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Goat Milk in India

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Backyard Chittagong Chicken Farming:

A Source Of Better Livelihood For Rural Farmers

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POULTRY FARMING IN INDIA:

Poultry farming includes rearing of chicken, duck, geese, quail, turkey, guinea fowl for both meat and egg purpose. Poultry, apart from chicken also includes ducks, geese, turkeys and guinea fowl. However, it mainly deals with chicken. Chickens constitute 91% of the global annual poultry income. This is probably because chickens are more easy to handle and more economical to culture. The present article is mainly devoted to chicken poultry. Poultry farming is one of the old practices of domestication. The domestication of chicken in India dates back to 3200 B.C. The ancient Indians were attracted by their use as food as well as for sports. Cock-fighting was known in India over one thousand years B.C. and till recently, it was regarded as an important sport providing a lot of entertainment to the people. Recent years commercial broiler and layer industries had a boom in economic upliftment of marginal poultry farmers. Eventhough the commercial poultry supplies maximum protein supplement to the people of India, consumers prefers native chicken meat and egg rather than broiler meat and layer egg. This is because of awareness on organic farming and the native / desi chicken egg and meat are comparatively tastier than commercial poultry meat and egg.

DIFFERENT BREEDS OF CHICKEN:

India and its neighbouring countries are supposed to be the ancestral home of the present day chicken. South and Central India, Assam, Burma, Ceylon, Sumatra, Java and their adjacent islands are the native place for the old world chickens. According to William Beebe these birds migrated northward and westward from India till they reached Greece by 525 B.C. The Iranian invaders carried these birds through Persia into Palestine and the Jews of Palestine introduced them to Europe. In course of time these birds spread to Australia, America, Africa and the remaining parts of the Asia. The present-day breeds of poultry can be traced back to the wild jungle fowl of South and Central India from which the modern breeds have descended. There are four known species of wild fowl which still exist in their natural habitat. They are as follows:

Chicken may also classified based on their utility as,

1) Egg type - Eg. White Leghorn, Minorca, Ancona
2) Meat type Eg. Cornish, Plymouth rock, Brahma
3) Dual purpose - Eg. Rhode Island Red, New Hampshire
4) Game bird - Eg. Aseel
5) Fancy variety - Eg. Silky, frizzled, bantams
6) Desi type- Eg. Kadaknath, Naked neck, chittagong.

Chittagong:

Chittagong chicken is named after the Chittagong district in south-eastern region of Bangladesh where it is largely bred. The origin of Chittagong is Malayan Peninsula, hence it is also known as "Malay". They are also called Deang Fowls, as the best specimens are bred in a place in Chittagong called Deang. This breed is mainly famous for delicious meat. Eventhough it is lays good number of eggs; it has poor mothering ability which leads to more chick mortality in natural brooding. The Chittagong chicks are very delicate compare to other native chicken chicks but grow at a faster rate and comparatively it is a handy variety. This is breed is a dual purpose breed reared for both meat and egg purpose.

Another breed Brahma developed in the Britain and exported to United States of America by cross-breeding Shanghai birds with Chittagong chicken. Hence the Brahma chicken breed has distinctive characteristics of head shape and pea comb of Chittagong.

Body confirmation

The Chittagong breed has no specific plumage colouration but the most popular colour is golden and light yellow. It has a small pea comb which resembles a single comb due to its tiny warts. The body is relatively short with a small tail. The head and neck should be long, the beak yellow, the wattles very small and red, and in the hen hardly visible, the ear-lobes small and red, sometimes with a little white, the eyes white or light yellow, eyebrows prominent and overhanging the eyes, making the head look very broad, the neck long and the breast broad and deep, the carriage very upright with broad shoulders, the back sloping gradually to the tail being slightly narrow at the loins. The wings carried high and projecting at the shoulders, the tail small and full, (in the cock it should droop) the legs yellow, straight, long and strong, without feathers, and the plumage very close, firm, short and glossy, with the feathers narrow. The breast is broad and fleshy. The cock measures 30 inches from beak to toe. The average weight of the cock is about 4.5 kg and that of the hen is 2.5—3.5 kg.

Egg Production:

Chittagong breed is good layer lays an average of 120 to 130 eggs per year. The colour of the egg varies from brown to light brown and weighs slight more than regular desi chicken egg.

Cultural / Economic Significance:

Chittagong is a large bird with a very strong and hardy quarrel some temperament. The bird possesses all the characteristics of a good game bird such as colouring (primarily bay, chestnut, gray, roan, palomino, black, etc.), large eyes, long mane and tail, strong, yet refined legs, high headset when in action, and low tail set. They are good egg layers.

Disease management:

Compare to commercial broilers and layers the Chittagong breed is more disease resistant. Moreover regular

vaccination and deworming schedule as that of desi chicken can be followed for Chittagong chicken is necessary. The vaccination schedule for the chicks is mentioned below. The deworming of chicken to be done for every month and periodic fecal examination should be done to avoid mortality due to internal parasites. Regular debeaking is necessary at 45 days of age if the chicken is maintained under semi intensive system with over population. Dipping should be carried out with 1% of either cypermethrin or deltamethrin to control lice infestation whenever needed. Fencing and provision of shelter during night hours should be given to prevent predator menace.

Age of the chicken	**Vaccine name**	**Route of Administration**
Day old	Marek's	S/C
5th day	RDVK – F1 strain	Eye / oral
14th day	IBD	Intra nasal
28th day	Lasota	Drinking water or S/C
40th day	Fowl pox	S/C
8th week	RDVK	S/C
16th week	RDVK	Drinking water
24th week	Lasota	Drinking water
Above 24 weeks (2 months once)	Lasota	Drinking water

Points to remember

1.It is also known as Malay / Deang.

2.Dual-purpose bird.

3.The popular varieties are buff, white, black, dark brown and grey.

4.Pea comb, red ear lobes, over-hanging prominent eyebrows, feather-less shank

5. **Native Tract:** Found in the North Eastern states of India bordering Bangladesh

6. **Average weight of Cock:** 3.5 – 4.5 kg and Hen: 3 - 4 kg.

Conclusion:

Chittagong chickens that can be introduced in backyard poultry farming have following characters

- Adaptability in village condition
- Self propagation
- Good brooding capacity
- Well body conformation
- Hardy in nature
- Good scavengers
- Attractive and coloured plumage
- Escaping capacity from predators
- Disease resistance

Due to above mentioned characters, the Chittagong breed is better adoptability in village condition and can be raised for both meat and egg, it shall be propagated in rural areas of India for better livelihood of rural farmers.

Production and Marketing of Cheese: A Global Perspective

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Cheese is an old dairy delicacy prepared from the milk of cow, buffalo, goat and sheep containing high amount of minerals, protein, vitamins & calcium. Over the years, consumption of cheese has increased rapidly leading to the art of cheese making into a profitable business. The global cheese production is strong and the pace for exports is even stronger in the market. One of the oldest foods of mankind.Originated accidentally, word cheese derived from 'cese' which in turn derived from "caseus". Cheese is the curd or substance formed by the coagulation of milk Curd – a source of high quality protein food & Whey provided refreshing drink It was a prominent article of Greek and Roman diet 2500 yrs ago. Cheese making has been an 'Art' handed down from generation to generation. Until 18th century cheese making was essentially a farm house industry.

WORLD CHEESE PRODUCTION

The largest producer of cheese is USA, accounting for 30% of world production, followed by Germany and France.The biggest exporter of cheese by monetary

value is France. The USA, the biggest world producer of cheese, is a marginal exporter, as most of its production is for the domestic market. Germany is the largest importer of cheese and UK and Italy are the second- and third-largest importers. Greece is the world´s largest (per capita) consumer of cheese, with 27.3 kg.

WORLD CHEESE MARKET

EU and USA account for 70% of the world cheese production in 2012 and the production of cheese is expected to show dynamic growth until 2020 where the production will amount to 16.6 million MT. However, the relative share of the world cheese production will decrease to 66% in 2020 due to relatively higher

World cheese production 2000-2020

1,000 MT	2000	2012	2012/2000	2020 (prognosis)	2020/2012
EU-28	7,709	9,333	+21 %	10,606	+14%
Other Europe	266	291	+9%	338	+16%
CIS	448	866	+93%	1, 072	+24%
North America	4,227	5,618	+22%	6,720	+20%
Oceania	665	700	+5%	930	+33%
South America	1,118	1,625	+45%	2,067	+27%
Asia	293	456	+55%	1,288	+182%
Middle East + Africa	744	1.512	+103%	2,054	+36%
Total World	15,470	20,401	+32%	25,075	+23%

Source: IDF, ZMB, FAPRI, CNIEL, PM FOOD & DAIRY CONSULTING.

growth all other regions of the world except other Europe. It is one of the most dynamic food segments in the last 20 years with steady growth in production, consumption and international trade. Asia's major cheese producing countries are Iran, India, China, Japan, and South Korea and they account for more than 90% of the cheese production in Asia. The Asia Pacific cheese market valued at USD 8293.2 million in 2013 & is estimated to reach USD 15489.3 million by 2021. The market is poised to grow at a CAGR of 8.1% between 2014 and 2021. Asia Pacific, especially the China and India, are among the fast growing markets in the global cheese market. Moreover, growing preference for fast food by consumers due to a rapid changing lifestyle in prime markets of Asia Pacific such as India and China is expected to play a crucial role in boosting the consumption of cheese in this market over the next few years.

WORLD CHEESE CONSUMPTION

The positive development for the cheese consumption will continue from 2012 to 2020 where the world consumption will increase by 4.4 million MT (+21%) and the major regional changes are: EU will expand by 800,000 MT (+9%) which is slowest growing region in relative terms but high in absolute figures. The consumption of cheese in CIS (common-wealth of independent states) will increase by 300,000 MT (+26%) and here mainly Russia will contribute and mainly from imported cheese. In Asia the growth will peak with 63% but it is from a low level so in absolute terms it will only

World cheese consumption 2000-2020

1,000 MT	2000	2012	2012/2000	2020 (prognosis)	2020/2012
EU-28	7,502	8,870	18%	9,629	9%
Other Europe	245	318	30%	372	12%
CIS	714	1,150	61%	1,445	26%
North America	4,390	5,557	27%	6,950	25%
Oceania	266	268	1%	302	13%
South America	918	1,642	78%	2,041	24%
Asia	557	1,023	84%	1,672	63%
Middle East + Africa	1,108	1,840	66%	2,676	45%
Total World	15,700	20,668	32%	25,087	21%

Source: IDF, ZMB, FAPRI, CNIEL, PM FOOD & DAIRY CONSULTING.

Table 1: India: Estimated Retail Sales of Packaged Dairy Products

($ million)	2010	2011	2012	2013	2014
Fluid Milk	4,559 (84.02)	5,252 (83.06)	6,055 (81.96)	7,042 (80.86)	8,098 (79.69)
Powder Milk	186 (3.43)	207 (3.27)	232 (3.14)	261 (3.0)	293 (2.88)
Dairy Only Flavored Milk Drinks	115 (2.12)	152 (2.4)	198 (2.68)	257 (2.95)	325 (3.2)
Yoghurt and Sour Milk Products	297 (5.47)	399 (6.31)	537 (7.27)	716 (8.22)	933 (9.18)
Cheese	99 (1.82)	124 (1.96)	155 (2.1)	195 (2.24)	244 (2.4)
Other Dairy	160 (2.95)	178 (2.82)	198 (2.68)	223 (2.56)	251 (2.47)
Non-Dairy Milk Alternatives	9 (0.19)	11 (0.18)	13 (0.17)	15 (0.17)	18 (0.18)
Total Milk and Dairy Market	5,426 (100)	6,323 (100)	7,388 (100)	8,709 (100)	10,162 (100)

2015 Exchange Rate 1 USD= INR 61.693
Figures in parentheses represent a percentage share of the total market value
Source: Euromonitor

amount to 600,000 MT.

MODE OF CHEESE UTILIZATION

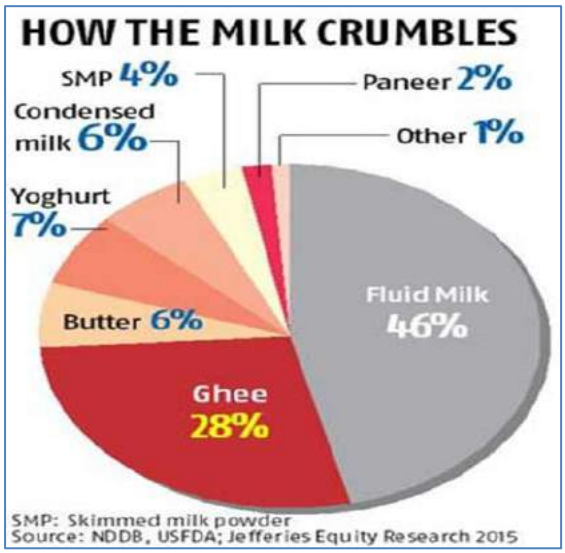
Cheeses are highly diversified. Cheese is capable of satisfying diverse range of sensory and nutritional demands. Use of cheese as food ingredients accentuated the need for specific and consistent properties.

Table 3. Utilization of cheese in different food products

Food Product	Usage (as % of total usage)
Pizza	26
Snack Foods	17
Soups/ Sauces/ Dressings	15
Frozen Entrees	14
Baked Goods	11
Appetizers	7
Pet Foods	6
Rice/Noodle mixes	3
Shelf Stable Entrees	1

MILK UTILIZATION PATTERN: INDIA

India Ranks First in Milk Production (146.3 MT) in the world (18.5 Per cent of World Milk Production) (2014-15). Milk Production in India Recorded a growth of 6.26 % compared to 3.1% of the world (2013-14 to 2014-15)



CHARACTERISTICS OF INDIAN CHEESE MARKET

Cheese production is growing at approximately 15 percent per year, which is partially driven by India's young demography and growing urban middle class. The increased availability of cheese styles like mozzarella and cheddar, coupled with growing awareness about usage is likely to drive further growth. Urban cheese demand represents 60 percent of total Indian sales. Urban per capita consumption is 700 grams per year while the national average is 200 grams

per year which is much lower than the world average of seven kilograms per year. Eighty percent of the total cheese market is processed cheese, which reportedly is mostly used by quick service restaurants and fast food chains for pizzas and burgers.

Table 4: India: Local Companies that Produce Cheese

Company /Brand	Popular Variants / Description
Amul	Cheddar, Emmenthal, Gouda, Mozzarella, and Processed Cheese
Britannia	Cheddar, Cream, and Cheese Spread
Gowardhan	Cheddar, Mozzarella, and Processed Cheddar
Milkana	Cheeses Slice and Cheese Spread
Milky Mist	Cheddar Cheese, Cheese Blends, Cheese Spread, and Mozzarella Cheese
Mother Dairy	Cheeses Slice, Cheese Cubes, and Cheese Spread
Choudhery Cheese Bazar	Mozzarella, Cheddar, Scarmozza, Cheddar, Gouda, Smoked Cheese, Feta, Emmenthal, Mascarpone, Edam, Ricotta, Parmesan
Flanders	Gouda, Kwark, Scamorza, **Bocconcini,** Mascarpone, Ricotta, Burrata
Acres Wild	Gouda, Fetta, Ricotta, Halloumi
Passion Cheese	Gouda, Feta, Parmesan, Cheddar, Edam, Mozzarella, Processed Cheese, Emmenthal, Ricotta
Dairy Craft	Mozzarella, Bocconcini, Mascarpone, Scamorza, Ricotta, Processed Cheese, Cheddar
Exito Gourmet	Mozzarella, Bocconcini, Burrata, Mascarpone, Ricotta, Scamorza, Parmesan, Cheddar, Gouda, Edam, Emmenthal, Monterey Jack, Processed Cheese
La Ferme Cheese	Mozzarella, Feta, Ricotta, Lofabu, Auroblochon, and Parmesan.

Source: Information collected from various industry contacts

CONCLUSIONS

Growth drivers of Indian Cheese Market

POTENTIAL to CONSUME - As a developing nation with a healthy growth in per capita income, unlike in the developed world, there is an increasing acceptance of milk and milk products in India.

STRONG CO-OPERATIVE EFFORTS - With support from Govt, the Co-operative movement is gaining strength in the country, leading to better prices for farmers & a more organized method of collection, processing & distribution

SURGE in RETAIL TREND - The arrival of food multinationals, rising popularity of quick-service restaurants, modern retail trade and technological advancements.

POTENTIAL to STORE - The government plans to open 30 mega Food Parks and many Cold Storage by the end of the 11th five year plan (2007-2012)

Impact of Global Climate Change on Agriculture

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Abstract

Agriculture and climate change are linked—crop yield, biodiversity, and water use, as well as soil health are directly affected by a changing climate. Climate change, which is largely a result of burning fossil fuels which adversely affecting the Earth's precipitation, temperature, and hydrological cycles. Continued changes in the compounded climate factors can decrease plant productivity, resulting in price increases for many important agricultural crops.

Key words*: climate change, crop, yield, plant productivity*

INTRODUCTION

Climate is the average weather of given region or area over a given period of time. It is a result of delicate balance between the sun, topography, oceans, atmosphere, plants, water system, and all living organisms. The greenhouse effect produces the relatively warm and hospitable environment near the earth's surface. However, the increased level of greenhouse gases (GHGs) (carbon dioxide (CO2), water vapor (H2O), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6) etc) due to anthropogenic activities has contributed to an overall increase of the earth's temperature and finally leading to a global warming. The average global surface temperature have increased by 0.74 ^{o}C since the late 19th Century, then temperature increase by 1.4 ^{o}C - 5.8 ^{o}C by 2100 AD with significant regional variations (IPCC, 2007).

Table 3:Estimates of future levels of CO_2

Year	CO_2 ppm
2000	369
2010-2015	388-398
2050/2060	463-623
2100	478-1099

CAUSES OF CLIMATE CHANGE

Table 1: Atmospheric composition (Dry atmosphere by volume)

Gas	Volume	Gas	Volume
Nitrogen (N_2)	780,840 ppm (78.08%)	Hydrogen (H_2)	0.55 ppm
Oxygen (O_2)	209,460 ppm (20.94%)	Water vapor (H_2O)	Typically 1% to 4%
Argon (Ar)	9,340 ppm (0.934%)	Nitrous oxide	0.5 ppm
Carbon Dioxide(CO_2)	381 ppm	Xenon	0.09 ppm
Neon (Ne)	18.18 ppm	Ozone	0.0 to 0.07 ppm
Helium (He)	5.24 ppm	Nitrogen Dioxide	0.02 ppm
Methane (CH_4)	1.745 ppm	Iodine	0.01 ppm
Krypton (Kr)	1.14 ppm	Ammonia	Trace

Table 2: Overview on greenhouse gases conc., life time and their global warming potential (GWP)

GHGs	Concentration		Life time (Years)	GWP
	1750	1998		
CO_2 (ppm)	280	360	120	1
CH_4 (ppb)	700	1745	14.5	23
N_2O (ppb)	270	314	120	296
CF_4 (ppt)	40	80	> 50000	5700
C_2F_6 (ppt)	0	3.0	10000	11900
SF_6 (ppt)	0	4.2	3200	22200
Tropospheric ozone (ppt)	25	34	0.01-0.05	---

A. Natural: i) Continental drift, ii) Volcanoes, iii) Ocean currents, iv) Earth's tilt, v) Comets. Meteorites and asteroids
B. Human induced: i) Burning of fossil fuel, ii) Change in land use pattern, iii) Industrialization, iv) Urbanization, v) Deforestation, vi) Transportation

DIRECT OBSERVATIONS OF RECENT CLIMATE CHANGE

Global average air temperature**:** Updated 100-year linear trend of 0.74 [0.56 to 0.92] ^oC for 1906-2005, larger than corresponding trend of 0.6 [0.4 to 0.8] ^oC for 1901-2000 given in TAR, average ocean temperature increased to depths of at least 3000m ocean has absorbed 80% of heat added seawater expansion and SLR.

