVIOUR FOR E-GROCERY SHOPPING IN INDIA: AN OVERVIEW

Article Id: AL202074

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Food is one of the key categories of spends globally and major share of the consumer's wallet. The global food retail market was valued at USD 5,643.6 billion in 2013 and is expected to grow at a CAGR of 6.1 % from 2014 to 2020, to reach an estimated value of USD 8,541.9 billion in 2020. Food & grocery form the backbone of the Indian retail sector, with an estimated market size of U\$ 320 Bn. (Rs. 20,000 Bn.), the category accounts for about 57% of the total retail market. The food & grocery retail market is expected to grade over 3.5 folds and be worth US\$ 1,150 Bn. (Rs. 71,000 Bn.) by 2025.

Food retail has always been a tough business. Today's major grocery chains have all weathered repeated attacks from new competitors and new formats, and are always looking out for the next wave of competitive threats. Online grocery retail sector is one of the areas where IOT is set to make a huge impact. The trend of IOT is changing the grocery retail. Initially there were apprehensions regarding the online grocery shopping from the consumer point of view; later on, with the emerging digitalisation consumer adoption in the enterprise is currently experiencing a boom as consumers are able to analyse benefits of online grocery shopping.

The fast-growing trend of online shopping retail IOT- points out a rapid growth ahead for online grocery shopping as it saves time and worries and offers a plethora of innovative offerings. With more of Internet connectivity (rise of smartphone users), the growing popularity of mobile shopping, and dealing in daily consumption commodities, grocery e-stores do hold a potential in India. The market share is estimated to be less than \$100 million at present, but is expected to cross \$25 billion by 2020, expected to grow at a rate of 25-30% year-on-year in major Indian cities (prediction of retail consultancy Techno Pak).

Indian online groceries market is envisaged to grow and reach Rs 2.7 billion by FY'2019. There are roughly 25 odd companies in this space (as per Ken Research)

Term and Definition of E-Grocery Shopping

The online grocery industry is one of the growing industries in India. This particular business model is more popular amongst the people in service profession followed by business class and people retired. The paper strategically analyzed the Indian online grocery Industry.

Online Grocery Shopping at Global Scenario

Online grocery shopping paves a threat to the traditional bricks-and-mortar retailers in various sectors, and having lesser impact on food retailers. But this is changing – online grocery is coming of age. Online grocers have made 6% of the market capture in the UK, largely driven by online offerings from all major bricks-and-mortar players as well as a maturing offering from online-only player Ocado. Also, online grocers in the U.S. and Germany have a smaller share and has a scope of growing steadily. And moreover, major players such as Amazon Fresh and Walmart are ready to invest rapidly to accelerate this growth. As per a recent Nielsen Global E-commerce and the New Retail Survey, one-quarter of global respondents are already buying groceries online for home delivery, and more than half (55%) are willing to use it in the future. Online Grocery shopping finally picking up: With Amazon launching Amazon Fresh, disrupting existing grocery models, the existing players will have to ramp up their “click” sales and leverage their network for delivery. And innovation of certain e-commerce models by retailers makes it easy for tech-savvy, time-constrained consumers to get the items one want. Two such successful models are:

i. Click and Collect: Though not the first to start this, early last year, Walmart debuted its Walmart Pickup – Grocery service for registered customers. The concept allows customers to place their orders online any time from two hours to three weeks in advance and pick it up from a Walmart store, Neighbourhood Market or select FedEx Office location, free of any delivery charge. Assortment includes about 10,000 items including dairy, meat and produces as well as other frequent use items. Tesco also started its drive-through supermarkets as an extension to select existing stores. Customers order online, choose a collection time and later pick up their order from a designated area outside the store.

ii. Online Subscription Service: Consumers can create their order list online and select the frequency of replenishment. Orders will be delivered without additional charges at the specified frequency. Almost all online and click & mortar retailers have now got a

subscription service in place. This online-offline play will push the market in a new direction, and the most successful retailers will be at the cross-section of the physical and cyber worlds, leveraging technology to satisfy shoppers, through anytime anywhere commerce.

