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Vegetable Farming in Coastal Odisha

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Sr. No.	Full length Articles	Page
1	Pest survey, surveillance and forecasting <i>Mandeep Rathee</i>	466- 473
2	New Approach to Improve the Biological Response of Papaya (Carica Papaya) Using Kitchen Waste Extract As Plant Stimulant <i>Prasad Mithare, Akash Hondale and U.T. Mundhe</i>	473- 478
3	Role of Dormex on bud break of Temperate Fruits <i>Babita and Naseer Ahmed</i>	479- 482
4	Silage: enriched feed for increasing milk production in dairy cattle during lean period <i>Prasad Mithare, U.T. Mundhe and Akash Hondale</i>	483- 487
5	Importance of soil organic matter in Agriculture sustainability <i>M. S. Argal, M. K. Tarwariya and Amit Pippal</i>	488- 490
6	Identification of different orders of the class arachnida <i>Mandeep Rathee and Rachna Gulati</i>	491- 496
7	DNA Fingerprinting Methods and its Importance in Dairy Animals <i>T. Karuthadurai, T.Chandiranathan, T.Chandrasekar, Ekta Rana1 and Kotresh Prasad</i>	497- 500
8	Value addition of perishables by dehydration <i>Suman Bala, Renu Singh and Jitender Kumar</i>	501- 506
9	Recombinant veterinary vaccines <i>Ranjani Rajasekaran, J. John Kirubakaran and M. Vidhya</i>	507 -513
10	Black rice- The magic food <i>Sucheta Dahiya</i>	514 -515
11	Biochar: A Powerhouse of Benefits <i>Richa Khanna, Shilpi Gupta and Jayant Kumar Singh</i>	516 -518
12	Potentials and Problems of Vegetable Farming in Coastal Odisha <i>R. Srinivasan and Kalaiselvi Beeman</i>	519 -525
13	Mosquito borne viral diseases- a threat to life <i>Chaple A. R., Wankhade P. R., Vispute M. M., Adherao G. N. and Kamdi B. P.</i>	526 -529
14	Infectious laryngo-tracheitis (ILT) in commercial layer chicken <i>P. Suresh*, S. Saravanan, S. Chitradevi and K. Sukumar</i>	530 -532
15	A2 milk and its health benefits <i>Archana S. N., Sathya. P. and Srinivasan. C.</i>	533 -536
16	Vegetable seed production: a remunerative business <i>Davinder Singh and Rajkumar</i>	537 -540
17	Goat and Goat milk production as source of Indian farmers <i>Sudharshan Reddy Ravula, Divyasree Arepally, Ramachandra C T</i>	541 -543
18	Heat Stress in Dairy Cattle- a challenge to animal production <i>Rajeev Kumar Choudhary and Tripti Kumari</i>	544 -549
19	Eat more carrots: a way to healthy life <i>Davinder Singh and Rajkumar</i>	550-552
20	Proso millet or (cheena) is a important crop in indian farmer to unique nutrinal qualities, health beneficial and doubling farmers income by 2022 (<i>panicum miliaceum</i>) <i>S. K. Yadav, A. K. Sharma, Sushma Tiwari, P. K. Singh, and Ajay Singh</i>	553-559

(Note: 'Indian Farmer' may not necessarily subscribe to the views expressed in the articles published herein. The views are expressed by authors, editorial board does not take any responsibility of the content of the articles)

Pest survey, surveillance and forecasting

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Pest monitoring through field surveys and surveillance, aids in forecasting the buildup of pest population in a particular area and thus forms an indispensable component for sound implementation of integrated pest management as it. It reduces the load of pesticides application, helps in decision making and forms the basis of Integrated Pest Management in wide range of crops. This decision making process can lead to sustainable pest control with little or negligible hazards to non-target organisms and environment. Sampling techniques are quite handy in quantifying pest populations and damage caused by them. Forecasting of pests and predators based on surveillance provides an opportunity to minimize the yield losses and reduce expenditure involved in pest management.