HEAVIER PRECIPITATION, MORE INTENSE AND LONGER DROUGHTS

More intense and longer droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics.

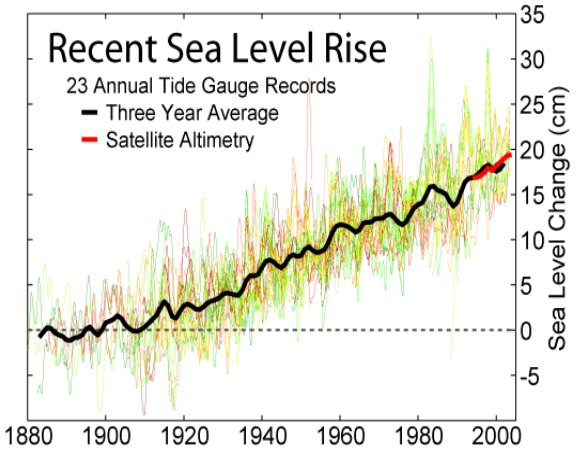


Fig no.1

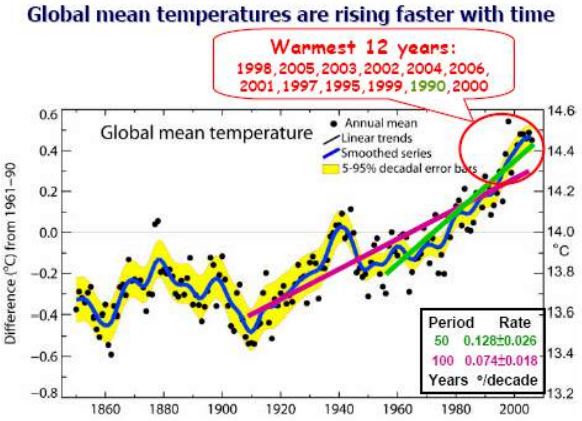


Fig no.2 *IPCC, 2007*

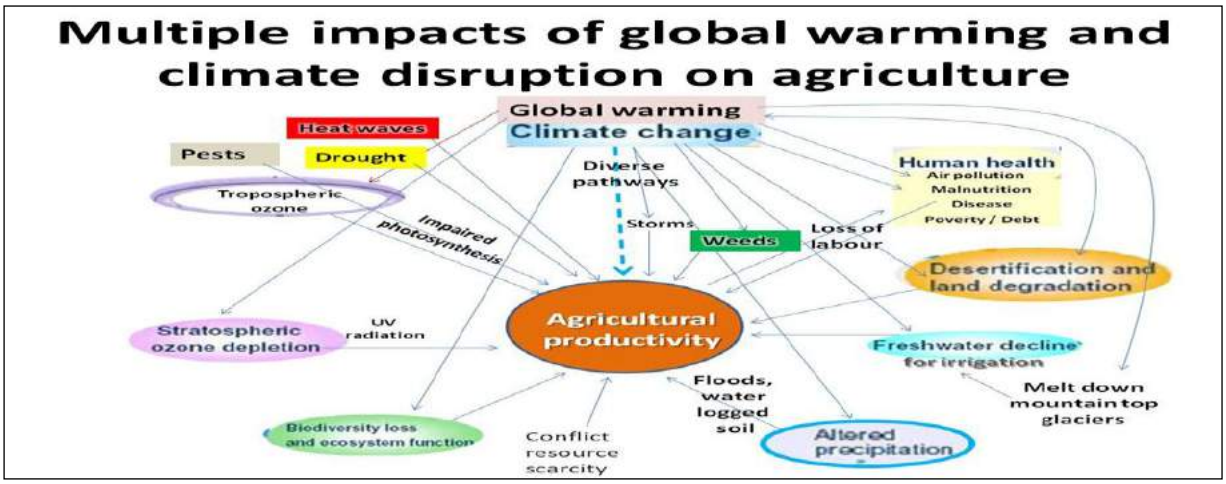
The frequency of heavy precipitation events has increased over most land areas. It is very likely that hot extremes, heavy precipitation and heat waves events will continue to become more frequent and that future tropical cyclones (typhoons and hurricanes) will become more intense.

Fig no. 3

Fig no. 4

EVIDENCE ON LOSS OF BIODIVERSITY

Since the 1950s, Europe has lost more than half of its wetlands and most high–nature–value farmland; and many of the EU's marine ecosystems are degraded. At the species level, 42% of Europe's native mammals, 45% of butterflies, 43% of birds, 30% of amphibians, 52% of freshwater fish and 45% of reptiles are threatened with extinction; most major marine fish stocks are below safe biological limits. Some 800 plant species in Europe are at risk of global extinction. This loss of species and decline in species' abundance is accompanied by significant loss of genetic diversity. Since the late 1970s, an area of tropical rain forest larger than the EU has been destroyed, largely for timber, crops such as palm oil and soy bean, and cattle ranching. Wetlands, drylands, islands, temperate forest. Mangroves and coral reefs, are suffering proportionate losses. Species' extinction rates are now around 100 times greater than that shown in fossil records and are projected to accelerate,



threatening a new 'mass extinction' of a kind not seen since the disappearance of the dinosaurs.

Table 4: Climate change scenarios for India

Year	Season	Increase in temperature, ^{0}C		Change in rainfall, %	
		Lowest	Highest	Lowest	Highest
2020s	Rabi	1.08	1.54	-1.95	4.36
	Kharif	0.87	1.12	1.81	5.10
2050s	Rabi	2.54	3.18	-9.22	3.82
	Kharif	1.81	2.37	7.18	10.52
2080s	Rabi	4.14	6.31	-24.83	-4.50
	Kharif	2.91	4.62	10.10	15.18

Source: Lal et al., 2001

Some Specific Impacts on India:

i) Stress on the land and water resources,
ii) Threat to ecosystems and biodiversity,
iii) Agriculture: Yields of major crops expected to decline,
iv) Potential for drier conditions in arid and semi-arid parts of India
v) Greater vulnerability to extreme climate events like typhoons, cyclones, droughts and floods, particularly in coastal areas.

IMPACT ON AGRICULTURE

Factors effecting crop production in changing climate

Evidences on Agriculture

- Most of the studies and models on impacts of climate change on agricultural production systems indicate that there will be negative effects on crop yields over the next century.
- Changing of wheat sowing time from mid November to mid December.
- Cultivation of temperate fruits in much higher altitude than earlier
- Rice yields are decreased by 3% to 10% under a scenario of 1.50C rise in temperature and a 2 mm day-1 increase in precipitation.(Saseendran *et al.*, 2007)
- Yield losses would be more in case of winter wheat than that of rice and that the associated economic impacts would affect more adversely the lower income groups of the society.(Kumar and Parikh, 1998)
- Fankhauser (1995) has estimated the annual forestry losses to be US$1.8 billion in the OECD and US$2 billion for the world as a whole due to the climate change.
- Decreased precipitation and increased temperature and a, could have adverse effect on forests

(Ravindranath N H and Sukumar R (1998).

- Modification in cropping pattern from wheat to maize in Bihar.

IMPACT OF CLIMATE CHANGE ON SOIL

Organic matter content: Rise in atmosphere CO_2 concentration increase photosynthetic rates and water use efficiencies and increase in organic matter supply to soil very fast, that's result carbon concentration reduce simultaneously.

Microbial activity: Increase in temperature, in which soils are warm, microbial activity will be increase.

Changes in clay mineral surfaces:

1. Hydrolysis- means removes silica and basic cations.

2. Cheluviation- removes maximum Al and Fe.

3. Ferrolysis- decreases CEC by altering Al interlayering.

4. Dissolution of clay minerals- produces Al salt and amorphous silica.

5. Reverse weathering- creates montmorillonite.

Mitigation:

1. Drought proofing by mixed cropping

2. Selecting genotype in crops that have a higher per day yield potential to counter

3. Yield loss from heat-induced reduction in growing periods.

4. Participatory and formal plant breeding to develop climate-resilient crop varieties that can tolerate higher temperatures, drought and salinity.

5. Resource conservation

6. Frost management by irrigation

7. Heat stress alleviation by frequent irrigation

8. Shelter belts

9. Invent short duration varieties/crops

10. Altering fertiliser rates to maintain grain or fruit quality and be more suited to the prevailing climate

11. Changing the amounts and timing of irrigation

12. Soil moisture conservation (e.g. crop residue retention)

13. Altering the timing or location of cropping activities

14. Develop a long-term land use plan for ensuring climatic resilience and food security.

15. Provide more funds to strengthen research for enhancing adaptation and mitigation capacity of agriculture.

CONCLUSIONS

Increased temperature hampered the grain filling which ultimately leads to reduction in yields. Poor verbalization occurs due to increase in extremes of weather elements. In general, climate changes have the potential to lead to large disruptions in agricultural sector in the state and have adverse impacts on food security.

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Ultra-High Density Plantation of Mango:

New Technology for Increasing the Income of the Farmers

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Mango comes first among the top rated delicious fruits; mango farmers are used to get considerable income. India is the world's largest producer and exporter of mangoes but the average yield per hectare of mangoes in India is one of the lowest in the world – even behind countries like Bangladesh and Pakistan. The mango productivity in India is estimated at 6 metric tonnes per hectare while that of Brazil is 16 metric tonnes per hectare. Despite this, India ranks first among the mango producing countries of the world, accounting for about half of the world mango production (43,000 MT) followed by China, Thailand and Pakistan. The export of fresh mango fruit is limited only to Alphonso and Dashehari varieties, which accounts for 0.2 per cent of the total production. The low productivity in mango is mainly due to low plant population per hectare; the absence of scientific methods of irrigation; inefficient nutrient management; improper orchard management practices; greater losses due to insect, pests and diseases; natural phenomenon like heavy rainfall, strong wind velocity, hailstorm etc.; unscientific method applied by the farmers for plucking the fruits and majority farmers are unaware about the quality parameters for export mango. Therefore, there is need of increasing the productivity gains of mango fruits along with maintaining the quality of fruit. Under these circumstances, alternative method of plantation and management is necessary to deal with these conditions – giving higher yield at less cost with more resilience to climatic stresses maintenance export quality of fruits.

Ultra-high density plantation (UHDP) is a new and proven technology, commonly practiced for mango cultivation worldwide and combined with other sustainable agricultural techniques, has the potential to yield 200% more produce than that of the traditional method. The ultra-high density mango plantation is a technique which has utilized all the resources optimally and thus, increased the production per unit area as well as raises profit margin of

mango farmers. Now-a-days, mango is cultivated through this technique by the farmers for their consumption as well as for export purpose which includes mango fruits of uniform shape, colour, flavour and freshness. In the conventional planting technique of mango cultivation, it is very difficult to maintain uniformity, but the adoption of new technology called **"Ultra-High Density Mango or Meadow Orcharding"** planting ensures export quality of mango fruits.

ORIGIN OF UHDP TECHNIQUE:

The ultra-high density mango plantation methods as it originated in the field of South African farmers, now has been evolved in a scientific way in our country. A few years back, when many scientists went for international seminar in South Africa, they were surprised by watching a farmer's field where 900 mango trees were planted in an acre. Traditionally, our farmer's familiar with 40 to 70 trees per acre, while some of the latest growers switch over to 200 trees per acre, but the orchard of 900 trees in an acre was a surprise for our scientist. Since, this technology helps to raise the productivity and maintain the uniformity as well as quality of the fruits, our scientist started to adopt this technology according to Indian climatic conditions.

ADOPTION OF UHDP TECHNIQUE:

Accommodation of the maximum possible number of the plants per unit area to get the maximum possible profit per unit of the tree volume without impairing the soil fertility status is called the **high-density planting**. HDP orchards were first planted in Europe at the end of the 19th century and since then there is a decline in traditional orchards with low densities. The underlying principle of a HDP is to make the best use of vertical and horizontal space per unit time and to harness maximum possible return per unit of inputs which means **"planting of more number of plants than optimum through manipulation of tree size"**.

UHDP or Meadow Orchard System is a new concept of planting which has been developed in guava for the first time in India at CISH, Lucknow. The Meadow Orchard is a modern method of various fruit cultivation using small or dwarf tree with modified canopy. Fertilizer dose, spacing, growth regulation by the training and pruning, use of the mechanical

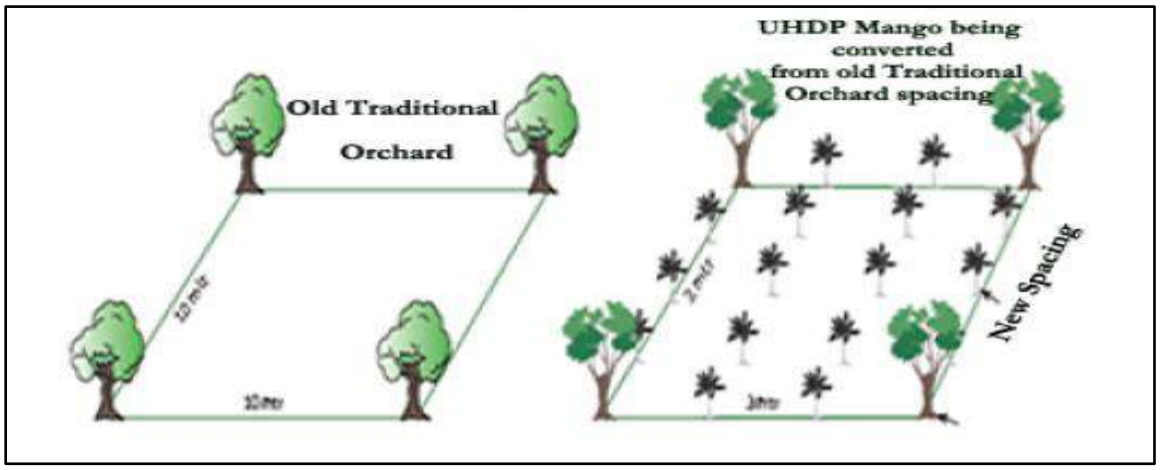

Figure 1. Mango Cultivation with UHDP Technology

devices etc. may also be tried either singly or coupled with other crop management practices for a successful adoption of this concept. It also promotes rate of photosynthesis that leads to high yield per unit area.

MECHANISMS OF UHDP:

1. Mango Cultivars: There are several mango cultivars which can be cultivated using this technique *viz*. Alphanso (also known as King of mango fruit), Imampasanth, Banganapali, Bangalora, Neelam, Bombay, Alampur, Baneshan, Totapuri, Himsagar, Langra, Chausa, Mankaurad, Kesar, Bombay green, Dashehari, and many other varieties. Basically, the availability of a dwarf plant is the first and foremost prerequisite for establishing any UHDP. The varieties suitable for dwarf scion are Amrapali, Alphonso, Langra and Himsagar while the suitable varieties for dwarf rootstocks are Vellaikolumban and Olour.

Whereas, several cultivars have been evolved by various scientists at ICAR and other Research Centers throughout the India which includes the cultivars such as Mallika, Ratna, Sindhu, Manjeera, Arka Anmol, Arka Aruna, Arka Neelkiran, Arka Puneet, etc. which has been recommended for this technique. Amrapali, is a popular mango cultivar, which can be planted at a spacing of 2.5 m × 2.5 m and thus, adopts 1600 plants per hectare.

2. Training and Pruning: Training and pruning are effective tools in UHDP by virtue of their impact on shape and size control of the tree. The training begins when the tree is first planted and continues throughout its productive life which helps to keep the trees within nearly 7 feet height and with balanced vegetative growth looking like an umbrella shape. Proper tree forms, branch angle and limb spacing in itself aids in growth control. First training is done after one growing season. Each plant is allowed to maintain single stem (main stem) with upward growth up to 60-80 cm and then four scaffold branches are allowed in four directions to make the tree frame. Thereafter, 2 shoots arising from each primary branch at a distance of 60-75cm from main stem is allowed to form secondary and likewise the tertiary branches. After start of bearing in plants, shoots arising from secondary and tertiary branches are given 15-20 cm deep pruning soon after fruit harvest. Spray of 1% urea combined with 0.2% copper fungicide should be done soon after pruning to increase the vegetative growth as well as to avoid the fungal infection.

Precautions to be maintained during training and pruning:

a. The height of tree should be maintained below 7 feet.

b. Cut ends should be treated with fungicide like Bordeaux paste or 2% Copper Oxychloride (COC) suspension or 0.2% Blitox-50 immediately after pruning as paint or as a spray.

c. Thinning of newly emerged shoots is essential to avoid excess shoots and overcrowding which should be done after one month of pruning.

3. Growth Regulator: In India, mango plant suffers from various problems like prolonged dormancy, excessive vegetative growth, reduced flowering and extreme fruit drop. Therefore, the mango yield not uniform in every year, so, to obtain good yield every

year it is mended to apply growth regulator culture just before flowering season. Application of growth retardants like 0.0001% Placlobutrazol (Cultar) should be done especially in areas where the climate is hot and humid which results in continuous vegetative growth, inhibits the growth promoting gibberellins within the tree with the result that vegetative growth gets restricted and trees put forth regular flowering by around September month. Spraying of 2, 4-D @ 10 ppm or NAA @ 50 ppm at pea stage and at marble stage helps in preventing fruit drop.

SUITABLE CROP MANAGEMENT PRACTICES:

1. Mechanization: It is the system automation which contributes to high production. One of the important farm operations that can be automated is irrigation and fertigation. In fact, irrigation and fertigation have been identified as one of the key factors for the success of high density orchards. Plant should not be kept under stress after pruning therefore, assured irrigation coupled with fertigation is essential after pruning and during fruit development in ultra-high density orchards.

The drip irrigation system ensures effective water management in ultra-high density mango. The farmer as to insure fixes a deeper which supply 4 liters of water per hour at a distance of 1 ½ feet from the seedling after one year the farmer fixed one deeper as the same distance of 1 ½ feet from the seedling. In the beginning, we give 4 liters of water per seedling after one year we have to rise to 10-liter water per seedling. The yielding trees have to be supplied with 20-25 liters of water, feeding the trees with water soluble fertilizers through the drip irrigation system ensures better productivity. The farmers have to supply the recommended water soluble fertilizers in recommended time intervals.

2. Planting Method: Planting is generally done with a ball of earth during rainy season in moderately rainy places and on the cessation of rains in the heavy rainfall areas. There is a popular preference for aged plants to young plants, but practically there is no difference in fruiting. The young plants are easy to transport and to establish. Planting is done in previously dug, exposed and filled pits of 1.0 m × 1.0 m × 1.0 m size. Sometimes wood is also burnt in the pits. Application of nitrogen to young plants hastens growth and before filling the pits 50 kg of well-decomposed FYM, 2 kilograms of super phosphate are added.