iii. Smartphones: The big game-changer: In 2011, Tesco (Home plus) introduced the first virtual supermarket in a South Korean subway system, and the model has spread to many other markets since. “Virtual stores”, are basically a virtual display of products on walls of metro stations and bus stops. Commuters can scan the QR codes with their smartphones for the display of the products, and place their orders as they wait for their trains or buses. In many cases, deliveries are made before the customer reaches a home or the destination of choice. Smartphones are set to deeply change grocery shopping. Apps have been developed to pull traffic inside the stores and to drive brand engagement and loyalty. Further, the smartphone is likely to influence consumers by providing actionable information when they’re standing in the aisles, ready to make the purchase decision. Supermarkets are already using the smartphones to: >> Provide nutritional information about food items by scanning the QR code >> Provide deals and discount information for products in the aisles >> Allow shoppers to scan product barcodes, build a shopping list and reorder products.

History of Grocery Shopping in India

Earlier there existed only mom and pop stores, street vendors and street hawkers, from whom the consumers have been shopping for food and grocery consumption based on their demographic profile which is termed as unorganised sector accounting for around 97% in India. Later on, with liberalisation and foreign direct investment into the retail sector in India paved the way for evolution of organised retail formats in food and grocery retail sector crepted in, offering plenty of commodity/product offerings along with service orientation and also emphasizing on certain physical determinants of the retail store format such as ambience, better services, etc. Various retail stores such as hypermarket, supermarkets, malls, discount stores, malls have emerged which serve the consumers with a enjoyable experience/or a fun filled family day out rather than just getting into a particular store, just pick up what you need and then leave. Therefore, most of the retailers are focusing on making the consumer trip to a organised retail store as a personalised experience and an enjoyable one by helping them save money and time in a store.

Later on, the concept of online grocery shopping has emerged with the first firms who came up in the online grocery sale segment were formed in 2011, increasing penetration of Internet connectivity (rise of smartphone users), the growing popularity of mobile shopping, and dealing in daily consumption commodities, grocery e-stores do hold potential in India.

Online Grocery Market in India

The online grocery market in India has gained a lot of traction over the past few months with the emergence of a host of first-generation start-ups and already established traditional grocery chains expanding to the digital platform. India's online grocery market is estimated to grow at a compounded annual growth rate of 62 per cent between 2016-2022. The online grocery shopping is still in its nascent stage, the overall grocery market in India is already worth over US\$ 360 billion (Rs 21,60,000 crore) making India is the sixth-largest grocery market in the world and is expected to touch US\$ 1 trillion by 2020, and also sales are expected to reach 2 percent of overall sales creating a potential market size of around US\$ 10 billion (Rs 60,000 crore) following the surge in number of players operating in the industry. Online grocery stores seem to be the next big opportunity in the e-tailing space. Also there are many online grocers coming up every week. Going by the way the global e-grocers are growing and the growth of e-commerce in the Indian market, and online would capture a small but significant market share. Therefore, the rapid growth of organized and online players is going to make their prominence in the next decade.