INTRODUCTION

Insect-pests need to be monitored during a cropping period to avoid their buildup, carry out timely and proper management practices to safeguard the crops. Knowledge of the increase or decrease or any fluctuation in an insect's population is quite essential as this actually helps in intervening with suitable management practices and containing the pest below economic injury level (EIL). Lack of proper monitoring and forecast technologies may lead to exacerbation of insects and ultimately pest damage and yield losses are likely to threaten food security. Cotton white fly, *Bemisia tabaci* (Gennadius) in the recent past (2014 and 2015) was found to be in epidemic form in Punjab, Rajasthan and Haryana and constant monitoring of this pest has enabled to contain this pest within these cotton growing states. An introduced pest, tomato pin worm, *Tuta absoluta* (Meyrick) was noticed in 2014 as a serious pest on tomato, in the Maharashtra region and has spread throughout Karnataka. Similarly, the papaya mealy bug, *Paracoccus marginatus* Tinsley became quite severe in horticultural crops in southern parts of India and was growing at an alarming rate, but because of constant monitoring it was intervened with a good number of biological control agents. Similarly, now the banana skipper, *Erionota thrax* Linnaeus which appeared in sporadic form in 2012-13 in Kerala is quite fast spreading and there is a constant watch over this. So it indicates that for those insect pests which suddenly appear or are quite regular or sometimes are introduced to a new area, proper monitoring or surveying is of great help, in order to follow their population, understand their life-cycle and take decisions. Monitoring can be done through a process called as the pest survey. Pest surveillance and monitoring form an integral part of IPM technology. Directorate of Plant Protection, Quarantine and Storage (DPPQS), Faridabad, is organizing regular rapid roving pest surveys on major field crops in different agro ecosystems in collaboration with ICAR and SAU's and a consolidated report is then issued by Plant Protection Adviser (PPA) to the Government of India.

PEST SURVEY

It is an official procedure which is continued or conducted over a defined period of time and space in order to determine the characteristics of a pest population, to determine the species occurring in an area and to judge its population dynamics.

Types of survey –

- Qualitative and quantitative survey
- Roving survey and fixed plot survey

Qualitative survey

Qualitative surveys are generally aimed at pest detection and used mainly at international borders especially for new and invasive pests.

Quantitative survey

Quantitative surveys determine numerically the abundance of pest population over time and space and serve as the basis of decision making for the farmers.

Roving survey

The roving survey is one type of survey which can be done over a larger area within a short period of time, to know the pest situation irrespective of whatever might be the pest in a larger area.

Fixed plot survey

For estimating a specific pest in a specific area fixed plot survey is used and the assessment of the population or damage from the pest can be done through a fixed plot of a region, by surveying repeatedly in an area over a period of time (say from sowing to harvesting).

SAMPLING

The sampling of a pest population depends upon the type of damage that a particular pest is going to cause and whether the absolute count of the pest or damaged plant parts are used for sampling.

Methods of Sampling

Block survey and point survey methods

Block survey method

In block survey methodology, over an area certain blocks of a fixed area say 1x1 meter and in that 1x1 meter are fixed. The number of the healthy plants and the number of plants affected are counted and converted to percentages. Here, blocking is done in a known area say for example one hectare area and the survey is done.

Point survey method

In point survey of an area 10 spots or 20 spots are marked depending upon our requirement randomly and from each spot either damage or the pest count is recorded. So in a roving survey or a fixed plot survey, either a block method or the point survey method is followed.

PEST SURVEILLANCE

Pest surveillance refers to an official process which collects and records the data on a pest occurrence or its absence, through a constant monitoring or survey or by other procedures.

Objectives of the pest surveillance

- to know the existing and new pest species
- to assess pest population and damage at different growth stages of crop
- to study the influence of weather parameters on pest
- to study changing pest status (minor to major or emerging or invasive)
- to assess natural enemies and their influence on pests
- to study the effect of new cropping pattern and varieties on pest
- to estimate the crop losses caused by the pests

Components of pest surveillance

- Proper identification of pest species
- Determination of pest population
- Estimation of natural enemy population
- Estimation of yield losses

Methods of pest surveillance- General surveillance and specific surveillance methods

General surveillance method

General surveillance is the process whereby the information of a particular pest, which is of concern for an area is gathered from many sources, wherever it is available and provided for the use by the National Plant Protection Organization. From different sources, either in a localized area or a regional area by certain institutions, the surveillance data is taken and given to the National Plant Protection Organization.

Specific surveillance method

It is a process by which this National Plant Protection Organization obtains the information on a pest of a concerned specific site in an area over a defined period of time. The surveillance is restricted only to a particular pest species and the data is gathered for the same.