If white ant problem is there then, 100-150 grams of polydol power should be added per pit. Cow dung if applied produces too much heat and attracts white ants and hence should not be applied where white ants are a serious problem. Manure is applied 2 months before planting or 6 months after planting. Planting is done on a cool day and preferably in the evenings and watered immediately and staked. While planting grafts, the graft joint or the union should be 20 cm above the soil surface to prevent entry of disease carrying organisms in to the graft joint.

3. Planting Geometry: It is a combination of tree arrangement and plant form. Tree arrangement in UHDP system must have sufficient alleyways for movement of farm machinery. The way trees are arranged also determines the

light distribution pattern and light interception level. Single hedge row and double hedge row system and square system having enough alley space is being practiced for UHDP. But, this technology reduces inter- as well as intra-row spacing by two-third over conventional planting. The spacing for UHDP methods has been adopted are 2.5 m × 2.5 m or 2.0 m × 2.0 m where the plant density will be increased by reducing the row spacing and thus, it helps to have more numbers of trees per acre. This spacing of 3.0 m × 2.0 m helps to have 674 trees in an acre which are 9.63 to 16.85 times more trees over conventional method which can adopt only 40 to 70 trees.

4. Irrigation: The irrigation requirements of young and non-bearing trees are different from those of bearing trees. During young and non-bearing period, speedy growth of the trees and expeditious development of their leaf canopy are the chief objectives to be achieved. This would require more frequent irrigations throughout the year than for the bearing trees. The newly planted young plants up to their first 4-6 months should secure irrigations twice in a week in hot weather. For the first 4-5 years, the irrigations must be frequent and regular though of light intensity because the root spread in the initial years are not very extensive. During rainy season, the interval may be adjusted keeping in view the intensity and distribution of rainfall. In bearing trees 2-3 months preceding flowering season, i.e. during October-December profuse irrigation is not advisable to induce flowering and to arrest vegetative growth. Irrigation may be beneficial from February to June. This stop the fruit drop and helps in development of fruit size. When the trees are in full bearing stage, generally 2-3 irrigations are given between fruit set and fruit development. It is better to avoid irrigations before harvesting for better quality of the fruit. Basin system of irrigation is generally followed to economize water. The basins may be connected in series or to a channel dug in-between rows.

5. Soil Management: Mango can be grown on a wide variety of soils, ranging from alluvial to lateritic, provided it is deep (2.0-2.5m) and well drained. Suitable pH of soil for mango cultivation is 5.5-7.0. A soil with good drainage, permeability, a fair water holding capacity and ground water at a depth of 3 to 4 m are featured ideal soil for mango cultivation. Very poor, shallow, alkaline, rocky and calcareous soil should be avoided.

6. Manuring: Mango orchards are not generally manured. But if manured, the yield will be more. The chief requirements during pre-bearing age are rapid growth and the development of strong framework. Good cropping, regular bearing and high fruit quality are the prime objectives of bearing trees. During non-bearing stage, nitrogen is particularly needed in heavy quantities to support healthy and fast growth. It would be advantageous to apply substantial portion of nitrogen in the form of organic matter, so that the texture of the soil, its moisture holding capacity and ultimately the development of roots there in may be improved. Phosphorous is needed for the development of roots, respiration and translocation of carbohydrates. Application of potassium will help in

The manurial schedule for mango crop is as follows:

Age of the plant (Years)	FYM (Kg)	Nitrogen (grams plant^{-1})	Phosphorous (grams plant^{-1})	Potash (grams plant^{-1})
1-3	5-20	50-100	40-80	100-200
4-6	100-200	100-200	80-100	200-400
7-9	200-250	200-250	120-160	400-600
10 and above	250	250	160	600

development of fruit, increases fruit quality and control of fruit drop.

During bearing age, the manurial programme aims to secure sufficient vegetative growth early in the season for the next year's growth and to ensure regular bearing with superior quality. This can be achieved by heavy dose of nitrogen a little earlier than flowering in the on-year to initiate vegetative growth and suppression of bud differentiation, so that, cropping in "on-year is reduced and the production of vegetative shoots are promoted.

7. Harvesting: The fruit injured or even slightly bruised during the picking operation losses its keeping quality and becomes unfit for export purpose. The usual practice of harvesting the fruits is knocking down the fruits or shaking the trees violently to get the fruit down need to be discouraged. In UHDP method, the height of the trees approximately little higher than the height of a man and tree bunches have uniform types of fruits. So, it is easy to pick up the fruits with the help of a step ladder without getting injure to the fruit as well as man. The fruits should always be harvested and kept in canvass bags or padded baskets and carried to the packing house. A small fruit stalk should be kept with the fruit at the time of harvesting helps in keeping the fruits in better condition in transportation and storage.

Transformation from conventional to UHDP: We can convert the conventional, traditional or normal method into ultra-high density mango orchard by systematic or step by step process.

ADVANTAGES OF UHDP:

- Cultivation land is shrinking year by year hence ultra-high density mango cultivation helps in raising the per acre yield along with best utilization of land and resources.
- The gestation period in UHDP is less, and the farmer starts getting returns in the early years, as UHDP orchards start commercial bearing from the 3rd to 4th year onwards against the 7th to 9th years required in traditional planting. The Ultra High Density mango planting orchard appears to be the most appropriate answer to overcome low productivity and long gestation period for early returns and export of mangoes.
- The control of excessive vegetative growth in the tree for increased productivity is the major principle of high density orcharding, therefore, controlling tree size by dwarfing rootstocks in high density orchards is one of the methods of increasing production. In high density system,

yields are improved in the early years of orchard life.

- Mango cultivation can be revolutionized by the adoption of ultra-high density planting system. This planting system heralds a new era where mango becomes quick, high, shrinking land availability.
- The farmers himself can maintain the tree and hand pick the fruits. In days of labour scarcity, this technology helps the farmer to carry out the entire operations without depending on labours.
- The trees allow to have only an average and balance load of fruits through training and pruning and thus, incisors 90% of the fruits with export quality.
- There is reduction in water used for irrigation by 50%.
- Increases fertilizer uptake capacity of plants when fertigation is practiced.

DEMERITS OF UHDP:

- Initially become little costly than conventional system.
- Economic life span of the orchard becomes lower.
- Chance of reduction in fruit size and weight.
- Intercultural operation becomes difficult.
- Maintenance of plant architecture becomes a tedious job.

CONCLUSION

UHDP orcharding gives higher yield as well as returns per unit area due to increasing the number of trees per unit area. It is possible by regular pruning and use of bioregulators for maintaining the size and shape of the tree. Mango planted at spacing of 3 m × 2 m (Alphanso, Kesar and Keitt) or 2.5 m × 2.5 m (Amrapali, Mallika, Ratna, etc.) gives higher yield under UHDP. The Government of India, through National Horticultural Mission Scheme, offers subsidy support for the farmers to introduce UHDP method of mango cultivation. The farmers are required to approach their nearby agricultural university or research centres or block to know the methods, techniques for UHDP cultivation along with to know about the subsidy details and formalities.

Table 2. Comparison between UHDP, HDP and Conventional Method of Planting

Parameters	UHDP	HDP	Conventional Planting
Gestation period (Year)	3	5	10-15
Plant population (trees acre^{-1})	674	200	40-70
Plant geometry	2.5m×2.5m	2.5m×2.5m to 5m×3m	7m×7m to 12m×12m
Pruning operation	Easy	Manageable	Very difficult
Spray operation	Easy	Manageable	Difficult
Probability of Insect, Pest and Diseases attack	Low	Moderate	High
Technology required	High	Medium	Low
Resource use efficiency	High	Medium	Low
Fruit uniformity	Highly Uniform	Uniform	Not Uniform
Yield at maturity (t acre^{-1})			
Prolific bearing varieties	10-12	7-8	4-5
Shy-bearing varieties	2-2.5	3-4	5-6
Remunerative price	High	Medium	Low
Establishment costs	High	Medium	Low
Opportunity cost	Low	Medium	Low
Market force of fruit in global market	High	Medium	Low
Marketable surplus	High	Medium	Low
Marketability	High	Medium	Low
Cost of production	Low	Medium	High
Optimality condition	High	Medium	Low
Quality of fruit			
Expected annual income (Lakh Rs. acre^{-1})			
Prolific bearing varieties @ Rs. 5 kg^{-1}	0.50-0.60	0.35-0.40	0.20-0.25
Shy-bearing varieties @ Rs. 12 kg^{-1}	0.60-0.72	0.36-0.48	0.24-0.30
Commercial orchard life (years)	25-30	30-50	Up to 50
Cost of orchard till it comes to commercial bearing (Lakh Rs. acre^{-1})	1.53	0.60	0.50
Management practices	Easy to manage due to small tree size	Easy to manage due to small tree size	Difficult to manage due to large tree size
Labour intensification	Less labour	Less labour	More labour

Benefits to Farmers through Banana Tissue Culture

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Abstract

Cultivation by using plantlets produced from banana micropropagation has many advantages over traditional breeding process. Tissue culture method is a well standardized cost effective process for the production of large quantity of healthy disease free planting materials in short time duration. It also helps in production of huge quantity of plantlets in order to fulfill the demands of banana farmers of Odisha to increase socio- economic condition of the farmers ultimately to increase the state economy.

Keyword: *Mass propagation, banana, RPRC.*

INTRODUCTION

Banana and plantain are mostly cultivated within 30◦ latitude north and south of the equator (Stover and Simmonds, 1987) in the tropical region. They require an average temperature of about 30◦C and a minimal rainfall of 100 mm per month (Swennen and Rosales, 1994). It is world's second largest fruit crop and fourth most important global food crop which is produced over 150 million metric tons per year (FAO, 2014). The major banana growing states in India are Maharashtra, Gujarat, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha, Bihar, Madhya Pradesh, West Bengal, Assam, Tripura and Manipur. In case of Odisha, Banana is grown over area of 20,000 ha and production is over 2,00,000 MT (National Horticulture Mission, Odisha). The area and production of Banana in Odisha is substantially fluctuating particularly in the years of 95-96 and 99-2000. It is mainly because of frequent cyclonic weather, drought and floods occurring in the state. This is major drawback in development of Banana in the state. In Orissa, sowing time is May-June & September-October and harvesting takes place around the year. Banana is grown in the districts of Angul, Bolangir, Ganjam, Puri, Sundergarh, Nayagada, Mayurbhanj and Keonjhar. Fertility of soil is very important for successful cultivation, as banana is a heavy feeder. Banana is essentially tropical plant requiring a warm and humid climate that is available in the state.

BANANA TISSUE CULTURE

Conventional vegetative means for banana propagation has been found to express several negative impacts which include transmission of diseases, low production, very slow as the rate of multiplication of suckers and poor preservation of original plant genetic material (Hussein, 2012). The problem of emerging from conventional breeding process can be solved by propagating banana through tissue culture (Ali *et al.,* 2011) which offers mass propagation and

Figure 2: Tissue cultured banana plantlets

clean planting material. Several scientist and researchers had reported various techniques for in vitro propagation of banana (Wong *et al.*, 2006; Venkatachalam *et al.*, 2007). Growth regulators play a key role for developing a specific mode of growth in the cultured cells or tissues, which may be due to accumulation of specific biochemical contents in them.

The single or combination of different hormones in the medium causes maintenance of specific and balanced inorganic and organic contents in the growing tissue. This leads the cells or tissues to develop either into shoots/or roots or even death (Dahot, 2007).

Advantages of banana tissue culture

- Production of large numbers of alight disease free planting materials in short duration of time.
- Cost effective.
- The plantlets produced are genetically identical to mother plant.
- High yield.
- Short maturity period.

***Figure 1: Banana plants in RPRC nursery*.**

Success stories of Banana Tissue Culture of Regional Plant Resource Centre, Odisha.

Local varieties of banana like Gaja Bantala, Patakpura as well as out of state variety like Yangambi had been planted in RPRC mother block. Morphological data including plant height, diameter, no. of leaves, no. of suckers, days of inflorescence were measured. The detail study of yield up to 3rd generations was conducted that includes no. of hands in a bunch, no. of fingers in each bunch and weight of the bunch. Farmers from different locations of Odisha had cultivated Gaja Bantala by utilizing the tissue cultured plantlets of RPRC and also benefited by generating revenue for the state.

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Importance of colostrum Feeding to Calves

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True colostrum is the "first milk", which is rich in antibodies that can protect the calf passively from immune suppressed diseases during the early period until its own immune system becomes functional. Colostrum provides the first source of nutrients right time to the calf after birth. Adequate intake of high quality colostrum at appropriate time in early life is the single most important factor governing the survival and health of the young calf. Apparently the cost of raising dairy animals increases if the calf during early neonatal life suffers from mortality or requires medicine to treat preventable diseases.

COLOSTRUM

Colostrum is a secretion of the mammary gland following the birth of offspring. Colostrum is distinguished from whole milk because it contains high concentrations of immunoglobulins (Igs) or antibodies. Antibodies are proteins which function to identify and destroy disease causing pathogens in the body. Colostrum contains approximately 24 % solids, compared to 12 % solids in normal whole cow's milk. It is also a vital source of growth factors and nutritional elements such as protein, sugar, fat, and vitamin A, vitamin E and minerals.

Nutritional value of Whole milk and Colostrum

Typical analysis	Whole milk	Colostrum
Total solids %	12.5	23.9
Fat %	3.6	6.7
Protein %	3.2	14.0
Immunoglobulins %	0.09	6.0
IgG_1 (g/100mL)	0.06	3.2
Lactose %	4.9	2.7
Minerals %	0.74	1.11
Vitamin A (µg/dl)	34	295

Source: Volac-agriculture news

AMOUNT OF COLOSTRUM AND TIME OF FEEDING

Generally a calf should receive colostrum 5 to 6 % of its body weight within the first six hours of life and another dose of colostrum 5 to 6 % of its body weight when the calf is 12 hours old. Calves on bottle fed colostrum have a better chance of receiving enough immunoglobulins than calves left to nurse oneself from its own mother. Calves which fail to drink of their own within 3 hour of birth should be given colostrum by esophageal feeder. Feeding of colostrums to calf in time is

crucial for calf ruminal and vital health. As the 24 hour mark the gut begins to close and it becomes extremely difficult for the calf to absorb immunoglobulins present in the colostrum, beyond which the calf's intestine becomes impermeable to large proteins. Normally, at six hours after birth, calves absorbed 66 % of the immunoglobulins present in colostrum, but at 36 hours after birth calves were able to absorb only about 7 % of immunoglobulins.

Apart from being a nutrient rich and containing bioactive compounds to promote gut development, the immunoglobulins offers significant protection against disease during the first few weeks of early life. Cow placenta does not allow the transfer of maternal immunoglobulins to the calf before birth, so calves are born without adequate antibodies. The calf's ability to produce its own antibodies develops slowly over the first 3-4 weeks. In case of insufficient antibody rich colostrums provision, there will be a weak immune response against infection and consequently increased risk to poor diseases and mortality rate.

FACTORS AFFECTING QUALITY OF COLOSTRUM SECRETION

- **Age of cow**: Older cows in continuous exposure to more pathogens develop typically higher levels of circulating immunoglobulins which may be transferred into colostrum. In contrast, the immunoglobulins content of heifer colostrum may be lower, as heifers have a less developed transport mechanism for Ig G from blood into the mammary gland. Colostrum from third lactation cow is considered to have better quality antibodies.
- **Dry period**: A short dry period of less than three weeks does not allow sufficient time for IgG to accumulate in mammary gland.
- **Vaccination**: Colostrum from cows vaccinated against diseases such as rotavirus. *E. coli*, Bovine Viral Diarrhoea or Infectious Bovine Rhinotracheitis typically have a higher Immunoglobulin content.
- **Breed**: Colostrum quality varies within the breed and between breeds. Example Jersey colostrum contains a higher level of Immunoglobulin than Holstein colostrum.
- **Pre-partum milking/first milk**: Pre-partum milking 1-2 times to reduce discomfort in the cow has little impact on IgG, but intensively pre-milking or the production of more than 8 litres of colostrum in the first postpartum milking may be linked to a significant reduction in Immunoglobulin concentration.

CLEAN COLOSTRUM FEEDING

Clean colostrum feeding is essential to provide passive immunity to the calf. Since it is one of the first ways to potentially expose the calf to such pathogenic *E. coli, Salmonella* or *Mycobacterium avium paratuberculosis*, the bacterial species responsible for Johne's disease. Pathogens can also cause diseases such as scours and septicemia and may interfere with passive absorption of the antibodies from the gut into the circulation system. Cleaning udders, milking equipments and Calf feeding equipments well before harvesting, storing and feeding

colostrums are important and feed calves' colostrum that has a total bacteria count of less than 100,000 colony forming units (CFU)/ml and a total coliform count of less than 10,000 CFU/ml.

STORAGE OF COLOSTRUM

Surplus colostrum within 2 hours of collection can be refrigerated to control bacterial growth. Refrigeration at 4° C in plastic container maintains the viability of antibodies and other components of colostrum for up to 7 days. For long term preservation, the best method is storing colostrum in deep freezer for up to one year with little nutrient loss. This can be done in 2 litre stackable, plastic container or freezer bags (be sure to double bag). Thawing colostrums slowly in warm water (38°C) to preserve quality. Rapid thaw can damage and reduce the efficacy of colostral antibodies or it can also be thawed in a microwave set on low power for short periods of time and constantly pour off thawed portions. This is some advantage of pool colostrums feeding from different cows as it minimize the effect of low immunoglobulin in colostrum and increase the volume available to calves and has a negative effect on the acquisition of immunity. It also increases the risk of disease transmission to calves, since multiple cows are represented in a single feeding. It is best to have colostrum from one's own herd, since using colostrum from other herds raises biosecurity issues as well as differences in antibody concentrations. Therefore it is advisable to know the herd operation and their health management strategies before using their colostrum. Colostrum replacement products are also available and in such products, the replacer must deliver at least 100 grams of Ig G for absorption to the new born calf.

CONCLUSION

Colostrum is the critical first step to the health and survival of newborn calves. The successful transfer of the antibody protection through colostrum from cow to calf is based on four key factors:

- How quickly the calf receives colostrum after birth within one hour is best.
- How much colostrum the calf receives 4 litres at first feeding.
- The immunoglobulin concentration in the colostrum.
- Low levels of pathogens in the colostrum.