Major Online Grocers in India

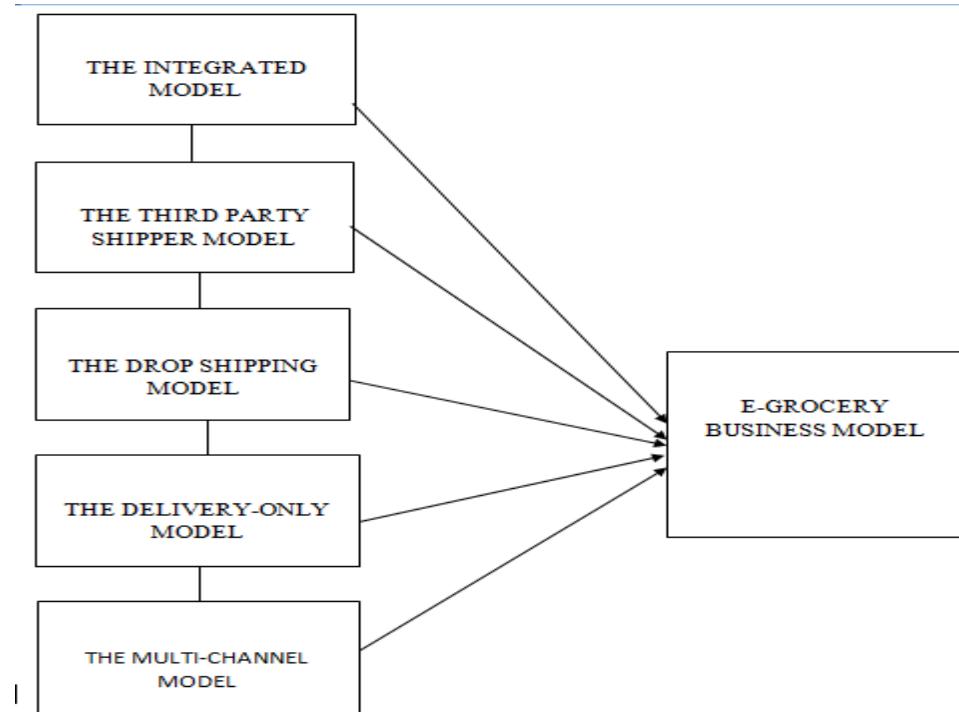
7 best grocery stores in India



1. Big Basket
2. Grofers
3. Zopnow
4. Nature's Basket
5. Amazon Groceries
6. Aaramshop
7. Bazaar cart
8. Naturally yours
9. Reliance fresh



E-Grocery Business Model



Consumption Pattern

As India is a developing country, dominated by the unorganised retail formats, the emerging organised sector, most of the online grocers are finding difficulties to make their place in the present scenario. However, Various factors like increasing awareness and health consciousness, changing lifestyles and time poverty, increasing drift towards convenience and improving availability of convenience foods are increasing the share of processed and packaged foods (including ready to eat / ready to cook traditional and westerns food options,

snacking etc.) in the consumer's food basket. Digital technologies are adopted more quickly by the more engaged younger and newer digital shoppers and also hasten the expansion of digital grocery shopping further.

Future Prospects

Online shopping portals provide goods and services at purchase rates, but the accruing cost of manpower, transportation and storage, resulting in a considerable burden on their expenditure, while their income remains the same. The net inflow being less than the outflow in a crowded market segment may not sound like a solid business model, but generating profit is not an immediate priority for these entrepreneurs. Right now, it is all about grabbing the eyeballs and getting investors on board, and the truth is, these start-ups have been attracting copious investments from venture capitalists and equity firms. These funds help the online grocery enterprises meet their cost of operation as well as ramp-up their operational outlay. Ultimately, the future of online grocery shopping seems extremely secure. The factors such as convenience, comfort, smartphone penetration and ease of use they offer and hassle-free shopping experiences of online grocery shoppers paving the way for grocery platforms to gain momentum.

Conclusion

Grocery shopping will reach maturity and saturation in the near future, but we can't see rise of grocery e-commerce models for a country like India, for demise of brick and mortar supermarkets, but reconfigure the role of the grocery store for the digital food.

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CLIMATE SMART AGRICULTURE: APPROACHES TOWARDS SUSTAINABILITY FOR GLOBAL FOOD SECURITY

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Climate smart agriculture (CSA) which can be defined as sustainably increasing agricultural productivity and incomes by the adapting and building resilience to climate change through the reducing of greenhouse gases emissions. It is also can define as an approach to help guide actions to transform and reorient agricultural systems as effectively and sustainably to support the development and food security under a changing climate. It can also be said as identifying which production systems and enabling institutions are best suited to respond to the challenges of climate change for specific locations for maintaining and enhance the capacity of agriculture that support food security in a sustainable way.

Why it so emerging topics in modern farming system

- 1) Agricultural production systems expected to produce food for a global population which will amount to 9.1 billion people in 2050, over 10 billion by end of the century (UNFPA 2011).
- 2) Climate change that can have effects on all human beings due to its alarming threats to the environment, and agricultural production system all over the world
- 3) The rate of climate change, along with the world population along with income growth issues threatens food security all over the globe.
- 4) In 2005, about 50% of the economically active population with 2.5 million natives in developing countries depended on agriculture production for their living whereas at present 75% of the world's poor lives in rural areas (World Bank, 2008).
- 5) The vital sources of greenhouse gases (GHG) emissions in the agricultural field are not only CO₂ but also causing nitrous oxide N₂O emission that has a share of about 58% in total GHG emissions through the application of fertilizers and soils whereas the CH₄ that has a share of about 40 % in total GHG emissions does so through its

release by livestock and rice cultivation are contributed by the agricultural practices and natural processes which create situations are difficult to effectively control and evaluate.