PEST FORECASTING

Successful pest control programmes requires efficient monitoring of pest populations, host–parasitoid ratios, starting densities of parasitoid, timing of parasitoid releases, dosages and timing of insecticides application and level of host feeding and parasitism. Pest forecasting is the forecasting of the incidence or the outbreak of the pest based on the information obtained from the pest surveillance. Through the accumulation of the data of this pest surveillance and integrating with certain abiotic and biotic factors, one can prepare certain models called as forecasting models, based on which the actual prediction of the occurrence of pests is done, either in a short term or in a long term so that farmers get ready in containing these pests well in advance. E.g. CLIMAX model for *Helicoverpa armigera* and FRUFLY Model for *Ceratitidis capitata*.

Uses of pest forecasting

It is helpful in predicting the pest outbreaks and initiating the control measures. Knowledge of the suitable stage or weak link in the life cycle of a pest, at which the control measure can maximize the protection, may help in preventing pest build-up. So with this valuable information farmers can decide exactly when the control measures have to be initiated so that the pest can be maintained with a minimum economic loss.

Types of forecasting-

Short term forecasting

Short term forecasting is based on one or two seasons. Suppose in a particular season, if a particular pest has actually reached a higher level and caused a serious damage, then the reasons for such outbreaks are assessed and if similar reasons occur in the next season, then one can predict and caution the farmers, that this pest is going to come and then cause the damage.

Long term forecasting

For long term forecasting, the data regarding pest and natural enemy population over a period of time, say for about 5 to 10 years is accumulated and correlated the weather parameters. Then prediction is made well in advance for a longer time but a short term prediction is quite accurate and advantageous. For a long term prediction accurate data over a longer period of time is must.

SAMPLING TECHNIQUES

For the determination of population of a particular pest species, different sampling methodologies are employed.

The sampling techniques are broadly categorized into absolute sampling and the relative sampling. Population indices also help determine the pest population.

Absolute sampling

The total number of insects per unit area (hectare, one meter row length, quadrat etc.) represents the absolute population and the number of insects per unit of the habitat (per plant, shoot or leaf) represents the population density. It involves counting all the insects which are present, either on a plant or in an area, but this is quite tedious or practically not possible, so often the relative plant sampling methods are used. Main methods followed are Quadrat method and CMRR (Capture, Mark, Release and Recapture) method.

Relative sampling

Relative sampling includes measurement of the pest in terms of some values which can be compared over time and space. In this, the insects are collected from a particular area, sampled it in particular spots, and then actually counted or predicted over a larger area. Relative estimates are affected by: behaviour of the insect, insect age, level of activity, response to stimuli, efficiency of trap etc.

Population indices

Measurements of the size of population based on the magnitude of their products or effects are population indices. Insect products such as frass, exuviae or webbings are often used for estimating the pest population. The damage by direct pests is sampled by

estimating plant damage like number of damaged bolls or fruits per plant, pods damaged per meter row length etc. While for indirect pests extent of defoliation can be measured by leaf area meters and plantimeters. Some of the sampling techniques for major insect pests are given in Table 1.

Methods of sampling

- In situ count: Direct count
- Knock down count
- Sweeping net
- Shaking and beating
- Killing bottle
- Crushing and cutting down
- Crop samples (seeds, grains, fruit, root, leaves etc.)
- Remote Sensing
- Insect traps (Sticky traps, pheromone traps, light traps, bait traps, pitfall traps, pheromone or para-pheromone traps, coloured traps, water traps)

Then the quite essential thing is that when these samplings should be done. For instance normally, the most injurious stage of the insect is counted. In case of the lepidopteron pests the immature stages cause a lot of damage, so larval counts are made. An early egg mass count is also helpful in judging forthcoming threat and controlling the pest before it starts causing the damage. In certain groups, both the immature as well as the adult insects are counted as both are responsible for damaging the crop. Sample size should be decided based upon the area being surveyed or the nature of the pests and crops. So proper sample size is must. Always a higher sample size will give the accurate result.

CONCLUSION

After knowing the importance and uses of surveillance and forecasting, the most important thing is the decision making, where in after assessing the population or the damage of the crop, farmers must compare it with the ET and EIL, and if the pest level crosses the ET, then farmers can take a decision regarding pest management utilizing suitable measures and thus prevent the pest from reaching the EIL. Survey, surveillance and forecasting, thus help farmers in knowing pest status, applying control measures and safeguard the crops without much expenditure.