Entomopathogenic Nematodes:

Potential Biological Control Agents against Insect Pests

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Extensive use of chemical pesticides has resulted in widespread insect resistance to pesticides and adverse effects on beneficial insects, wildlife, and human health throughout the world. In response, there has been increased demand for alternative and selective pest control agents, in particular, biological control. Biological control methods can be used as part of an overall integrated pest management (IPM) programme to reduce the legal, environmental, and public safety hazards of chemicals, a more economical alternative to some insecticides. Biological control exploits insects, fungi, bacteria, viruses and nematodes as biological insecticides. Nematodes associated with insects, are referred to as entomophilic, entomogenous or entomopathogenic are known to parasitize, cause disease and kill the insects. The entomopathogenic nematodes are potential agents as they serve as vectors of bacteria, achieve a quick kill of the target insect pests and are safe to vertebrates and humans. Entomopathogenic nematodes (EPNs) of the families Steinernematidae and Heterorhabditidae are well known biological control agents of insects because of their unique mode of action. They kill their hosts with the aid of bacteria carried in the nematode's gut; steinernematids carry *Xenorhabdus* spp. whereas Heterorhabditis carry *Photorhabdus* spp. (Adams and Nguyen, 2002; Poinar, 1990). EPNs possess several attributes (broad host range, target specificity, safety to non-target organism, compatibility with other chemicals, no residual hazards and most importantly environment friendly) of an ideal insecticide and can be well fitted into integrated pest management (IPM) programme (Shapiro-Ilan *et al*., 2002). Besides that, several insect pests have developed resistance against many prevailing insecticides and hence, there is an urgent need to find out suitable eco-friendly alternative for managing those pests. For an instance, diamond back moth (DBM) has been found resistant to multiple insecticides covering almost all insecticidal classes and is the only insect pest that has developed resistance to *Bacillus thuringiensis* (*Bt*) (Ganguly and Singh, 2006). The activity of *Bt* has undoubtedly spurred a renewed effort to develop useful alternatives. Subsequently, *Photorhabdus luminescens*, a symbiont of the entomopathogenic nematode species *Heterorhabditis*, was used in a laboratory bioassay to study the pathogenicity of the

bacteria against *Plutella xylostella* larvae, which showed that the larvae of DBM died in 72 hours indicating that the bacteria alone were sufficient to kill the insect (Lanjewar *et al*., 2008). EPNs are being exploited (world-wide) to manage insect pests of agricultural importance (Bedding,1981; Kaya and Gaugler, 1993).

MAJOR ENTOMOPATHOGENIC NEMATODE GROUPS

- Allantonematidae
- Diplogasteridae
- Mermithidae
- Rhabditids (Steinernematidae and Heterorhabditidae)

Though above mentioned EPNs are come in major group in which Rhabditids are the most important and mostly commercially used.

Rhabditids

Nematodes from the families Steinernematidae and Heterorhabditidae have proven to be the most effective biological control organisms (Kaya and Gaugler 1993). Steinernematidae has two Genus i.e. steinernema and neosteinernema. Steinernema has 16 species out of which *Steinernema carpocapsae* is most important. Neosteinernema has one species still today *Neosteinerma longicurvicauda.* In other way, family Heterorhabditidae have Heterorhabditids having six (6) species, e.g. *Heteorhabditis bacteriophora.*

The infective juvenile of both nematodes carry specific bacterium. The bacterium carried by Steinernematidae usually *Xenorhabdus* species and Heterorhabditidae carried *Photorhabdus* species. Several species from both genera are presently used as microbial insecticides and are produced commercially by varies companies around the world.

SYMBIOTIC ASSOCIATION WITH BACTERIA

An area in the anterior part of the intestine of the infective stage juveniles of *Steinernema* and *Heterorhabditis* is modified as a bacterial chamber. In this chamber the infective juvenile carries cells of symbiotic bacterium. The bacterium carried by Steinernematidae is usually a species of the genus *Xenorhabdus*, and that carried by Heterorhabditidae is a species of *Photorhabdus*. Two species have been recognized in the respective genera namely *X. nematophilus* further divided into four subspecies *viz*., *nematophilus, bouienii, poinarii* and *beddingii* and *P. luminescence, a* bioluminescent symbiont. Each species of *Steinernema* is naturally associated with one of the *X. nematophilus* subspecies (Table 1). These bacteria are medium to long motile rods with peritrichous flagellae. They are gram-negative facultative anaerobic and do not have environmentally resistant stage and have not been naturally found except in the nematode vectors or insect hosts. Nagesh *et al.* (2002) isolated two symbiotic enterobacteria from entomopathogenic nematode *Steinernema* and *Heterorhabditis* spp. based on morphology, electron microscopy and culture studies. The bacteria isolated from indigenous *Steinernema carpocapsae* and *Heterorhabditis* spp. confirmed to the description of *Xenorhabdus* and *Photorhabdus* spp. Hussaini *et al*. (2001) determined the total protein and lipid contents of larvae of *Galleria mellonella, Helicoverpa armigera, Leucinodes*

Table 1: *Steinernema* and *Heterorhabditis* species and their respective symbiotic bacteria

Nematode genera	Nematode species	Bacteria
Steinernema	*affine*	*Xenorhabdus bovienii*
"	*anomali*	*Xenorhabdus spp.*
"	*carpocapsae*	*X. nematophilus*
"	*cubanum*	*X. poinarii*
"	*glaseri*	*X. poinarii*
"	*intermedium*	*X. bovienii*
"	*faltiae*	*X. bovienii*
"	*rarum*	*Xenorhabdus spp.*
"	*scapterisci*	"
"	*monticolum*	"
"	*riobrave*	"
Neosteinernema	*longicurvicouda*	*Xenorhabdus spp.*
Heterorhabditis	*bacteriophora*	*Photorhabdus*
"	*argentinensis*	*luminescens*
"	*hawaiiensis*	"
"	*indica*	"
"	*marelatus*	"
"	*brevicaudis*	"
"	*megidis*	"
"	*zealandica*	"
		"

Source: Kaya and Koppnhoffer (1996).

orbonalis, Phthorirmaea operculella and *Spodoptera litura* infected with *Steinernema corpocapsae* and *Heterorhabditis indica.* It was observed that early instar larvae were more susceptible to nematodes due to lower protein lipid ratio compared to later instars. Similarly, *G. mellonella* followed by *P. operculella* and *L. orbonalis* larvae of second and fourth instar recorded lower protein to lipid ratios and produced higher yields of infective juveniles of *S. carpocapsae* and *H. indica.*

EPNS MODE OF ACTION

The pathogenicity of EPNs involves penetration into the insect's body, and proliferation of their symbiotic bacteria on which they feed and reproduce. The penetration is accomplished by a special stage of EPN life cycle called infective juvenile (IJs). These juveniles release the symbiotic bacteria stored in their gut into the insect's haemolymph (Bird and Akhuirst, 1983; Endo and Nickle, 1991). The bacteria multiply and kill the insect, by septicemia, within 24-48 hours. The proliferated bacteria constitute the food source for the infective juvenile, which recovers into adult to initiate the life cycle. The nematode life cycle which starts with fertilized eggs laid by female, involves four juvenile stages. The first juvenile stage hatches from the egg and

develops into the second juvenile stage, white feeding on bacteria. The latter juvenile stage develops in turn, into the third, fourth stage, and finally into adult male or female (Lunau *et al.,*1993). The cycle continues to run until the food source (bacteria) becomes limited. At this situation, the first juvenile stage develops through the second stage towards the infective juvenile. These juveniles store large amounts of food reserves in their body and small amount of symbiotic bacteria in their gut. They retain the second juvenile cuticle so their body becomes covered by double cuticle. In contrast to other stages, they do not feed, and move much faster (Campbell & Gaugler, 1991a). The double cuticle layers protect the infective juveniles from desiccation and other harmful environmental conditions such as, nematophagous fungi (Timper and Kaya, 1989). An infective juvenile is a non-feeding stage having the mouth and anus closed. Fat reserves are used for prolonged survival in the soil until the IJ reaches a host. In the gut, the IJs carry symbiotic bacteria, which play an important role in the pathogenicity to the host. The bacteria kill the insect by various toxins and hydrolytic enzymes and proliferate on its body whereby providing a mass of food to the nematodes.

INSECT-NEMATODE RELATIONSHIP

1. Phoretic Relationship

The insect serves as carrier for the resistant stage of the nematode. This relationship commonly occurs when both nematode and insect occupy same ecological niche. The nematodes are generally carried from one place to another under elytra of beetles, coiled around abdomen, attached to legs or located elsewhere on exoskeleton of insect *e.g.* Rhabditidae, Diplogasteridae, Aphelenchoididae etc.

2. Facultative Relationship

The nematodes under facultative relationship are able to parasitize and kill healthy insect and complete their life-cycle in the host's environment. Most of the nematodes are found in the body cavity, intestine, malphigian tubules, pharyngeal glands, trachea or colleterial glands. They receive nourishment at the expense of the host and thus can be considered as parasites. Species in family Steinernematidae and Heterorhabditidae do not develop in nature apart from their insect host, yet they can be artificially cultured in the laboratory. Hence, they show both facultative and obligate parasitism. e.g. Rhabditidae and Aphelenchoididae.

3. Obligate Relationship

The obligate nematode parasites require a single living insect to complete the life-cycle and development. There is no free living stage of the nematode. The nematodes occur in the body cavity of the host (Mermithidae, Allantonematidae) but some may occur in the intestine (Diplogasteridae) or reproductive system (Rhabditidae). The effect of these groups on the insect host ranges from negligible to sterilization and death.

Pathogenecity and Life cycle

- EPNs complete most of their life cycle in insects with an exception of infective juveniles, the only free-living stage found in soil.
- Infective juveniles of both *Steinernema* and *Heterorhabditis* locate a host and enter through its natural body

openings such as mouth, anus or spiracles.

- Infective juveniles of *Heterorhabditis* also enter through the inter-segmental members of the host cuticle.
- Infective juveniles then actively penetrate through the mid gut wall or tracheae into the insect body cavity (haemocoel) containing insect blood (haemolymph).
- Once in the body cavity, infective juvenile releases symbiotic bacteria from its intestine in the insect haemolymph.
- Bacteria start multiplying in the nutrient-rich haemolymph and infective juveniles recover from their arrested state (dauer stage) and start feeding on multiplying bacteria and disintegrated host tissues.

Toxins produced by the developing nematodes and multiplying bacteria in the body cavity kill the insect host usually within 48 hours.

- These bacteria also produce a plethora of metabolites, toxins and antibiotics with bactericidal, fungicidal and nematicidal properties, which ensures monoxenic conditions for nematode development and reproduction in insect cadaver.
- Heterorhabditid and Steinernematid nematodes differ in their mode of reproduction. For example, in heterorhabditid nematodes, the first generation individuals are produced by self-fertile hermaphrodites (hermaphroditic) but subsequent generation individuals are produced by cross fertilization involving males and females (amphimictic). In Steinernematid nematodes with an exception of one species, all generations are produced by cross fertilization involving males and females (amphimictic).
- Depending on availability of food resource, both heterorhabditid and steinernematid nematodes generally complete 2-3 generations within insect cadaver and emerge as infective juveniles to seek new hosts.
- Generally, life cycle of entomopathogenic nematodes (from infective juvenile penetration to infective juvenile emergence) is completed within 12- 15 days at room temperature. The optimum temperature for growth and reproduction of nematodes is between 25 and 30^{0}C.

FORMULATION OF EPNS FOR APPLICATION

i. Desiccated cadavers

Nematodes are applied in the form of infected wax moth (*Galleria mellonella*) larvae were found to be as effective as aqueous nematode suspension against soil pests. The application of nematode infected insects can be superior to aqueous suspensions. A formulation based on desiccated cadavers coated with clay has been developed that may allow application without cadavers rupturing or adhering together.

ii. Capsules

Macrogels containing encapsulated nematodes have been suggested as delivery systems for the control of soil and foliar pests. Encapsulation of nematodes in calcium alginate gel bends was first reported by Kaya and Nelson (1985) who advocated then-use as baits, or for soil applications. When the alginate capsules were placed in soil with

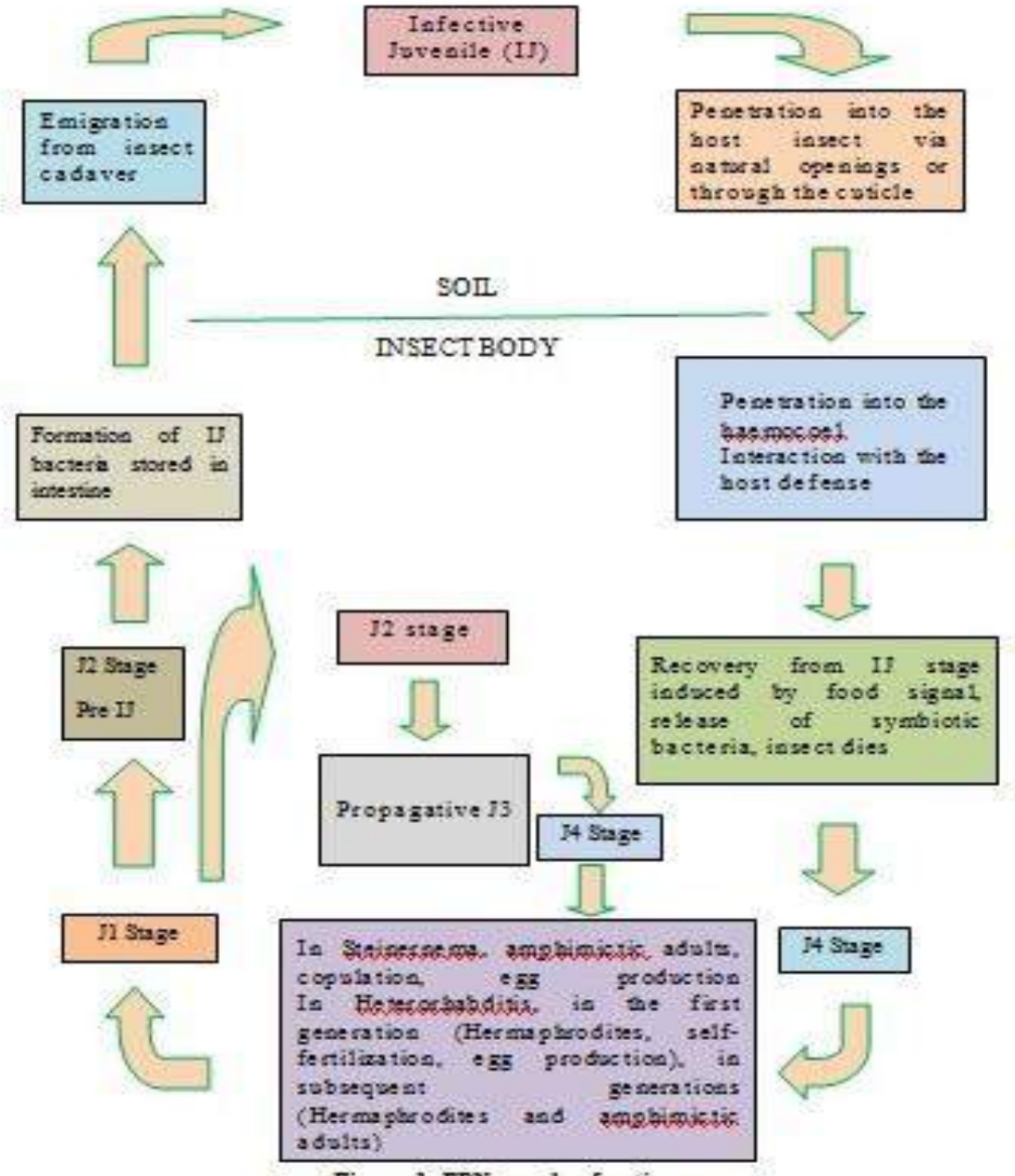

Figure 1: EPNs mode of action

adequate moisture, most nematodes migrated out of the granules within a week. Navon *et al*. (1999) reported high nematode survival for 48 hours in the gel at 61% relative humidity. A gel-forming polyacrylamide used to enhance water-holding capacity of sandy soils, has been shown to enhance survival of *S. carpocapsae* when applied against the root weevil in citrus (Georgis, 1990).

iii. Baits

Baits containing infective juveniles, an inert carrier (*e.g.* corncob grits, groundnut hulls or wheat bran), and a feeding stimulant (*e.g.* glucose, malt extract, molasses or sucrose) or a sex pheromone have been developed (Georgis, 1990). *S. carpocapsae* and *S. scapterisct* have shown particular promise in the baits; because of their 'sit-

and-wait' foraging strategy they do not escape the formulation and are more tolerant of desiccation than other species. Yet only moderate control of cutworms, grasshoppers and tawny mole cricket was achieved (Georgis, 1990) than other species. Yet only moderate control of cutworms, grasshoppers and tawny mole cricket was achieved (Georgis, 1990). When trap stations were used that ensured nematode contact with the target pest and protected nematodes from sunlight and desiccation.

APPLICATION TECHNOLOGY

General guideline for applications include pre-irrigation with at least 6mm of water or, post irrigation with 6-12 mm of water and subsequently at least every 1-3 days to maintain soil moisture for nematodes. Soil temperature at the time of application should be between 14^0 to 30^0C. For storage the nematode packages should be kept in cool place, such as a refrigerator-avoiding freezing. To overcome the impact of abiotic and biotic factors on nematode efficacy and persistence, the inundative application of high concentration of a specific nematode species has been used as a primary control strategy. They may also be applied in infected insect cadavers which are disseminated and the progeny IJs that exit the cadavers subsequently achieves pest suppression. This may be superior to application in aqueous suspension. Commercialization of nematode-infected cadavers has been prevented due to problems in storage and application.

a) **Soil application:** As with chemical insecticides, spraying nematodes directly onto the soil surface is the most commonly used application method. This broadcast method provides good coverage and is simple and quick. Timing soil application of nematodes with the lifecycle of the target pest is a key factor. A spray volume of 750 - 1900 L/ha is usually sufficient for most nematode species to reach the target insects in soil. Presently they are being applied through conventional spraying equipments such as high volume sprayers, drip irrigation, food baits or, through sound trap.

b) **Foliar application:** Use of nematodes to control insect pests on the foliage presents a considerable challenge, because of rapid desiccation, lethal UV light. Under high humidity and during the early morning or evening, nematodes are effective against foliar pests. Where foliage created a cryptic habitat (e.g., buds, dense canopies, leaf mining and rolling, and so on), nematode performance increases considerably, compared to that on exposed surfaces. Antidesicants have been used successfully to retard evaporation of the nematode suspension on foliage in foliar application of EPN. Glycerine 10% has been the most effective adjuvant for increasing survival and activity on foliage. High cost of glycerine and the risk of phyto-toxicity at high temp. had lead to search for more suitable adjuvants.

c) **Application to plant propagation material:** Nematodes have also been used successfully to disinfest plant-propagating materials. The nematodes are sprayed on the stacked cuttings, which are then placed in large bags. Also could be used for dipping the sticks in a suspension containing nematodes. After dipping, the rootstalks were planted in the field with significantly lower post planting shoot infection.

d) **Use of nematode in insect traps:** Nematodes have also been successfully used in traps designed to lure and kill insects. Traps have been tested against immature and/or adult hemimetabolous insects (Grasshoppers, Cockroach) and adults of holometabolous insects (House-fly); larval stages of the holometabolous insects (*Agrotis*). These may contain a food arrestant and a sex pheromone.

COMMERCIAL PRODUCT

The future of nematode based products for insect control is excellent. The technology used for producing, formulating, packaging, storing and shipping nematode product was developed past two decades, even though some of the technology is more than 60 years old. Since the first commercial product was developed, vast technological improvements have been made. Further improvement in the method of production and storage etc. will lower the cost of nematode product and make them competitive economically. Some of the commercial product of EPNs is listed below (Table 5). There are cottage industry companies that sell nematode products, most of which contain *S. carpocapsae.* While *S. carpocapsae* wasthe first nematode product marketed*, S.scapterisci* become commercially available in 1993, and *S. riobravis* in 1994.