- 6) In the current circumstances, climate change problems have become a vital scenario that guarantees the sustainability of livelihood.

Approaches for climate-smart Agriculture

- 1) Efficient Resource Management
- 2) Integrated renewable energy technologies for farming systems
- 3) Availability of technical knowledge of farmers
- 4) Resource conserving technologies
- 5) Crops Genetic Modification
- 6) Land-use Management
- 7) Cropping Season variation
- 8) Crops Relocation
- 9) Efficient pest management
- 10) Forecasting
- 11) Crop modelling
- 12) GIS mapping

Efficient Resource Management

Resource management is a very significant feature of CSA with future climate. It is reported as the food losses are found through all stages of the food production till food utilization which are almost one-third part of food produced is wasted (Gustavsson *et al.*, 2011) and the energy consumed in annually world food losses are almost 38 % of the final energy utilized by the total food chain that include All the food chains, from agricultural, transport, conservation, processing, cooking and consumption are likely areas for improving energy use efficiency (FAO, 2011).

Integrated renewable energy technologies for farming systems

The suitable energy technologies, tools and different services in farming fields are important to create a stable change to energy-smart and proficient food systems. Whereas the number of new technologies which can be very important for energy-smart food systems

includes are windmills, solar panels, photovoltaic lights, biogas extraction units, power generators, tools for bio-oil mining and purification, fermentation and distillation processes for ethanol extraction, bio energy-operated water pumps,

Availability of technical knowledge of farmers

In South Asia farmers mostly belong to poor families with limited to their recourses, therefor they are experimenting with climate variability for centuries but conventional environmental knowledge of people improved with developed in the test of time could give different ideas and feasible options for adaptation procedures to adopt new technology

Resource conserving technologies

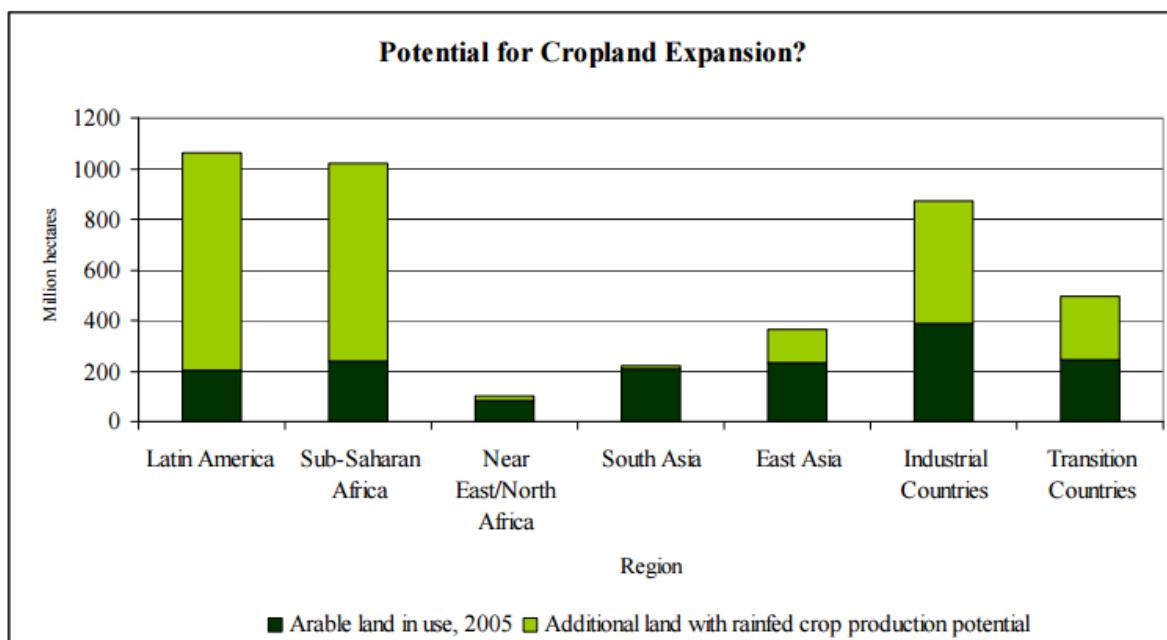
The resource-conserving technologies (RCTs) consists of techniques which enhance efficiency in the management of resources and application of inputs that use of direct, identifiable and comprehensible economic advantages that decline in production costs; saving fuel, labour and water; the timely sowing of crops, resulting in improved yields. The RCT such as zero tillage systems (ZT) or no-tillage is a cultivation system which can be explained “as the system of cultivating crops into untilled soil by creating thin channels to have adequate depth and width to attain suitable seed coverage