Table 1. Sampling techniques for major insect pests of some crops

Crop	Pest	Economic threshold	Method of sampling
Cotton	Leaf hopper	2 nymphs/leaf or yellowing and curling of 20% leaves from margins	Count leafhopper nymphs from underside of three fully developed leaves in the upper canopy of each of 20 random plants or count leaves showing yellowing and curling from margins and healthy leaves of 20 random plants in a field
	Whitefly	6-8 adults/leaf	Count whitefly adults as above

	American bollworm	5-10% infested fruiting or 1 or 2 larva/plant	Examine all fruiting bodies of 20-25 random bodies or one larva/2 plants. plants for the pest damage and also count number of larvae present
	Spotted bollworm	10% drooping shoots or 5-10% infested fruiting	Count drooping shoots and healthy shoots of 25 random plants or examine all green fruiting bodies of the above plants for spotted bollworm induced holes or damage
	Aphid	10-15% infested plants	Examine presence of aphid or its symptoms on 20-25 random plants
	Thrips	10 thrips/leaf or 25% infested plants	Same as for aphid
Tomato	Fruit borer	One larva/m ²	Count larvae in 1m ² micro plot from 10 random sites in a field
Gram	Gram pod borer	One larva/m	Count larvae in one meter row length from 10-20 random sites in a field
Okra	Leafhopper	2-5 nymphs/leaf	Same as in the case of cotton
Sorghum	Shoot fly: After one week of crop germination	One egg/plant or presence of eggs on 5% plants	Examine 30 plants for the presence of eggs
	Shoot fly: After one week of crop germination	Dead-hearts in 15% plants	Examine 30 plants for the presence of eggs or count dead hearts
	Stem borer	One larva/plant Symptoms of damage dead hearts, shot holes in leaves, unfilled ear head	Examine 30 plants for damage symptoms
Sugarcane	Early shoot borer	Dead hearts in 15-20% tillers	From 5 random rows in a field, examine 100 tillers/row for dead-hearts
	Top borer	Dead hearts in 10% tillers or 5% dead hearts in the ratoon crop	Same as for early shoot borer
	Pyrilla	3-5 insects/leaf	Count pyrilla nymphs and adults on 10 random plants taking 6 (2 upper, 2 middle and 2 lower) leaves/plant
Paddy At earing	Green leaf hopper	5-15 insects/hill	Select 5 micro-plots of 1m ² each in a field and shake vigorously plants in 5

stage	white backed plant hopper brown leafhopper		hills/plot or shake vigorously 25 random plants and count leafhopper fallen on water
At flowering stage	Stem borer	5-10% plants with dead- hearts or 2% white ears or 1 egg mass/moth/m ²	Same as above Count infested and healthy tillers in 25 random plants
	Leaf-folder	2 damaged leaves/ plant or one larva/hill	25 random plants or count number of larvae in 25 plants
	Rice gundhi bug	1-2 insects/hill	Count the insect on 25 random plants

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New Approach to Improve the Biological Response of Papaya (*Carica Papaya*) Using Kitchen Waste Extract As Plant Stimulant

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The response of crop against kitchen waste bio-extracts was observed in papaya crop during the *kharif* season of 2017 in progressive farmer Mr. Kashinath Ramban's field in Chikurthi village, Zaherabad taluk, Sanagareddy District, Telangana state. This area is situated on the right side of the river Manjra. All the facilities required for crop cultivation are available on farm & the soil of the field consists of well drained black soil. The aim of modern agriculture is to reduce inputs without reducing the yield and quality & identification of organic molecules able to activate plant metabolism may allow an improvement in plant performance in a short period of time, with low cost. Kitchen waste extract contain a wide range of nutrient compounds that are mostly essential for plant growth & reproduction, which also contain various micro-organisms beneficial for growth of plant roots. The biostimulants extracts increased leaf pigments (chlorophyll) and plant growth by stimulating root growth and enhancing nutrient use efficiency of plant which leads in increasing tolerance to biotic and abiotic stresses. In this study we observed that kitchen waste extracts are promising in management against papaya leaf curl disease. The infected plant has shown significant response and recovery from diseased to healthy plants.

What is kitchen waste?