Table 2: Commercial Products of Entomopathogenic Nematodes

Nematode	Product	Country
Steinernema carpocapsae	ORTHO	United
	BioVector	
	Sanoplant	Switzerlan
	BodenNiitzlin	Germany
S. feltiae	Magnet	United
	Nemasys	United
	Stealth	
S. *riobravis*	Vector MC	United
S. scapterisci	Proactant Ss	
H.	Otinem	
H. megidis	Nemasys	United

PUSA NEMAGEL: AN EPN BASED FORMULATION

The nemagel contains an indigenous insect killer nematode *Steinernema thermophilum* which has been isolated from IARI laboratory. The nematode species is heat tolerant and can kill a broad range of soil and foliar insect pest such as DBM, gram pod borer, cut worm, root grub, mustard aphid, and so on. It has been found safe for plant, farm animals, non-target organism, human and the environment. This bioagent can also effectively kill insect pest at a wide range of soil moisture. The formulation overcome contamination by not allowing growth of micro-organism and does not require any chemical reagent for its application. The nemagel contains both bioagent and hydrogel offers an effective for managing insect pest and water in agriculture. The formulation can be applied in the field as a soil application at sowing as well as at drip irrigation. It can also be applied as foliar application.

CONCLUSION

Entomopathogenic nematodes have been ecologically successful as exemplified by their wide distribution in various soil habitats throughout the world. With its fine attributes, which make them an excellent alternate tool for control of insect

pests, EPN has sparked heightened interest amongst biocontrol workers and leads to immense opportunities to test them against a wide variety of insect pests. Potential of EPN as a biopesticide is proved in other parts of the world and successful control of several pests has been achieved by using the nematodes in large-scale field trials in many parts of the world. The establishment of entomopathogenic nematodes in India would bring several benefits such as firmly establishing insect nematodes will promote the sustained use of agriculture and develop a better understanding of biodiversity. Any kind of use of EPN in biological control should always consider the tremendous benefits to the environment related with the use of EPN. Biocontrol nematodes are exceptionally safe for users and the environment and the benefits outweigh possible risks to non-target organisms.

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Economic Broiler Farming: Scope and Limitations

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Abstract:

Broiler farming in India is in boom because of its high demand among the people and fast return. Because of adaptation of various technologies broiler production has been increased remarkably in last few years. In India a lot of farmers are small scale farmers which are uneducated or non-trained farmers. But trained farmers are expected to get more profit because of their unique management ability. Integrating broiler farming with any other farming will boost up the profit. Contract broiler farming is a new process for easy farming and getting better profit. Adaptation of better management practices and balanced nutrition may lead to better production. However, farmer should take care of feed cost according to the market value of broilers. Finally, marketing through proper channel is essential to get sufficient profit for a farmer. So application of scientific technology by taking care of seasonal variation, minimizing additional cost, providing good nutrition and following profitable marketing channel one can get sufficient profit from a broiler farm.

Keywords: Broiler, contract broiler farming, economics, integrated farming, marketing

Introduction:

Broiler industry is one of the profitable agro-industries which can effectively tackle the problems of unemployment and underemployment in the rural areas, particularly of small and marginal farmers. It has been transformed from the traditional small-scale backyard farming to large-scale commercial farming in India, with an annual growth rate of 11.44 percent, production of 3.725 million tons and employment of 4.29 million people (Index Mundi, 2015). India stands fourth largest producer of poultry meat in the world, valued at US$ 6.6 billion. Poultry production accounts for about 0.66 percent of India's GDP and 7.72 percent GDP from the livestock sector (Prabakaran, 2014; Rajendran *et. al.*, 2014). An increase in per capita consumption by one egg and 50 grams of poultry meat can create employment for about 26,000 persons per year (Kazi, 2003).

Poultry meat production increased from 0.069 million tons in 1961 to 3.725 million tons in 2014. Despite this achievement, the per capita availability of poultry meat in India is only 2.96 kg which is way below the ICMR

recommendation of 11 kg meat per capita per annum. On the supply side, several factors have contributed to the worldwide growth in poultry production: (i) genetic progress in poultry strains for meat and egg production; (ii) better understanding of nutrition fundamentals; and (iii) disease control (Ravindran 2013). Given the size of the India's poultry sector, its price competitiveness and Indian entrepreneurship, India is set to take a more active role in the global poultry trade especially with respect to exports to the Middle East (Hellin *et al.,* 2015)

Among all the livestock farming, return of capital investment is fastest in broiler farming. So planning should be such that farmer gets maximum benefit out of this broiler farming and young population will get attracted towards this sector. Broiler industry can be adopted under a wide range of climatic conditions (Singh *et al,* 2010).

The advantages of broiler farming are

- Initial investment is lower than layer farming
- Rearing period is 5-6 weeks only
- More number of flocks can be taken in the same shed
- Broilers have high feed conversion efficiency i.e. the amount of feed required for unit body weight gain is lower in comparison to other livestock
- Faster return from the investment
- Demand for poultry meat is more compared to sheep/goat meat

Some challenges have been reported by several authors, including Faridi and Golian (2011) and Yassin *et al.* (2012). The economic evaluation of broiler breeder production is very challenging for two main reasons:

1. Several factors affect its profitability, which makes statistical analysis difficult
2. Production informations are hard to obtain from the genetic companies.

According to a survey by Sultana *et al* (2012) in Bangladesh, about 36% respondents reported more marketing age of birds, 32% reported higher cost of production and 30% reported lack of training facilities.

EXPENDITURES IN A BROILER POULTRY FARM:

Non-recurrent expenditures:

These expenditures are done only once. These include Poultry house, farm house, store room, toilet, farm vehicle, fence, refrigerator, generator (backup). It should be noted that some assets may not be necessary for the project. Some can be hired from other farmers instead of purchasing them. For example, if it is cheaper to hire transport for the project, it will be better off not to purchase a farm vehicle. It is advisable to note that prices for the required items vary greatly depending on Geography and season of farming.

Land: Land cost varies largely depending on the area. So area should be chosen where land cost and building material cost is minimal. The plot should not be located closer to rivers or streams as that may result in the pollution of water by chicken wastes during rainfall periods. Chicken runs located next to rivers and streams may expose broiler chickens to the dangers of floods. The poultry farm should be far away from human population.

Fixed Assets: Along with the nonrecurring expenditures, some assets are there which are going to be purchased

or procured irrespective of the no of the birds. These are Electricity, tube feeder, manual drinker, insurance, labor. Care should be taken that in this aspect much investment is not done. But these factors are primary importance of a poultry farm.

Labour: Carvalho *et al.* (2008), in their study on broiler production costs in Western Minas Gerais, Brazil, stated that the third main cost of broiler production activities is related to labor expenses (fixed and temporary employees), which accounts for 3.61% of total broiler production costs. But decreasing labors will also affect the performance of the animal. So farmers can use some automated machines which can decrease the cost of production and do the work of some labors.

Activities prior arrivals of day old chicks include:

- Houses, surrounding areas and all equipments must be cleaned and disinfected before chicks' arrival.
- Litter materials (wood shavings, chopped straw, etc.) should be evenly spread throughout the brooding area to a depth of 8 – 10 cm.
- Houses must be pre-heated for a minimum of 24 hours before the arrival of chicks. Monitor pre-placement temperatures on a regular basis to ensure uniform temperatures throughout the brooding area.
- Ensure that adequate clean water at room temperature is available. Water is vital in the early stages of the chick's development.
- Provide fresh, dust free starter crumbs in the brooder area. Ensure chicks have easy access to feed (i.e. use flat pans, trays or paper sheeting).
- Do not place feeders or drinkers directly under or near brooders.

Integrated farming System

The concept of vertical integration with contract farming as an intermediary chain of governance strategy is a commonly adapted as 'mantra' by various integrators in the poultry industry. The system provides for several advantages in terms of efficiency in adopting sophisticated technologies and achieving economic benefits even in case of small scale farming systems (Sundararajan, 2007). Integration had created a situation in which the production cost has come down even though the prices of basic raw materials have been on the increase. Integration has provided way for employment generation. It prevented migration of rural youths to cities and towns. More than this an additional contribution is made to the nation's GDP. Also earns foreign exchange through exports.

Chicken- Fish Integration: Chicken raising for meat (broilers) or eggs (layers) can be integrated with fish culture to reduce costs on fertilizers and feeds in fish culture and maximize benefits. Chicken can be raised over or adjacent to the ponds and the poultry excreta recycled to fertilize the fishponds. Raising chickens over the pond has certain advantages: it maximizes the use of space; saves labour in transporting manure to the ponds and the poultry house is more hygienic. No significant differences have been observed on the chickens' growth or egg laying when they are raised over the ponds or on land. In case of the former, the pond embankment could still be utilized for raising vegetables. 30-50 broilers could be raised

on a 1000 m^2 pond. For the first 14 days, chicks need to be raised separately in a brooder (not on pond), as they need higher temperature of 28-33 ºC (85-95 ºF). The chicken house can be constructed over the pond at least 0.5 m above maximum pond water level, or on the embankment. Each bird requires 1.5 ft^2 space (50 birds require 75 ft^2 space). The house can be made of bamboo or any other locally available cheap materials. Roof can be covered with hay or similar material. Enough cross ventilation should be maintained to keep cool during hot days. Floors are to be constructed with bamboo slats, with 1 cm gap, to allow excreta to fall into pond, but not wide enough for the chicken's feet to get caught in between and injured. Any fast growing chicken, like Shavar Starbro broilers, can be raised. Feed with starter mash for 14 weeks and with finisher mash for 58 weeks.

Broiler Farming techniques

A farmer interested in broiler poultry farming has two options:

I. ***Non-contract broiler farming (NCBF):*** In this set-up, the farmer has to bear all the expenses, such as procurement of chicks, feed, medicines and vaccines; overhead farm expenses (labor, electricity, water, litter material, farm disinfection, etc.); and transportation. The farmer has to admit all three risks – investment, production and market risks.

II. ***Contract broiler farming (CBF)/integration****:* In this case, the integrator provides Extension Advisory Services (EAS) and inputs such as chicks, feed, medicines and vaccines. The integrator bears the transportation cost, investment (inputs) and marketing risks. The contract farmer provides labour, shed, electricity, water, litter material, and other miscellaneous services or equipment that may be required. Because the major chunk of the expense (working capital) is borne by the integrators, they are the absolute owners of the movable stock (broiler birds) on the farm, and the farmer's role is that of caretaker who gets a predetermined price, which is listed in the contract. This payment to the farmer is linked to various parameters such as the FCR, mortality of birds, etc. A farmer is rewarded for surpassing the set standards and penalized if any of the agreed-on criteria is not met. The integrator is also relieved of his biggest threat -- disease outbreak -- as his millions of birds are reared at different locations in relatively small numbers by several small farmers. Broiler contract farming may be significantly influenced by several factors such as price per bird, feed conversion rate, average body weight, average marketing age, mortality rate and rearing housing system. However, it is not influenced by size of the farm (Majid and Hassan, 2014)

Management Practice:

Begum and Alam, (2009) reported that per broiler net return is more than 1.4 times higher in scientifically managed farm than that of private farm that reared broiler without management intervention. Sonaiya, (2009) indicated low biosecurity as being one of the technical factors contributing to productivity and profitability of

smallholder family poultry. Bio-secured farms found to have higher FCR as compared to that of non-bio-secured farms. Seasonal variation was also seen in case of growth and profitability these are higher in winter as compared to that of summer (Ali *et al.,* 2015). Jaim and Islam (2008) concluded that feed consumption was lower and efficiency was higher in technically supported farms than that of nonsupported farmers.

Trained farmers had more knowledge and skill on broiler farming compared with non-trained farmers. Ershad *et al.* (2004) who reported that total feed consumption per bird were 3.3, 3.9 and 3.7 kg for CLP (Certificate in Livestock and Poultry organized by Bangladesh Open University), farmers trained by Youth Training Center (YTC) and nontrained farmers, respectively. Market body weight was 1.60±0.17 kg and 1.451.45±0.21 kg per broiler bird for trained and non-trained broiler farmers, respectively.

In Jammu, all the broiler farms were managed under deep litter system. Fifty per cent of broiler units were found to have grass roof, forty per cent had cement roof and only ten per cent had hut type roof. In majority of cases, chicks were fed thrice daily, whereas mature birds were fed twice daily (Ali *et al.,* 2015)

Litter management:

Poultry houses need to be managed in a way that will minimize litter moisture and improve litter quality. Litter storage conditions (prior to use), bird nutrition, environmental conditions (humidity and condensation), and equipment (drinkers, foggers and evaporative cooling pads) in houses all can contribute to problems with litter moisture – if not managed properly. Moist litter will increase the incidence of breast blisters, skin burns, scabs, bruising, condemnations and downgrades. Wet litter promotes the growth of pathogens. Furthermore, wet litter is the primary cause of ammonia emissions from litter. Chickens are sensitive to ammonia, and ammonia can cause blindness, decreased growth rate, reduced feed conversion rate and condemnations. To keep litter dry, circulation fans should be used to move air within the house while moving warm air off of the ceiling and down to the floor. In addition, heating and ventilating a house will remove moisture, since warmed air holds moisture and can be ventilated from a house. Re-using litter can be beneficial and economical, if managed properly, and has become a standard in the poultry industry. As poultry litter is re-used, the chance of nutrient or pathogen contamination to waterways is reduced, which benefits the environment. In-house pasteurization/composting of litter between flocks of broilers has become a popular management practice in the broiler industry. In-house pasteurization of broiler litter provides a means for poultry producers to confidently re-use litter from previous flocks. Broiler litter that has undergone in-house pasteurization has reduced pathogen content and reduced moisture content. Manure is recognized as an excellent source of the plant nutrients nitrogen (N), phosphorus (P) and potassium (K). In addition, manure returns organic matter and other nutrients such as calcium, magnesium and sulfur to the soil, building soil fertility and quality.

DEAD BIRD MANAGEMENT:

A satisfactory system for disposal of dead birds and farm animals is necessary for sanitation, disease and odor prevention, as well as for environmental protection. For destruction of dead poultry birds, poultry digesters may be used with proper specification authorized by Livestock sanitary board. Incineration of dead birds and animals may be the quickest and most sanitary method of disposal. Wastes can be disposed of as fast as they accumulate, and the resulting stabilized residue does not attract scavengers or insects. Commercial units are available with oil or gas burners and usually are equipped with automatic timers. Flies in and around poultry house should be controlled. One of the largest management problems facing poultry producers is filth fly control. Water management and maintenance of sanitation are the factors helpful in controlling flies. These management practices will lead to decrease in poultry bird disease and mortality. Ultimately income will be increased.

Mortality Control in Case of Broilers

Vaccination schedule in Broilers

Age	Disease	Vaccine
Day old	Newcastle	Lasota
Day 7	Infectious bursal disease	IBD vaccine
Day 14	Newcastle	Lasota
Day 21	Gumboro	Mildstrain

Broiler chickens should be vaccinated with Lasota or New Castle and H_20 or Mild Strain vaccines mixed with drinking water once during the rearing period. It is important that farmers request for a vaccination history when purchasing day old chicks from the suppliers because that will assist them to know what was done, not done and where to start.

Disease control: Disease is one of the factors which contribute to mortality in poultry production. These include bacterial, viral and parasitic diseases. Treatment of these diseases therefore is according to the causative agent.

Mortality: Under good management practices, a mortality rate will range between 5 to 10% per year.

Effect of family training on profit and cost of broiler production

High feed cost is involved in rearing broilers by trained farmers because of using quality broiler feed. Management cost for vaccination, medication, litter, electricity and transportation is generally higher for non-trained farmers because of loss of money in disease treatment because of less bio security measures adopted. So as a whole total production cost is lower for trained farmers than that of non-trained farmers (Ershad *et al.,* 2004) (Islam *et. al*., 2010).

Biosecurity is Security from transmission of infectious diseases, parasites and pests to a production unit. Sometimes it may not be critical to diagnose the disease, but important part is knowing where the problem arises and what is the cause. Proper biosecurity measure decreases the mortality and ultimately leads to increase in profit.

Islam *et al*. (2015) demonstrated less mortality, better FCR and more net profit in trained small scale farmers as compared to non-trained farmers by taking 60 small scale broiler farmers in Bangladesh.

Improvement of management and biosecurity:

- ✓ Strengthening Diagnostic facilities for rapid detection and characterization
- ✓ Biosecurity at all levels i.e. housing, building, fences, entry in farms, disposal of dead birds, manures etc.
- ✓ Education regarding biosecurity principles and management practices.
- ✓ Controled movement of farmers, poultry, equipments.
- ✓ Marketing practices, transport of birds,
- ✓ Slaughtering practices at markets, disposal of leftover (feathers, visceras)
- ✓ Only one bird species on premise to avoid disease spread

Difference in farm practices in trained and non-trained farmers

Parameters	Trained Farmers	Non-trained farmers
Vaccination and medication Schedule	Strictly followed vaccination and medication schedule recommended by Bangladesh Livestock Research Institute (BLRI)	Not so aware of vaccination and medication schedules.
Quality chicks and feeds	Were able to identify the high quality chicks and feeds	Were not so skilled to perform that task.
Farm bio-security practices	Practiced farm bio-security as per recommendation.	Bio-security practices were ignore
Interval between two Batches	Maintained two weeks gap strictly	Did not maintain the interval strictly
Cleanliness and disinfection	Maintained it regularly and properly as per instructions	Maintained it irregularly and improperly

Feed Cost:

For broiler production, feed is the largest single production cost and can constitute up to 70 percent of the total costs and 86-87% of the total variable cost of production(Davis et al. 2013). The high feed cost leads to competition between man and animals for limited grains. High cost of operation of feed mills adds more problem to economic sector. So profitability of broiler production is needed to be evaluated taking feed cost and input cost as a primary component. In recent years, farmers have increasingly been formulating feeds for poultry using locally available feed stuffs. In the case of poultry production in India, feed accounts for 55-64% of variable costs (Landes et al. 2004). The predominant grain used in poultry feeds is maize (or corn, *Zea mays* L.).

Minimum cost versus maximum margin

When looking to minimize feed cost, it is important to appreciate the effect on margin. We know that as nutrient level increases, feed cost (per bird) increases. However, due to improved bird performance the revenue from the birds also increases, and therefore margin over feeding cost is improved. The maximum margin is clearly not produced by minimizing feed cost (indicated by the red circle), but is achieved at the point where the difference between revenue and cost is greatest (indicated by the green circle). The producer should aim to feed the birds to ensure margin is in the maximum margin zone illustrated in the

figure. To do this, maintaining or increasing dietary nutrient density is necessary.

Decreasing nutrient levels decreases feed cost but can also decrease margin: Interestingly, reducing nutrient density has a negative effect on feed cost per kg live weight. Live weight and FCR are affected so significantly by reductions in nutrient density that lower density diets become less cost effective when expressed per kg live weight.

Lowest feed cost does not produce maximum margin: By reducing nutrient density of the feed, the feed cost per bird can very easily be reduced. However, this will reduce performance and when corrected back to equal live weight will actually result in an increased cost of production.

The Balanced Protein density of the diet is an economic decision: The level of Balanced Protein in the feed will have a major influence upon margin achieved and profitability. However, Balanced Protein is only one of the two main components of the nutritional package and energy also needs to be considered. It is of key importance to appreciate that all modern broilers are responsive to amino acid and energy density and that margin over feed cost must be considered when determining an appropriate feeding strategy. In general, reducing Balanced Protein level reduces feed cost per tonne but also reduces performance and profitability

The effect of reduced dietary energy density was to increase feed intake, illustrating that, to a point, the broiler appears to compensate for lower energy density levels by increasing feed intake. the birds on the good quality pellets were able to increase feed intake when energy was reduced, resulting in improved live weights. However, the birds on the poor quality pellets were not able to increase intake, and as a result live weight was actually reduced when dietary energy was reduced.