Crops Genetic Modification

Environmental stress mostly affects the decay of organic matter in the soil, availability of nutrients and water to the plant, which recycling of water and nutrients. The nutrient concentration and period of environmental limits conclude the level of effect on crop growth cycle and biomass accumulation. It is reported that Crop yields in Asia are estimated to decrease by 2.5-10% from 2020 and by 5-30% after 2050, that is the most horrible decrease in South and Central Asia (Cruz *et al.*, 2007) there for the adjustment techniques that can play enhanced by the availability of new crop varieties which are tolerant to heat, drought and salinity and thus reduce the risks of climate situation and the genetic diversity of the seed structure and seed composition has been recognized as a very effective defence against plant disease and pest attack and risks of climate.

Land-use Management

The changing land-use practices like to be the location of crops and livestock production, rotation or shifting production between livestock and crops, shifting production out of marginal areas, changing the intensity of the application of fertilizers and pesticides, capital and labour that can help minimize the risks from climate change on production of agriculture. Whereas the adjustment of a sequence of the crop by altering the time of sowing, spraying, and harvesting the crop, in order to take benefits of the altering length of seasons of growth and levels that changing heat and humidity associated is one more option.



Land uses management and resources (**Source:** Burnisma, 2009)

Cropping Season variation

Planting dates can be set to reduce infertility induced by the increased temperature which may save the flowering period from coinciding with the hottest period whereas the changing of sowing or planting dates to take benefit of the wet period to avoid intense weather events in the growing season and cultivation systems include improving the better cultivars and enhancing the intensity of farming various crops there for farmers will have to manage the changes in different hydrological regimes by adopting changed crop rotations (Pathak *et al.*, 2012).

Crops Relocation

It is necessary to different regions and crops that are very much prone to climate change variability, so these should be repositioned to more appropriate areas would be more appropriate for these kinds of crops with respect to quality must be identified and evaluated for suitability.

Efficient pest management

1. To the development of cultivars resistant to diseases and pests;
2. Integrated pest management (IPM) adoption having more dependence on biological control with a change in cultural practices.
3. To the adoption of substitute crop production and techniques, as well as places that are resistant to pests and other hazards

Crop modeling

Crop modeling is a creative and newly developed tool for dealing risks in Agriculture where the computer-aided simulation models play an important role to approach the techniques which establish crop management responses and forecast crop yield. Whereas two crop management systems are APSIM (Agricultural Production System Simulator) and DSSAT (Decision Support System for Agro Technology Transfer) that are mostly used in the whole world (Ahmad et al., 2014)

GIS mapping

GIS (Geographical Information System) that is used in analysis and mapping which helped in the estimation and computation of the storm course and flooding associated with hot cyclones which create a risk and hazard maps at different possible scales to show the threat allocation across the different geographical region which can be site-specific include provincial or municipal administrative areas and other small national landscapes, like river basins, coastlines and lake.

Hazards

Vulnerability

Risk

Used to inform:

- DRR-specific plans
- Adaptation-specific plans
- CSA strategies
- Land-use or territorial planning
- Development investments
- Post-disaster recovery planning

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Hazards - Republic of Nicaragua, Dirección de Hidrología Superficial

Vulnerability - ©FAO, Thomas Hofer

Risk - ©FAO, Truls Brekke

Risk Assessment and mapping (Source: IPCC, 2007)

Conclusion

It reported that (FAO) if the present production and consumption rates continue, agricultural production should increase 60% by 2050 to meet the needs of food of world's population for achieving food security and agricultural development goals with adaptation to climate change will be required to lower emission intensities per output by improving food protection through the moderate climate change, sustainably use the natural resource, use all products more competently, have less inconsistency with greater constancy in their outputs with more fruitful and more flexible agriculture requires a most important change in the way of the use of land, water, soil nutrients and genetic resources management by climate-smart agriculture techniques

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