Kitchen waste is defined as left-over organic matter from restaurants, hotels and households as shown in table 1 & table 2. Tons of kitchen wastes are produced daily in highly populated areas, kitchen wastes entering the mixed-municipal waste system are difficult to process by standard means, such as incineration, due to the high moisture content. Furthermore, organic matter can be transformed into useful fertilizer and biofuel. New disposal methods that are both environmentally and economically efficient are being developed which rely on various forms of microbial decomposition.

Physical Properties: Kitchen waste is a nutrient rich, eutrophic environment containing high amount of carbohydrates, cellulose, protein, oil and inorganic salts. In the meantime, it contains a certain amount of calcium, phosphorus, potassium, iron and other trace elements. The content of each component in the food waste (dry matter): crude protein accounted for 15% to 23%, fat 17% to 24%, ash 3% to 6%, Ca element 54%, P element 43% and NaCl 3% to 4%. These organic molecules which can support abundant populations of microorganisms & the anaerobic nature of kitchen wastes is typical for a eutrophic environment, because aerobic bacteria deplete oxygen through respiration at a faster rate than oxygen can be replenished by diffusion.

Biological Interactions:

A syntrophic and nutritionally mutualistic relationship exists among the organisms in kitchen waste environment forming an anaerobic food web. Hydrolytic enzymes break down complex molecules into monomers which can be used by fermentative bacteria. Products of fermentation can be further reduced to methane by Methanogens. In addition, *Pseudomonas aeruginosa* produces a biosurfactant called rhamnolipid which can increase bioavailability of nutrients in kitchen waste for other bacteria. Researchers also found that lactic acid bacteria can suppress the growth of food poisoning bacteria such as *Staphylococcus aureus*, and *Bacillus*.

Microbial Processes

In general, four steps occur in anaerobic digestion including hydrolysis, acid fermentation, acetogenesis, and methanogenesis. In acid fermentation step, lactic acid bacteria ferment monosaccharide and produce lactic acid, which can be used industrially to make various commercial products such as plastic. Additionally, acid-tolerant bacteria can be used to ferment sugar to produce ethanol, which is thought to be a promising new energy source.

Beneficial Microorganism Involved:

Lactic acid bacteria are one of the main groups of acid fermenting bacteria in kitchen waste environment. One example of lactic acid bacteria is *Lactobacillus plantarum*, which is gram positive, and rod-shaped. *Lactobacillus plantarum* ferments on glucose present in kitchen waste and produces lactic acid.

Acetogenic bacteria can act as primary fermenters that use sugars to generate acetate as well as acting as hydrogen consumers allowing possible secondary fermenters to grow. Ex: *Clostridium spp*, which are gram positive and form endospores. *Clostridium spp*. is also responsible for producing the odour of kitchen waste due to sulphur compounds released.

Table.1 Kitchen waste component

S.No	Items	Constituents
1	Vegetables	Onion, celery, rhizomes, pepper, garlic, ginger, corn shell, potato pieces, leafy materials, curry leaf, spinach, okra, chilies, cauliflower,

		cabbage, peas, beans.
2	Fruit	Mango pulp, Orange peels, grapes, papaya peel, pineapple peel, banana peel.
3	Meat	Chicken pieces, fish waste, mutton pieces, & bones
4	Eggs	Eggs shells.
5	Dairy Items	Milk, cheese, curd, buttermilk and yogurt.
6	Leftovers	Rice, wheat bread, sorghum bread, pulses flour dal, Noodles, other cereals.
7	Other	All kinds of tea residue, medicine, edible oils etc.

Table.2 Composition of kitchen waste

S.No	Constituents	Percentage Value (%)
1	Cooked Rice	23-60
2	Cereals	9-18
3	Cooked Vegetables	6-16
4	Chapatti	18-40
5	Salad & Vegetable waste residues	18-30

Table.3 Ingredients present in the kitchen waste bio-extracts

1	Activated nutrients	7	Growth hormones	13	Metabolites
2	Amino acids	8	Enzymes	14	Macro nutrients
3	Anti-oxidants	9	Vitamins	15	Micro nutrient
4	Carbohydrates	10	Humic Substance	16	Trace Elements
5	Cellulose fibre	11	Fulvic Acids	17	N-Fixing Bacteria
6	Complex sugars	12	Proteins	18	Organic acids

What is Kitchen waste Bio-Extract?