Summary: maximising margin rather than reducing feed cost

1) When faced with rising feed cost it is tempting to reduce the feed cost per tonne by reducing the nutrient levels in the diet.
2) Lower nutrient levels will result in poorer biological performance which may therefore reduce overall margin.

Broiler feeds were for a long time formulated based on linear models that, although prioritize minimum feed costs, do not take into account some important factors such as bird density, market weight, physical space, and feed energy and protein levels (Afrouziyeh et al, 2011). On the other hand, an increasing number of researchers understands that, in order to work under the concept of precision feeding, nonlinear models, which take into account the factors mentioned above, need to be employed (Penz Jr. *et al.*, 2009).

Nonlinear formulation models help breeders to determine the best time to change diets, both from economic and environmental perspectives, identifying optimal marketing strategy and determining nutrient levels that maximize animal performance (Van Milgen *et al*., 2008).

MARKETING:

The marketing plan will review the four P's of marketing i.e. Product, Price, Place and Promotion helping to ensure that you

havea product that the market wants and one that you can sell at a profit. Information regarding market requirement in an area or demand in an area can be generated or gathered from a number of sources. Such as

- Provisional and national chicken marketing agencies
- Industry and trade publications and journals
- Online computerized information systems
- Other growers
- Discussion with potential customers and suppliers
- University libraries and business research centers

Broiler-Feed Price Ratio

The price of broilers divided by the price of feed per pound is the broiler feed ratio. The broiler-feed price ratio decreases as the cost of feed increases relative to the price of broilers. Fluctuations in the price of broilers and feed bring about changes in the feed-broiler price ratio. When feed is cheap relative to the price of broilers, profits are higher. Feed is cheap relative to the price of broilers when the broiler-feed price ratio is high.

Determining time of marketing:

In addition to feed efficiency, broilerfeed price ratio, and number of lots produced per year, other factors influence a producer in his marketing decisions. A producer considers price and mortality risks and the nature of the market demand for broilers in deciding when to market. (Back, 1954)

The factors affecting time of marketing fall into two categories: production factors and market factors. The production factors are those considerations a producer would take into account in deciding when to sell his birds if he is at liberty to reach the decision on his own:

Risk on the Time of Marketing:

Risks the producer must face include fluctuations in selling prices, mortality, and low gains in weight. Producers often sell birds sooner than the estimated most profitable ages and weights to market because of the risk element.

The broiler industry operates completely as a live bird market (or 'wet' market), with birds retailed as live birds and slaughtered in front of the customer in the retail shop. Almost 98% of the consumption is in live-form limiting therefore the area that can be catered from a production centre. Customers have over the years developed a perception that fresh poultry meat purchased as live bird and slaughtered on site in their presence is better in quality as problems may be difficult to detect until it is thawed.

Broiler bird trading is very volatile where prices are determined based on demand-supply in a given market for the day. The broiler prices fluctuate widely and even short surpluses result in a very wide fluctuation in market prices. Consumption of poultry and other meats is adversely affected during religious festivals leading to significant drop in demand. With the little scope for sale of frozen products or inter regional movement due to preference of live birds, the seasonal swings in demand are causing high volatility for market prices of broilers.

BROMARK (Broiler marketing Cooperative Society):

Bromark, a brainchild of late Padmashri Dr.B.V.Rao is an all India Broiler Farmers'

Body registered under the Multi State Cooperative Societies Act in 1994. The objective of the Bromark is to ensure the gap between producers' price and consumer price is reduced and promote the consumption of chicken meat by advertising on its nutritive value.

Bromark like NECC for eggs is announcing farm gate price for broiler live kg at all important production centers in the state by assessing the demand and supply trends and trying to reduce middlemen exploitation to the maximum extent.

Broiler marketing:

The Broiler production is marketed mostly by big farmers, integrators, private wholesalers and retailers. In the interior pockets, the producers themselves are marketing in small retail outlets and catering to the local requirements. While most of the broiler birds are consumed within the state, surplus broilers at times are sent to other states from AP depending upon the supply and demand position The success of broiler farming depends upon the existence of an efficient marketing system. Marketing of broilers require special efforts because of the peculiar characteristics of broilers. If the broilers are not disposed of as soon as they reach marketable weight, the producers called Integrators have to incur additional costs in terms of feed. The demand for broilers also varies from season to season.

Consumer demand for poultry is rising, driven by both income growth and change in prices of poultry meat in relation to other goods. Secondly, the structure of India's poultry market is changing. In particular, the introduction of vertical integration in poultry production and marketing has lowered costs of production, marketing margins and consumer prices of poultry meat.

PROCESS IN BROILER MARKETING

Marketing of broiler birds is a peculiar operation because it deals with the live-birds. Utmost care is to be taken in rearing the birds with feed, medicine, supervision and the like. In marketing of these birds, they have to be lifted in time, and dispose through the easily in possible Channels. Any delay or fault in the process of marketing will play havoc in terms of loss in profit, mortality and delay in lifting will result in the broiler becoming fibrous which is usually not preferred and excess feed also will be required.

Wholesalers and Commission agents are mainly involved in purchase of broiler chicken from integrators. A commission agent generally acts as an agent between integrator and wholesalers. The wholesalers purchase broilers in huge quantity from the integrators and sell it to retailers. The Broiler Co-ordination Committeee (BCC), situated in Palladam, is an Association of Broiler Integrators. They regulate the functions of the integrators and it is empowered to fix broiler live bird price. In Jammu, the most frequent marketing channel adopted by broiler farmers was 'Producer to trader to retailer to consumer' (Dwivedi *et al*., 2015).

MARKETING CHANNELS

Marketing channels are sets of interdependent organizations involved in the process of making a product or service available for use or consumption. Thus Marketing Channels refer to the

path through which the broiler travels from the integration to the ultimate consumer. The survey reveals that the integrator of the study area use three alternative channels for marketing their broilers.

Channel I – Broiler Integrator – Commission Agent – Wholesaler – Retailer – Consumer.

Channel II – Broiler Integrator – Wholesaler – Retailer – Consumer.

Channel III - Broiler Integrator – Retailer – Consumer

CONCLUSION

Though Broiler farming started its debut as a backyard venture, it has today transformed itself into the fastest growing sector due to introduction of Integration of support activities. Easy adaptability of broiler to different agro climatic conditions and substantial employment opportunity coupled with high profit encouraged people to involve them. 'Price fluctuation' was the most important constraint in marketing of broiler birds by the integrator, followed by 'Price cutting' and 'Competition' in marketing of broiler birds in the study area.

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Goat Milk in India: Current scenario, health benefits and future aspects

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India is the largest producer as well as consumer of milk in the world and accounts for 18.5 % of world's production (155.5 million tonnes - 2016).The milk is mostly from cattle and buffalo which occupies a combined 96.4 % of total milk output. However goat milk constitutes merely 3.4 % of the total but goat milk is not a new concept in India. Goat popularly referred as poor man's cow mostly finds its place in every other household in developing and underdeveloped countries of Asia, Africa and Indian subcontinent. Goats form an important component of livestock industry and play a vital role in the socio-economic structure of rural poor *(Park and Haenlein,2006).*India has 26 recognised breeds of goat out of which 5 can be considered as dairy goat breeds. With increasing human population in India and increase in demand of animal protein among the vegetarian elite of the country. Goat milk and its products can act as one of the best substitute and has also got wide scope in country like India where 12.4 % of people come under below poverty line group.

CURRENT STATUS & AVAILABILITY

Goat milk is fast finding many takers now. However goat milk is an old concept in India .It is well known that mahatma Gandhi was fond of it. Goat milk is also very popular in European and African countries and cheese is also made out of it. There are several rich Indians who import goat milk cheese. The 19th livestock census of India predicts the total goat population to be 135.17 million declining by 3.82 % with respect to 2007 census but the total milk yield from goats has increased from 4782.57 thousand tonnes to 4949.91 thousand tonnes thus contributing 9564 crores of rupees to livestock GDP *(livestock census, 2012).*This makes India the highest goat milk producer that is nearly 29 % of the total world's goat milk production which is predicted at 15510 thousand tonnes. The state of Rajasthan is the highest goat milk producer with 1712 thousand tonnes from 7307 thousand animals in milk followed by Uttar Pradesh *(livestock census, 2012)*. The production is attributed to some milch breeds which include Jamunapari (best dairy goat breed in India), Barbari and to some extent by Sirohi and Marwari. However the average

milk production per lactating animal still remains low with 0.6kg/day.

The production remains low because 96 % of world's goat population is concentrated in Asia and Africa where majority of world's poor live. In India goat rearing is practised mostly by small and marginal farmers along with crop production. Goat rearing supplements them with additional income brought about by selling goat milk and meat. This becomes the sole reason for reduced production as well as the availability of goat milk. Goat milk is commercially sold in certain pockets of the country where people are aware of its health benefits and nutritional measures. As also goat milk is a niche product and is much more expensive than cattle and buffalo milk. But if availability would be easier then it is worth including it in a family diet.

NUTRITIVE VALUE AND PRODUCTS FROM GOAT MILK-

Milk is one of the few wholesome foods available. If we consider goat milk its nutritive value is almost same as cow milk with additional benefits. It is an excellent source of vitamin B (Riboflavin, Biotin, Niacin & panthothenic acid) and vitamin D along with calcium and phosphorous level.100 gm of goat milk provides 69 calories of energy, 3.6 gm of protein and 11gm of cholesterol which is low as compared to cow milk.100 gm of goat milk cheese provides 364 calories along with 21.6 gm protein, 79 gm cholesterol and 29.8 gm of fat out of which 20.6 gm is saturated.

Goat milk contains trace mineral selenium which is very commonly deficient in the human body and it is a necessary nutrient for immune modulation and antioxidant properties *(Belewu and Adewole 2009).* Goat milk is having much higher level of butyric(C4:0),caproic(C6:0), caprylic (C8:0) , capric (C10:0) , lauric (C12:0), palmitic (C16:0), linoleic(C18:2) acid but is low in stearic(C18:0) and oleic acid(C18:1).Three of the medium chain triglycerides(MCT) (C6-C14) have actually been named after goats, because of their predominance in goat milk.If we consider products associated with goat milk channa has been manufactured from goat milk using citric acid, lactic acid or sour whey at coagulation temperature normally used for bovine milk. Such channa has been successfully used in preparation of acceptable quality 'rasogolla' and 'sandesh'.paneer,khoa,ghee,icecream,yoghurt are also prepared by admixing with buffalo milk. Manufacture of mozzarella cheese from a 50:50 blend of buffalo and goat milk is done in India.

GOAT MILK VS COW MILK

Goat milk is similar to cow milk is many aspects but has also got certain special characteristics and if minutely studied goat milk is more closer to human milk rather than cow milk hence goats are called as foster mother of humans. Goat milk is recommended as a useful alternative to cow milk for rehabilitating undernourished children *(Zenebe et al.2014).* It has higher Iron content than cow milk *(Kucukcetin et al., 2011; Domagala, 2009)*. Goat milk exceeds cow milk in MUFA, PUFA and medium chain triglycerides (MCT), which are known to be beneficial for human health especially in cardiovascular condition *(Minervini et al. 2009).* It has high vitamin A, Niacin, Folic acid and fat content but low in

cholesterol when compared with respect to cow milk. Studies showed improved digestive utilization of fat and protein, and higher apparent digestibility coefficient and absorption of calcium, phosphorus, magnesium, iron, copper, zinc and selenium *(Barrionuevo et al., 2002; Lopez-Aliaga et al., 2010).* The good metabolic utilization of several minerals in goat milk is suggested to be due to higher protein content, cysteine levels and amount of vitamin C and D compared to cow milk *(Alferez et al., 2003).*

HEALTH BENEFITS OF GOAT MILK

The nutritional and health benefits of goat milk are related to a number of medical problems, foremost being food allergies with cow milk protein. Goat milk does not contain complex proteins that are the main stimulant of allergic reaction to cow milk and cow dairy products. Goat milk shows unique nutritional differences in smaller fat globules in different milk protein polymorphism and in higher content of short chain,Mono and polyunsaturated fatty acids all contributing to easier digestion in human and used as therapeutic nutrient in mal absorption syndrome ,premature infant feeding ,cholestrolemia ,gall stones and cystic fibrosis. Goat milk has medicinal value for treating various gastrointestinal disorder and diseases and is beneficial for patients of T.B and chronic abdominal diseases *(Baur and Allen, 2005).* Goat milk has long been used and recommended as a supplement to reduce indigestion and to sooth irritated areas in the stomach or intestine *(Park et al., 2007).* Goat milk does not produce the sticky feeling in the blade of throat that is often experienced with cow milk products. This property is probably due to the fact that goat milk products do not stimulate a defence response from human immune system. All milk contains certain level of lactose which is known as milk sugar. A relatively large proportion of the population suffers from a deficiency of lactase enzyme which digests lactose. This deficiency results in a condition called lactose intolerance which is fairly common. Since goat milk is digested and absorbed in a superior manner there is no leftover lactose that remains undigested which cause painful and uncomfortable effects of lactose intolerance *(Haenlein,2004; Lopez-Aliaga et al., 2010).*

CONSTRAINTS IN GOAT REARING & MILK PRODUCTION

Goat production is facing diverse challenges and multiple constraints and the major problem associated with goat production is the fact that goat is reared by lower income group mostly as a sideline activity and management still remains at subsistence level. Unavailability of high genetic potential dairy breeds in India is also a major cause of reduced goat milk production followed by lack of feed, proper treatment and knowledge of diagnosis of diseases. Goat primarily being browsers rather than grazers require additional space under extensive system and India being a highly populous country there is lack of proper grazing and browsing area for goats. The average milk production per lactating goat still remains low at 0.6 kg/day and the milk is mostly used for household consumption in rural areas. Even if substantial amount of milk is produced in certain areas, lack of proper channelization, storage and transport act

as major hindrances. Goat milk is also not easily accepted by many people in the country due to its intense smell and unusual taste and flavour of the milk *(Gomes et al., 2013).* which may be due to presence of breeding buck near the lactating doe or due to extensive grazing. All these reasons sum up for the reduced goat milk production in India.

FUTURE SCOPE AND PERSPECTIVES

Dairy goat sector in India is still a novice and scopes are immense. The present time demands scientific interventions which will enhance goat milk production in the country. These includes introduction of new germplasm or crossbreeding indigenous animals with exotic ones which are high milk yields like Sannen, Alpine etc.Setting up of commercial dairy goat units and switching over from traditional approach will go a long way in increasing goat milk production. Dairy goat production should be visualised as a business enterprise rather than subsidiary farming as demand for goat milk is increasing day by day due to its health benefits and medicinal properties. In states like Bihar, Jharkhand, Odisha and Chhattisgarh where large goat population is present and are reared mostly for meat purposes, there exist huge scope for introduction of dual purpose goats as well as dairy goats to supplement milk production. However government interventions and awareness among goat keepers and farmers is the prime need if goat milk production is to be commercialised in India.

CONCLUSION-

Even if India has the highest goat population in the world, the dairy goat industry is just finding its roots in India. Several areas of the sector are yet to be explored and scope is vast as compared to other livestock sector. Hence dairy goat rearing needs to be more commercialised for better sustainability as well as poverty alleviation. A time may not be far when goat milk will also be available in local shops and outlets like that of cow and buffalo milk.

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Rice Biofortification: Tool for Fighting Micronutrient Malnutrition

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Over three billion people are currently malnourished due to micronutrient (i.e. micronutrient elements and vitamins) deficiency, resulting in egregious societal costs including learning disabilities among children, increased morbidity and mortality rates, lower worker productivity, and high healthcare costs, all factors diminishing human potential, felicity, and national economic development. The nutritional deficiencies (e.g. iron, zinc, vitamin A) account for almost two-thirds of the childhood death worldwide. Most of those affected are dependent on staple food crops for their sustenance. Importantly, these crops can be enriched with micronutrients using plant breeding and/ or transgenic strategies, because micronutrient enrichment traits exist within their genomes that can be used for substantially increasing micronutrient levels in these foods without negatively impacting crop productivity.

IMPACT OF MICRONUTRIENT MALNUTRITION

Humans require at least 49 nutrients for their normal growth and development, and the demands for most nutrients are supplied by cereals, particularly rice due to its staple role. Among these nutrients, mineral elements play numerous beneficial roles due to their direct or indirect effect in both plant and human metabolism and the deficiencies or insufficient intakes of these nutrients leads to several dysfunctions and diseases in humans.

Iron (Fe) and zinc (Zn) are essential micronutrients in plants and animals. Fe deficiency is one of the most prevalent micronutrient deficiencies in the world, affecting an estimated two billion people and contributing to 0.8 million deaths per year worldwide. Fe and Zn deficiencies are the sixth and fifth highest health risk factors, respectively, in developing countries, and they have high mortality rates. Fe deficiency is a serious concern in children and young women of developed countries. Children, adolescents, and pregnant women are at highest risk of Fe deficiency as this problem is more severe during rapid growth when nutritional demand is high. Fe deficiency could be effectively ameliorated by promoting nutritious foods, using Fe supplements, and fortifying food with Fe; however, these strategies are not easy to implement and practice, especially for poor families

with limited financial resources. Zn deficiencies in humans occur as a consequence of an inadequate dietary intake. Factors that decrease absorption include dietary inhibitors, such as phytate or certain types of fiber, drugs, and interactions between essential nutrients. Fe and Zn deficiency could also be mitigated by increasing the iron (Fe) and zinc (Zn) concentrations of staple foods, such as rice, could solve Fe and Zn deficiencies, which are two of the most serious nutritional problems affecting humans.

SEED MICRONUTRIENT LOCALIZATION AND RICE BIOFORTIFICATION

Rice (*Oryza sativa*) is the well-known holder of two important titles: the most important food crop in the world and a model cereal species. Rice is the staple food in many parts of the world, including many developing countries in Asia, Africa, and Latin America In rice seeds Fe localizes to dorsal vascular bundle, aleurone layer, and endosperm as well as it localizes to the scutellum and vascular bundle of the scutellum of embryo. During germination localization of Fe changes significantly, particularly in embryo and 36 h after sowing, Fe localizes to the scutellum, coleoptiles, and epithelium, as well as to the leaf primordium and radicle. Unlike Fe, Zn is unevenly distributed to all of parts of the seed, with a significantly high value for the aleurone layer and embryo. "Biofortification" that refers to the breeding of staple plants/food products with high bio-available micronutrient content using both conventional and non-conventional (molecular, genomic and transformation) approaches is being used to improve the nutritional quality of major crops). Biofortification has the potential to provide coverage for remote rural populations, where supplementation and fortification programmes may not reach, and it inherently targets the poor who consume high levels of staple foods and little else.

ADVANTAGES OF BIOFORTIFICATION

1. The biofortification strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members, including women and children who are most at risk for micronutrient malnutrition. As a consequence of the predominance of food staples in the diets of the poor, this strategy implicitly targets low-income households.
2. After the one-time investment is made to develop seeds that fortify themselves, recurrent costs are low and germplasm may be shared internationally. It is this multiplier aspect of plant breeding across time and distance that makes it so cost-effective.
3. The biofortified crop system is highly sustainable. Nutritionally improved varieties will continue to be grown and consumed year after year, even if government attention and international funding for micronutrient issues fades.
4. Biofortification provides a truly feasible means of reaching malnourished populations in relatively remote rural areas, delivering naturally fortified foods to people with limited access commercially-marketed fortified foods, which are more readily available in urban areas.