Kitchen waste Bio-Extract is a liquid derived from the fermentation of vegetables and fruits & other leftover materials in the kitchen waste with sugar. It contains carbohydrates, cellulose, protein, oil vitamins, minerals, hormones, enzymes, natural sugars, & salts. It contains various types of macro & micro nutrients essential for plant growth & it can be used slurry in irrigation or foliar spray for all types of crops & vegetation. Bio-Extract helps to develop soil productivity by introducing organic matters to increase soil fertility.

How to make kitchen waste Bio-Extracts?

- The major components involved in extract is cooked rice, pulses/dal, vegetables waste residues, fruits waste, animal waste, dairy product waste & miscellaneous items etc.

- The left-over organic matters from households is collected in a large container with an air tight lid and all the material is mixed properly.
- Add sufficient amount of Sugar/Jaggry/Molasses should be added at the rate (1/3) of total weight of the kitchen waste. (Kitchen waste 10 kg + Sugar/Jaggry/Molasses 3 kg).
- After adding Sugar/Jaggry/Molasses, seal the container with lid to form anaerobic condition in which temperature inside the container slightly increases around 45-50° C after 1-2 days.
- Higher temperature is essential for destruction of harmful pathogenic micro-organisms.
- Optimum moisture should be maintained around (60-70%) & allow to ferment for 8-10 days.
- After 10 days, filter the suspended solid particles & extract the liquid from the container and suspended solid waste is re-used as best compost material in the field.
- Store the liquid extract in air tight plastic container & it can be kept for 1-2 months safely.
- Final pH of well prepared Bio-extract should have (6.5 pH).

How to apply kitchen waste Bio-Extracts?

The liquid kitchen waste Bio-Extracts is used as various forms:

1. Foliar spray:

- a. Concentration/ Dose:** (1:10) 1 lit of liquid extract is diluted in 10 lit of water.
 - b. Spraying Interval:** Repeated spraying is done @ 7-8 days interval in Horticulture crops & 10-15 days interval in field crops for good response.
- 2. Fertiligation:** 100 lit liquid extract is diluted in 1000 lit of water tank & irrigated.
 - 3. Seed Treatment:** Concentration of 50-100 ml liquid extract is mixed in 1 lit of water & seeds are soaked for 30 min for effective germination.

Benefits/uses of kitchen waste bio-extracts.

- Bio-extract can be used for various crops by diluting with water and foliar spraying is done.
- Bio-extract can transform kitchen waste to bio-degradable compost.
- Bio-extract can help to improve soil fertility and reduce insects especially sucking pests which spread viral disease & stimulate plants' immune system.
- Increase profits, cut operating costs, lead to 50% reduction in fertilizer.
- Increase microbial root protection from soil pathogens.
- Produce deeper roots system and absorb more nutrients & increase soil nutrient reserve.
- Improve biotic & abiotic stress tolerance and Increase production in terms of yields.
- Improve root development & Accelerate establishment.
- Enhances fertilization and neutralize the pH of soil.

- Vigorous growth & results number of flowers & fruits.

RESULTS

The papaya crop has been infested severely with Papaya leaf curl virus (PaLCuV), which is a begomo virus, naturally transmitted through whitefly (*Bemisia tabaci*). The kitchen waste bio extracts was sprayed on infested plants as new approach towards management of crop against papaya leaf curl disease. The spray concentration was (1:10 ratio) 1 lit of liquid extract was diluted in 10 lit of water and sprayed on the crops repeatedly @ 7-8 days interval. Repeated Spraying of extract has reduced the whitefly infestation to certain extent & also the infected plant has shown significant recovery from infestation, the kitchen waste bio-extracts increased leaf pigments (chlorophyll) and plant growth by stimulating growth hormones and enhancing nutrient use efficiency of plant and increase tolerance to biotic and abiotic stresses.

Inference: Response of papaya crop to kitchen waste bio-extracts application as foliar spray @ 7-8 days interval has showed significant recovery in each diseased plant to healthy plant & responded very well. However, more information about these procedures is needed and this topic needs more study and investigation. On the basis of the information described in the present article, some points are represented as conclusion.