METHODS TO IMPROVE IRON AND ZINC CONTENT IN RICE

Iron concentration in the brown rice ranged from 6.3 to 24.4 ppm while zinc concentration ranged from 15.3 to 58.4 ppm. As rice is consumed primarily in the polished state, it would be more appropriate to study the genetic variation for iron and zinc content in the polished rice grains. Outer layers of brown rice are removed during milling. In this process, most of the minerals that are concentrated in the outer layers of rice grains are lost. On an average 70 % of iron is lost during milling while loss of zinc during milling is around 24%. The most important way to improve the iron content in rice is the enhancement of the absorption, transport and accumulation of iron. Apart from agricultural methods such as the use of iron fertilizers, conventional breeding, genetic engineering and molecular approaches have been used to improve the iron and zinc content in rice.

MOLECULAR APPROACHES FOR DEVELOPING IRON AND ZINC DENSE CROPS

Molecular markers are valuable tools in both basic and applied research such as DNA fingerprinting, analyzing genetic diversity, marker-assisted breeding, phylogenetic analysis and map-based cloning of genes. The microsatellite markers are supposed to be particularly suitable for evaluating genetic diversity and relationships among closely related plant accessions or individuals, such as different rice cultivars. Genes/QTLs have been mapped for several agronomically important traits such as disease and insect resistance, yield, quality and abiotic stress tolerance traits (drought, sub-mergence tolerance, salinity tolerance, etc. But, there have been only a few studies to map QTLs for mineral traits. A major QTL for high-Zn has been identified in rice on chromosome 5 flanking microsatellite markers, RM 167 and RM 87, using a selective phenotyping and genotyping approach via microsatellite marker analysis. Recombinant inbred lines were developed to map high-Fe and high-Zn traits and are being used to map genes/QTLs for high-micronutrient traits (Fageria, 2001).

TRANSGENIC APPROACHES TO FE BIOFORTIFICATION OF RICE

Approach 1: Enhancing Fe accumulation in seeds by introducing the Fe storage protein, ferritin gene, SoyferH1, SoyferH2 or Pv ferritin, under the control of endosperm-specific promoters.

Approach 2: Enhancing Fe transport within the plant body by the overexpression of NAS.

Approach 3: Enhancing Fe influx to seeds by expression of the Fe(II)-NA transporter gene OsYSL2 under the control of the OsSUT1 promoter.

Approach 4: Enhancing Fe uptake and translocation by introduction of the phytosiderophore synthase gene IDS3.

Approach 5: Enhanced Fe uptake from soil by over expression of the Fe transporter gene OsIRT1 or OsYSL15.

Approach 6: Enhanced Fe uptake and translocation by over expression of the OsIRO2 gene.

CONCLUSION

The biofortification strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members, including women and children who are most at risk for micronutrient malnutrition. As a consequence of the predominance of food

staples in the diets of the poor, this strategy implicitly targets low-income households.

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Climate Change: Seed of Distress to Pulse Growers

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Abstract

In present situation, climate change is one of the reasons of threat to food security as it has huge impacts on different crop growth stages and ultimately on yield. Climate change along with escalating CO_2 concentration in atmosphere mostly affects the rainfed crops which includes pulses. In developing countries, pulses are most important source of protein but the productivity of pulses is generally lower than cereals and in addition to this, climatic aberrations are also attributed to its lower yield. However, the prediction of such events is difficult but dealing with current climate variability is at least equally important. The growing period of long duration pulse crops is likely to get reduced due to higher temperature during reproductive phage; it causes incomplete grain filling, hard and deformed seeds, faster as well as forced maturity. All these factors finally expressed as lower yield and poor income to the farmers. Being leguminous crops, pulse production can be increased with the higher concentration of CO_2 by shifting crop sowing time and adopting different suitable crop as well as water management practices.

Climate change and subsequent rise in global temperature has become a severe threat to crop production so, at present this is the most significant issue of world's food security. Latest projections of IPCC (International panel for climate change) indicate that after 2050, temperatures would increase by 3-4 degrees over present levels, with the paradox that by this time the world will have doubled demand for agricultural yield too. In addition, atmospheric CO_2 concentration, the pivotal player of global warming has also been increasing at a rate of about 1 ppm per year over the last 50 years and will increase at higher rates in the future. Along all these, there is no agreement in relation to precipitation with predictions ranging from 10–20% increase or decrease, depending on region which put some extra salt in plight for crop production. Preliminary estimation for the period upto 2080 suggests a decline of some 15 to 30% of agricultural

productivity in the most climate-change-exposed regions – Africa and South Asia. Almost all key winter crops under northern plains of India are gradually facing a "Warm winter" and this is primarily because of asymmetric pattern of warming i.e. night-time minimum temperature increasing more rapidly than daytime maximums. The variability of climatic events within years is also expected to increase; as a result crops will face extreme events such as more frequent heat stress and drought and these are already happening.

Major curses of climate change are on *rainfed* crops including pulses which account for nearly 60% of cropland area. Actually, though pulses lag behinds cereals in area expansion along with productivity, effect of changing climate also engulfing production and geographical adaptability with the same pace with cereals. In developing countries, pulses are the cheapest source of vegetarian protein in human diet and these are most vulnerable to climate change, especially winter pulses (chick pea, lentil, grass pea, pea, faba bean) as they are primarily grown in dryland areas on residual soil moisture and concentrated in the marginal areas of low rainfall without or hardly any option of irrigation as only 15% of the area under pulses has assured irrigation.

The high temperature causes the many negative effects on morphological, physical and biochemical characters of the crops. Flowering and seed set are the most critical growth stages affected by increased temperature. Few occurrences of heat waves at the time of reproductive stage make winter pulses prone to terminal heat stress that eventually and concurrently invites moisture stress too. These cause declined crop production and productivity by decreasing the amount of fruitful fertilization, less amount of pod set, reduced seed weight, forming hard and deformed seeds and less seed yield per plant. It is well known that male reproductive development is more susceptible than the female reproductive organs as pollen has to interact with external environment after releasing from anther. Hot weather results in reduced pollen germination, increased number of unviable pollens, pollen bursting, less growth of pollen tube and last but not the least altered stigma receptivity that leads to either less pod set or chaffy pods. During pod filling period, high temperature enhances pod abortion along with other yield reducing factors. Many reports suggested that climate change has beneficial effect on legumes due to more nitrogen fixation with increase in CO_2 level in atmosphere but this effect is nullified by the negative effects of high temperature.

Indian agriculture is already in crisis, and in the last twenty years nearly 3,00,000 farmers have killed themselves. In view of drastic environmental perturbations taking place it is inevitable for farmers as well as for the Indian government to adapt the changing situation adeptly as soon as possible. With climate change, the growing period has been reducing so, the planting date also needs to change for higher crop production and because of crop rotation period is also decreasing, farmers need to consider suitable crop varieties that have a higher per day yield potential with better heat hardiness, optimum crop densities and fertilization levels when

planting crops. For drought, some preventive measures should be considered including on-farm reservoirs in medium lands, stabilization of field bunds by stone and grasses, graded line bunds, contour trenching for runoff collection, conservation furrows, mulching and more application of Farm yard manure (FYM) to preserve the soil moisture and stepping towards sustainable production. Efficient water use such as frequent but shallow irrigation or supplemental irrigation at critical growth periods should be practiced and for this the government should also provide some subsidized measures. Simultaneously the breeders should aim at selecting or engineering the genotypes with higher water use efficiency, better osmoregulation, increased thermo-tolerance with higher root volume, good vegetative growth and drought hardiness in reproductive stage; as reproductive stage is the main game changer to determine the yield potential in any weather aberrations, may cause huge yield loss and for this, changing in planting dates may be proved as preventive measure for drought escape or avoidance under the future changing climate. In India, agriculture still accounts for about 40% of per capita income in rural areas. Poverty is declining in rural India, but still many parts of agrarian India are the deepest pocket of poverty. Rural households are predominantly net buyers of food, so any reduction in production and/or increases in price affect them proportionately. Thereby maintenance of production potential is very much important to encourage farmers in addition to increase per capita production and per capita availability of pulses with other crops; for this the governments obviously should venture, and the agricultural credit system should be more smoother so that the farming community can easily avail all the resource facilities.

CONCLUSION:

Now the upshot is that we cannot escape from the impacts of climate change but we can lessen the burden of loss due to climatic aberrations in pulse production hence, a bridge of cooperation by private and government sector should always be maintained. India still accounts high amounts of child death due to malnutrition and huge numbers of underweight feeding mothers therefore, to combat these pulses are the cheapest way out. So to ascertain sustainable food and nutritional safety and security we need to act at the global, regional, national and local level.

Impact of Rabies on Livestock and Public Health

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Rabies is one of the most important zoonotic diseases affecting humans and livestock health in India. Rabies has one of highest case fatality ratios of any infectious disease.The disease causes heavy losses in human and livestock population in our country.96% of the mortality and morbidity is associated with dog bites. Cats, wolf, jackal, mongoose and monkeys are other importantreservoirs of rabies in India.Dogs play an important role in the maintenance and spread of rabies in India the domestic animals like horse, buffalo, cattle, sheep, goat and pigs have been found to suffer from rabiesAll species of livestock are susceptible to rabies, cattle and horses are the most frequently reported infected species. Rabies is popularly known asHydrophobia.Livestock and other working animals can become infected with the rabies virus. Livestock is an important source of food and income globally and working animals contribute to livelihoods particularly of livestock dependent poor in many parts of the world. Working animals are not limited to cattle, buffaloes, horses, donkeys and camels for plowing the fields and transportation of people and goods as dogs are used for hunting, herding livestock, assisting military and police forces and guarding property. Moreover in some cultures, the consumption of dogs is a common practice. Deficient surveillance and the lack of reliable data on the number of rabies cases is a major constraint to assessing the economic impact of rabies on the local economies when livestock and working animals die due to rabies or infect humans. In addition, the need to pay for transport and expensive post-exposure prophylaxis for rabies exposed family or community members can lead to the unplanned sale of production animals and livelihoods assets, further impacting food and economic security.

Mode of Transmission:

Rabies is a zoonotic disease which infects domestic and wild animals. It is transmitted to other animals and humans through close contact with saliva from infected animals (i.e. bites, scratches, licks on broken skin and mucous membranes) and occasionally by aerosol route. Transmission of rabies under natural condition is commonly by bite of rabid animal usually carnivorous animals.90% of human cases occur due to the bite of rabid dog.

In India besides the problem in domestic animals like dog, cattle, horse, sheep and goat.Rabies infection also prevails in bandicoots, mongooses and rats. dogs are

presumed to be the main transmitter there are no arthropod vectors to be involved in transmission rabies virus can penetrate the mucous membrane of eyes,nose and mouth thus aerosol infection is possible in a rabies laboratory by accident there are few precedents of infection through consumption of unboiled milk or meat of rabid animals or breast fed children mother.

Symptoms of Rabies in Cattle:

They show loss of appetite and sudden fall

of milk yield. There is trembling or twitching of ears, paralysis of deglutition with excessive salivation and grinding of teeth, drooling head extension and Bloat choking behavior. Cattle will below incessantly in characteristic low pitched voice due to vocal cord paralysis .In field cases bellowing and excessive salivation are most common signs.

Symptoms of Rabies in Sheep:

Symptoms are more or less to cattle and buffalo. Remarkable symptom is sexual excitement, restless, starring eyes twitching of lips, salivation, aggressiveness and death

Symptoms of Rabies in Horse:

Weakness and lameness are the initial sign. Horse may show furious form and become violent and uncontrollable. The horse fall on ground, roll on the ground and chew foreign materials. There is drooling of saliva and convulsion. Horse may paw and kick viciously and remain very much destructive. Transient period of sexual excitement may also observed in both stallions and mares excitation state give way to complete exhaustion at that time the horse stand motionless, drenched with sweat, tremors or spasms are noted in specific muscles. The refuses to eat its food, shows dysphagia and ingest wood or feaces. In the terminal paralytic stage there is weakness of hind quarters. There is acceleration of pulse and respiratory rate. The horse falls on ground and dies. The entire course of the disease up to death requires 2-4days

Symptoms of Rabies in Dog:

Dog remains the major host of rabies virus among animals .Young dogs are considered to be more susceptible than adult .The incubation period between 90 to 147 days .The clinical development of the disease takes two general forms (a) furious or aggressive mad dog and(b)dumb or paralytic form

Furious form: In furious form the animal become restless, nervous and aggressive. The appetite may disappear or depraved .The animal loses fear of humans.The animal becomes sensitive to light and sound. Rabid animal bites that comes its way or attempt to eat wood ,soil, plants ,stones or other foreign objects a hoarse throaty howl replaces the normal bark and snarl in dog. This is considered to be in important diagnostic criterion.Excessive salivation and holding of head downward angle results in drooling saliva. Dilation ofpupil and no focusing stare present a frightening appearance. Frothing at the mouth and holding of tail between the rear legs are characteristic of canine rabies

Paralytic form: The animal becomes progressively paralysed. The jaws fallopen causing drooling of saliva and animal is unable to swallow food or water. The animal becomes comatose and dies due to respiratory failure

Symptoms of Rabies in Human:

Rabies symptoms may not show up for months, but when they do, a person is likely to feel like he or she has the flu. A headache, fever, and weakness are generally the first sign of the disease progressing. . The place that was bitten is also generally sore, itchy, and may have a prickly feeling. After a few days more serious signs will likely start to occur. As the disease progresses, an infected person will become confused, agitated, or extremely anxious. He or she will generally start foaming at the mouth, become hyperactive, and become afraid of water. Following these signs, hallucinations, convulsions, seizures, paralysis, and eventually death occurs. Hallucinations and an inability to sleep are other signs; and in some cases, the affected person's muscles become paralyzed and coma occurs. People with this infection typically die of heart failure. Since the incubation for rabies can take months, anyone who is bitten by a possibly rabid animal should seek healthcare assistance immediately whether symptoms are present or not.

Vaccination:

Rabies veterinary vaccine (5% sheep brain emulsion) is used in animals of all species either for post-exposure treatment or pre -exposure prophylactic immunization against rabies by subcutaneous route.

Pre-exposure immunization

Primary vaccination –three injections one each on day 0, 7, 21 and 28.

Booster injection– one year later.

Post-exposure immunization

Non-immunized animals or immunized previously but immunization period is passed away or incomplete previous vaccination – five injections one each on day 0, 3,7,14 and 28.

Subject already immunized, and within the immunization period of previous immunization – two injections one each on day 0 and 3.

Treatment

Rabies is a fatal disease. There is no specific treatment for the disease except management.

If there is an animal bite, there are a few simple steps you can take

- Wash the wound with lots of soap and running water.
- Followed by the application of ethanol, tincture or aqueous solution of Iodine.
- Give tetanus vaccination.

- Give antibiotics if required.
- If possible and without causing further injury, try to identify or capture the biting animal.
- If the biting animal is a dog, cat or ferret, it can be observed for 10 days after the bite.
- If it is not ill after that time, you were not exposed to rabies bite. If it is not ill after that time, you were not exposed to rabies.

Prevention and Control:

Dog remains the main source of rabies in India for both man and animals. Hence control measures should primarily be directed on canine rabies. The prophylactic immunization of dogs is one of most important method for rabies control. Control of canine population including elimination of stray dogs by shooting or poisoning, compulsory immunization of dogs maintained by owners, efficient lab diagnosis to facilitate early treatment, setting up of a reliable surveillance system to measure the effectiveness of controls measures and education campaign for enhancing awareness among general public about the disease The recommendations regarding domestic animal vaccination, management of animals exposed to rabies, and management of animals that bite humans are the core elements of animal rabies control and human rabies prevention

Public Health Education:

Essential components of rabies prevention and control include ongoing public education, responsible pet ownership, routine veterinary care and vaccination, and professional continuing education. The majority of animal and human exposures to rabies virus can be prevented by raising awareness concerning rabies virus transmission routes, avoiding contact with wildlife, and following appropriate veterinary care. Prompt recognition of possible exposure and prompt reporting to medical professionals and local public health authorities is critical.Public health educational programs are needed to create awareness both in the medical community and in the public regarding the dangers of inadequately managed animal bites. The importance of proper wound care, post exposure vaccination with modern tissue-culture vaccine and the administration of human rabies immune globulin, where indicated, must be reinforced.

Human Rabies Prevention:

Rabies in humans can be prevented either by eliminating exposures to rabid animals or by providing persons who have been exposed with prompt local treatment of wounds combined with the appropriate administration of human rabies immune globulin and vaccine. Exposure assessment should occur before rabies post exposure prophylaxis (PEP) is initiated and should include discussions between medical providers and public health officials. The rationale for recommending pre exposure prophylaxis and details of both pre exposure and post exposure prophylaxis administration are available in the current recommendations of the Advisory Committee on Immunization Practices (ACIP). These recommendations, in addition to information concerning the current local and regional epidemiology of animal rabies and the availability of human rabies biologics, are available from state health departments.

Market gardening as a lynchpin to farmers: Time to tower

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Nevertheless, the Indian agriculture has been in a climax amid climate change for several decades now, market gardening can be regarded as a promising scene and an endowment to the Indian agriculture. Even though farmers face struggle to pace with the challenges that are being posed by climate change and changing dietary orientation, the market gardening can be a savior to them. Therefore, market gardening is an effectual way to persevere farming and to drive toward a prosperous life.

Market gardening

Market gardening is the commercial production of vegetables, fruits, flowers and other plants on a scale larger than a home garden, yet small enough that many of the principles of gardening are applicable (Bachmann, 2009). It had been followed in the areas which were located nearby cities and markets. However, the recent development of communication, transport facilities, cold storage, urbanization, have led to the production of vegetables and fruits in remote and rural areas. Meanwhile, from the perspectives of the nature it seems to minimize the water usage and reduced area to cultivate. As the farming has been viewed as a business in the recent past, it is more important to put the view into reality, in this respect, market gardening can help the farmers to march toward making farming as profitable business.

Market gardening in the backdrop of ICTs

Since market gardening deals with the cultivation of vegetable and flowers, the immediate disposal of the produce is inevitable and necessary. In this backdrop, ICT can be handy and effective in marketing. As the world has been pushed into the technological revolution and magical world, market gardening is not far from reaping the benefits of the technological realm. Gone are the days when farmers had to travel to a far area to sell the produce. In specific, the 21st century is an era of ICTs and farmers have also been brought into this era. In a flick of second farmers can trade their fresh vegetables and flowers of their garden. As we are living in the edge of apps, market gardening farmers can make use of the potential of these apps for marketing either through registering with marketing owners or retail & whole shoppers to sell the produce.

Market gardening in the light of Apps and e-Marketing

As mentioned above the universe has moved into the ICT era long back. The ICTs, have carried the globe to an unimaginable space and incalculable time. In this context, its penetration in enhancing the agricultural marketing is nothing short as e-marketing and apps pertinent to agricultural marketing have evolved as a blessing to the farmers. The e-Marketing is considered to save the time and money which are otherwise spent by the farmers in transporting and trading the produce of fresh vegetables, fruits to a distant markets. Moreover, e-Marketing is indeed useful in cognizing the price of the fresh vegetables and fruits not only in the nearest markets but also in the distant markets. e.g. e-NAM (e-National Agriculture Market). Besides, the central government has also launched numerous apps to facilitate farming, Pusa Krishi, mkisan, Shetkari Masik android app, AgriMarket, Kisan Suvidha app to name a few. Among these apps AgriMarket and Kisan Suvidha apps are explicitly helpful in knowing the marketing price of regional and state markets, therefore, these tools and gadgets mentioned above are reformative to the farmers to make a remunerative income.

Market gardening as a guardian against climate change

Climate changes have posed uncountable threats to the farming. Production of certain crops has become extremely heinous owing to the reduced supply of irrigation water, monsoon failure, labour shortage, land fragmentation, reduced fertility of the soil, depletion of underground water etc. However, these threats can be reduced by opting market gardening as it optimizes the cultivation of vegetables, fruits, flowers. Besides, it has the potency to overcome the above mentioned challenges and threats of production.

Market gardening as a solution to the changing dietary

It is evident that the recent shift in dietary orientation toward vegetables and fruits will have more demand for vegetables, fruits, and so on. Therefore, the market gardening is evinced to be successful. Besides, it is said to create more profits to the farmers.

CONCLUSION

Therefore, as market gardening of vegetables and flowers can be mediated through the recent developments viz, ICTs, communication and transport facilities, It is certainly helpful to the farmers and can serve as a platform to earn more income by the farmers. Moreover, the recent ICT revolution is the key for farmers as many of the apps developed with the help of ICTs quench the need of the farmers either directly or indirectly. Further, market gardening is widely recognized as an alternative to overcome the climate change and suffice to the changing dietary orientation of the people. Thus, on the whole, market gardening is a lynchpin to the farmers who face challenges much against the awaiting prosperity.

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Status of Arsenic Contamination of Groundwater In Karnataka And Remedial Options

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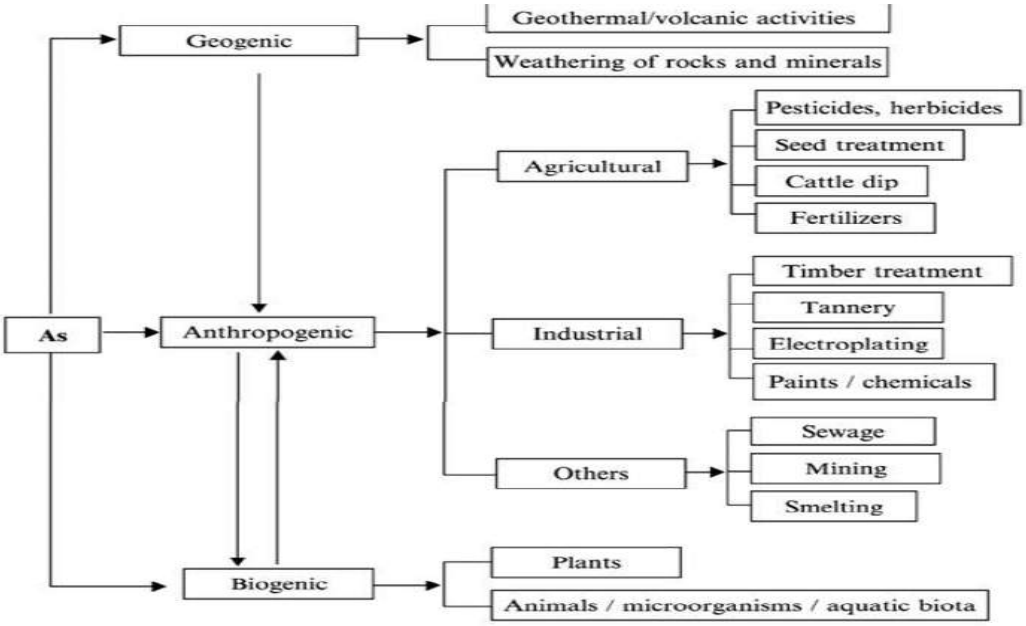
Arsenic is a naturally occurring element in the earth that is present in combination with both inorganic and organic substances. Organic arsenic is 500 times less harmful than inorganic arsenic. Inorganic arsenic trioxide is a component of geologic formations and can be washed out into the ground water. Arsenic is found in the Earth's crust and in small quantities in rock, soil, water and air. About one third of the arsenic in the atmosphere is mobilised in the environment through a combination of natural processes, such as volcanoes, weathering reactions, biological activity and the rest comes from anthropogenic activities. Environmental arsenic problems are the consequence of mobilisation under natural conditions, but due to increased anthropogenic activities through mining activity, combustion of fossil fuels, the use of arsenical pesticides and herbicides has lead to serious impact on health of natural flora and fauna. Arsenic is the major pollutant of drinking water in India, Northern Chile, Thailand, Taiwan, China, Mongolia, Mexico, Argentina, Finland and Hungary. Due to natural geological contamination, high levels of inorganic arsenic trioxide can be found in drinking water that has come from deep drilled wells.

In a country like India, where around 80% of the rural population and 50% of the urban population use ground water for domestic purposes, the water quality issues like arsenic, salinity, nitrate, iron, flouride and heavy metals in water has to be viewed as a separate discipline. According to the report submitted by "Ministry of water resources, river development and Ganga rejuvenation (2014-15)" as many as 96 districts in 12 States have been affected by high arsenic contamination in ground water. 70.4 million People in 35 districts have been exposed to groundwater arsenic. Over one lakh deaths and 2 to 3 lakhs of confirmed cases of illness have reportedly been caused by groundwater arsenic.

SOURCES OF CONTAMINATIONS

Geologenic Source

Arsenic is extensively distributed in geological materials, but with variable concentrations. An average concentration of arsenic in the continental crust of the earth is 1.5 to 2.0 mg/kg. The mean



concentrations of arsenic in igneous rocks are 1.5 to 3.0 mg/kg and in sedimentary rocks, it ranges from 1.7 to 400 mg/kg. Arsenic ranks 52nd in crustal abundance and is a major constituent in more than 245 minerals. Arsenic is introduced into soil and water during the weathering of rocks and minerals followed by subsequent leaching and runoff. Therefore, the primary source of arsenic in soil is the parent materials from which it is derived.

Anthropogenic Sources

Arsenic is introduced into the environment through several anthropogenic activities. These sources release arsenic compounds that differ greatly in chemical nature and bioavailability. Major sources of arsenic discharged onto land originate from commercial wastes, coal ash, mining industry, and the atmospheric fallout from the steel industry. Arsenic trioxide (As2O3) is used extensively in the manufacturing of ceramic and glass, electronics, pigments and antifouling agents, cosmetics, fireworks, and Cu-based alloys. Arsenic-containing pesticides and herbicides release arsenic containing liquid and solid wastes that, upon disposal, are likely to contaminate water bodies and soil.

Biogenic Sources

Biological sources contribute only small amounts of arsenic into soil and water ecosystems. However, plants and micro- and macro-organisms affect the redistribution of arsenic through their bioaccumulation, biotransforma and transfer.

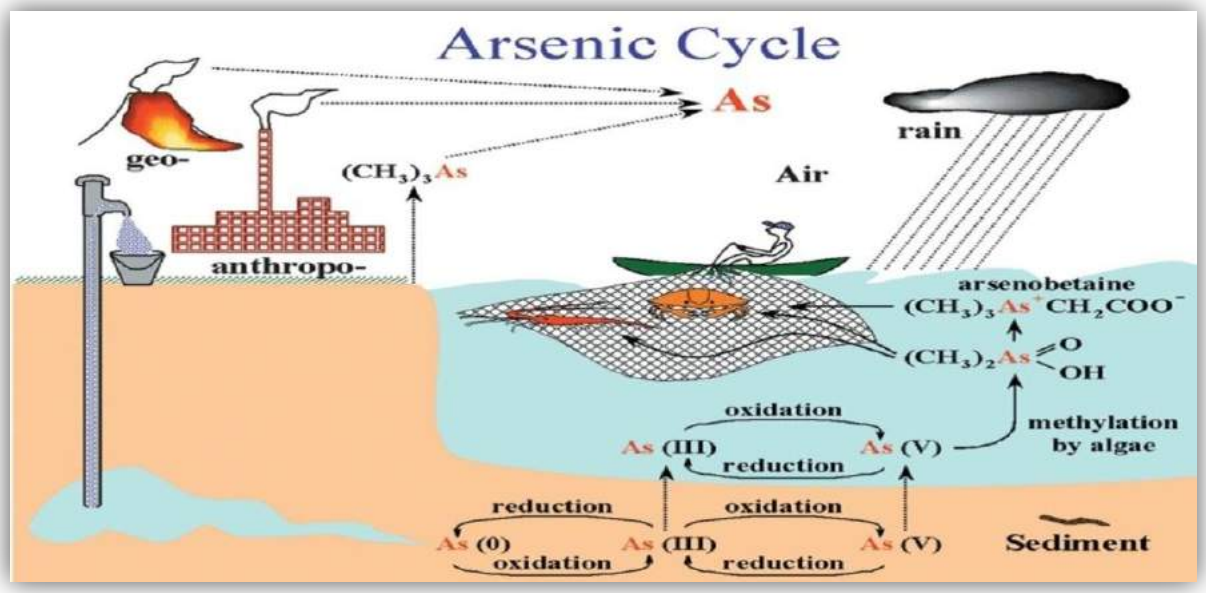
Sources for arsenic intake

Drinking water contaminated with arsenic due to deep drilled wells.

Besides drinking water, food may also make a significant contribution to the dietary intake of arsenic. All continents have problems with arsenic contaminated groundwater, but the problems are especially potent in South East Asia where millions of people are at risk of exposure of arsenic contaminated drinking water. Rice may take up arsenic from the surrounding soil and the concentration of arsenic in rice grains can reach elevated levels. Other crops have been tested for accumulation properties

of arsenic; for example beetroot, lettuce, potato and radish. Patel and co-workers reported the concentration of total arsenic in the field soil, rice grain, husk, straw and root ranging from 44 - 270, 0.17 - 0.72, 0.40 - 1.58, 2.5 - 5.9 and 204 - 354 mg/kg, which is several times higher than the limits of WHO specifications.

mg/kg of inorganic As (Olson et al., 2002). Arsenic belongs to the heavy metal group containing minerals such as Cadmium (Cd), Lead (Pb), Mercury (Hg) and these are cumulative poison. These heavy metals are persistant, build up and are not metabolized in other intermediate compounds. These metals



Effect of Arsenic poisoning on Livestock

Arsenic is colorless, odorless and very poisonous Arsenic can gain access to the body through the mouth, lungs and skin. Arsenic toxicity seems to predominantly affect the skin, lungs and gastrointestinal system, and also nervous disorders, deteriorated motor coordination, respiratory diseases, and kidney damage as well as cancers of the skin, liver, bladder and lungs. Arsenic has been used as feed additives for disease control and improvement of weight gain in non ruminants such as swine and poultry in high concentrations. Ruminants are less susceptible to arsenic toxicity and do not show any sign of toxicity unless the feed offered contains more than 200 to 300

are accumulating in food chain through uptake at primary producer level and than through consumption at consumer level.

Heavy metals disrupt metabolic functions in two ways:

1. Accumulate and disrupt function of vital organs and glands such as the heart, brain, kidneys, bone, liver, etc.
2. Displacing the vital nutritional minerals from their original place, thereby, hindering their biological function. It is, however, impossible to live in an environment free of heavy metals. There are many ways by which these toxins can be introduced into the body such as consumption of foods, beverages, skin exposure, and the inhaled air (Singh, 2007)

Status of Arsenic levels in groundwater of Karnataka

Mohan et al. 2012 investigated the occurrence and distribution of arsenic in groundwater from Nuggihalli mining area, situated in Hassan district of Karnataka. They analysed the ground water samples for arsenic and other quality parameters (pH, TDS, Ca, Mg, Na, K, Cl, HCO3, NO3, SO4, B, Fe, Mn) and found that levels of arsenic concentrations ranged from 0.002 to 0.51 mg/L and also reported that almost 79% of analysed water samples exhibited arsenic concentration higher than the maximum concentration limit of WHO specifications (0.01mg/L) for drinking. Nuggihalli and its surrounding areas are exclusively dependent on groundwater from bore wells for their agricultural and drinking purposes and levels of arsenic poses a great threat to human and livestock health. Hebbar and Janardhana, 2016, studied on the arsenic contamination in groundwater of the areas surrounding Ingaldhal, Chitradurga district, Karnataka state, and concluded that the levels of arsenic concentration in the groundwater samples, bore wells and hand pumps located in the rural areas surrounding a defunct copper mine, ranged from 0.104 mg/l to 0.235 mg/l. They also stated that according to the standards prescribed by WHO (2008) and BIS (1991), groundwater of the Ingaldhal region is unfit for drinking purpose. The study reveals that the source of contamination of arsenic in groundwater of the study region is both natural and anthropogenic as the area is known for base metal sulphide mineralization and the mining activity

According to the report submitted by "Ministry of water resources, river development and ganga rejuvenation (2014-15)" in Karnataka up to 1.00 mg/l level of Arsenic Contamination was detected in 2 districts as of 2009.

Department of Mines and Geology, Govt. of Karnataka has reported the presence of Arsenic in ground water in Yadgir (old Gulburga) and Raichur district. In Karnataka, Arsenic in groundwater is reported in areas of gold mining and associated activities. The leaching and enrichment of Arsenic is localized and the effect is likely to be more in the proximity of the dumpage in the phreatic aquifer and in bore wells along well defined lineaments passing through the dumpage. As per Rural Development and Panchayati Raj Engineering Department, Govt. of Karnataka, Bangalore, Arsenic free water is being supplied by installing pure drinking water plants.

tHE HINDU Newspaper dated June 22, 2013, reported that 44 villages in Manvi, Lingsugura, Deodurga and Sindhanur taluks of Raichur district, and 19 villages in Surpur taluk of Yadgir district, had arsenic content more than the permissible limit of 0.05 mg per litre because of which 100 borewells in 63 villages were sealed. Similar reports are

described by other national newspapers and local newspapers of Karnataka.

The remedial options available for getting Arsenic free water

***EX-SITU* ARSENIC REMOVAL**

Precipitation Processes

Adsorptive Processes

Ion-exchange Processes

Membrane Processes

***IN-SITU* (SUB-SURFACE) ARSENIC TREATMENT**

Use of Atmospheric O2 for Iron and Arsenic Rich Water

Use of Atmospheric O2 and Ferrous Chloride for Low Iron and Arsenic Rich Water

Electrokinetic Treatment

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Salmonellosis and their Public Health Significance

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Salmonellosis is a type of food poisoning caused by the Salmonella enterica bacterium. There are many different kinds of these bacteria. Salmonella serotype typhimurium and Salmonella serotype enteritidis are the most common types in the United States. Salmonellosis is more common in the summer than in the winter. Children are the most likely to get Salmonellosis. Most people with salmonellosis develop diarrhea, fever, vomiting, and abdominal cramps 12 to 72 hours after infection. In most cases, the illness lasts four to seven days, and most people recover without treatment (foodsafety.gov). In some cases, the diarrhea may be so severe that the patient becomes dangerously dehydrated and must Young children, older adults, and people who have impaired immune systems are the most likely to have severe infections.

SOURCES AND TRANSMISSION OF SALMONELLOSIS

Food may be contaminated during food processing or food handling. Food may become contaminated by the unwashed hands of an infected food handler. A frequent cause is a food handler who does not wash his or her hands with soap after using the bathroom. *Salmonella* may also be found in the feces of some pets, especially those with diarrhea. Human can become infected if do not wash his hands after contact with these feces. Reptiles, baby chicks and ducklings, and small rodents such as hamsters are particularly likely to carry *Salmonella*. Beef, poultry, milk, and eggs are most often infected with salmonella and human get infection byeating such items.

SYMPTOMS

Symptoms of salmonellosis include diarrhea, fever, and abdominal cramps. They develop 12 to 72 hours after infection, and the illness usually lasts 4 to 7 days. Most people recover without treatment. But diarrhea and dehydration may be so severe that it is necessary to go to the hospital. Older adults, infants, and those who have impaired immune systems are at highest risk. Typhoid fever occurs when *Salmonella* bacteria enter the lymphatic system and cause a systemic

form of salmonellosis. Endotoxins first act on the vascular and nervous apparatus, resulting in increased permeability and decreased tone of the vessels, upset thermal regulation, vomiting, and diarrhea. In severe forms of the disease, enough liquid and electrolytes are lost to upset the water-salt metabolism, decrease the circulating blood volume and arterial pressure, and cause hypovolemic shock. Septic shock may also develop. Shock of mixed character (with signs of both hypovolemic and septic shock) are more common in severe
salmonellosis. Oliguria and azotemia deve lop in severe cases as a result of renal involvement due to hypoxia and toxemia (Santos *et al*.,2001).

If you only have diarrhea, you usually recover completely, although it may be several months before your bowel habits are entirely normal. A small number of people who are infected with salmonellosis develop reactive arthritis, a disease that can last for months or years and can lead to chronic arthritis (Leirisalo *et al*., 1997; Dworkin *et al*.,2001).

DIAGNOSIS

Salmonellosis is diagnosed based on a medical history and a physical examination, symptoms, foods you have recently eaten, and your work and home environments. A stool culture and blood tests may be done to confirm the diagnosis.

TREATMENT

Electrolytes may be replenished with oral rehydration supplements (typically containing salts sodium chloride and potassium chloride). Appropriate antibiotics, such as ceftriaxone, may be given to kill the bacteria but are not necessary in most cases (Merck Manual) Azithromycin has been suggested to be better at treating typhoid in resistant populations than both fluoroquinolone drugs and ceftriaxone. Antibiotic resistance rates are increasing throughout the world, so health care providers should check current recommendations before choosing an antibiotic.

PREVENTION FROM SALMONELLOSIS:

- Do not eat raw or undercooked eggs. Raw eggs may be used in some foods such as homemade hollandaise sauce, Caesar and other salad dressings, tiramisu, homemade ice cream, homemade mayonnaise, cookie dough, and frostings.
- Cook foods until they are well done. Use a meat thermometer to be sure foods are cooked to a safe temperature. Do not use the color of the meat (such as when it is no longer "pink") to tell you that it is done.
- Avoid raw or unpasteurized milk or other dairy products.
- Wash or peel produce before eating it.
- Avoid cross-contamination of food. Keep uncooked meats separate from produce, cooked foods, and ready-to-eat foods. Thoroughly wash hands, cutting boards, counters, knives, and other utensils after handling uncooked foods.
- Wash your hands before handling any food and between handling different food items.
- Do not prepare food or pour water for others when you have salmonellosis.
- Wash your hands after contact with animal feces. Since reptiles are

particularly likely to carry salmonella bacteria, wash your hands immediately after handling them. Consider not having reptiles (including turtles) as pets, especially if you have small children or an infant.

- The FDA has published guidelines (USDA). to help reduce the chance of food-borne salmonellosis. Food must be cooked to 68–72°C (145–160°F), and liquids such as soups or gravies must be boiled. Freezing kills some *Salmonella*, but it is not sufficient to reliably reduce them below infectious levels. While *Salmonella* is usually heat-sensitive, it does acquire heat resistance in high-fat environments such as peanut butter (FDA).

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