COLLECTION OF KITCHEN WASTE LEFT-
OVER ORGANIC MATTER FROM HOUSE
HOLD



STORAGE OF KITCHEN WASTE AFTER
ADDING JAGGRY IN CONTAINER FOR
FERMENTATION



COMPARATIVE STUDY OF PAPAYA LEAF CURL DISEASE: (BEFORE & AFTER APPLICATION OF EXTRACT)

EXTRACTION OF KITCHEN WASTE BIO-EXTRACT AFTER FERMENTATION



PAPAYA LEAF CURL INFECTED PLANT



RECOVERY OF PLANTS AFTER SPRAYING OF KITCHEN WASTE BIO-EXTRACT @ 5 DAYS INTERVAL



RESULT OBTAINED DUE REGULAR SPRAYING OF KITCHEN WASTE BIO-EXTRACT AS A WELL MAINTAINED PAPAYA ORCHARD WITH LOW EXTERNAL INPUT SUSTAINABLE AGRICULTURE (LEISA)

FILTERING THE KITCHEN WASTE BIO-EXTRACT FOR SEPARATION OF SEDIMENTS



RECOVERY OF PLANTS AFTER SPRAYING OF KITCHEN WASTE BIO-EXTRACT REGULARLY @ 5-6 DAYS INTERVAL



Role of Dormex on bud break of Temperate Fruits

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Dormant deciduous fruit trees have a chilling requirement that is satisfied by exposure to low temperature. Chemical inducement of bud break of insufficiently chilled deciduous fruit trees is practiced in some areas of the world. The chemicals that have been used to induce budbreak of insufficiently chilled buds include: hydrogen cyanamide, thiourea, potassium nitrate, oil plus dinitrophenols, gibberellins, and cytokinins. These chemicals have been more effective when used in combination with proper timing of cultural practices, such as defoliation, water stress, and pruning and effectiveness depends on rate and time of application. The response of individual buds to treatment depends on the stage of bud development. Bud dormancy in woody perennials is a complex process that enables plants to survive long periods of adverse conditions, including the extremes of drought, cold, heat and is characterized by growth cessation, arrest of cell division, and reduced metabolic and respiratory activity. The transition of floral buds from dormant to active state required low temperature or chilling. Chemical manipulation to terminate dormancy and improved flowering in low-chill temperate and semi-deciduous subtropical fruits is possible.

As discussed above the major problem in the cultivation of most deciduous fruit trees is the lack of chilling hours that need to break bud dormancy. If the trees were exposed to sufficient chilling in winter as well as spraying with breaking dormancy agents the break of bud dormancy occurred. Complete substitution for chilling requirement of deeping rest buds has never been achieved by rest breaking. Two main purpose of using rest breaking agents are for improving level of bud break and for advancing bloom and vegetative bud development. Dormex (49% hydrogen cyanamide) a dormancy breaking agent was used widely to break bud dormancy. Cyanamide can break dormancy by increasing respiration and that induces early and more uniform grape bud break. Response of plants to hydrogen cyanamide application varied according to time of application and physiological stage of bud development, amount of chilling accumulated. Hydrogen cyanamide also accelerates vegetative and flower bud break and shortens fruit development period.

EFFECT OF DORMEX ON FRUIT CROPS

Dormex (Hydrogen Cyanamide) penetrates in the bud scale better and gets absorbed in the buds which initiate the process leading to bud break. In kiwifruit, it has been reported that Dormex can advance the date of bud break by 10 to 15 days. The mechanism by which Hydrogen Cyanamide exerts its effect is the inactivation of the enzyme catalase which detoxifies hydrogen peroxide (H₂O₂) by catalysing its breakdown to water and molecular oxygen (O₂). The consequent accumulation of peroxides into the cell leads to metabolic reactions which stimulate the plant and break the dormancy.

The application of Dormex at 2.5 per cent on apple was done after pruning to break the dormancy and the plants were flowering very well. The fruit yields were much higher and better coloured than the untreated trees. Apple trees treated with Dormex had more dense and uniform foliage. Dormex is a bud break stimulant promoting more uniform, normal and/or earlier bud break. An application of this plant growth regulator substitutes the lack of chilling hours in regions with mild winters. Dormex can help to condense harvest and harvest earlier. For young non-bearing trees, use the Dormex growth regulator for apical dominance suppression to achieve the desired framework for the trees. In bearing trees, Dormex compresses the bloom period to a few days depending upon the weather. Improved bud break uniformity will also facilitate thinning and promote greater uniformity of fruit maturity at harvest.

Dormex application results in reduced catalase activity in grapevine which also happens naturally during the acquirement of chill requirements. Dormex has been shown to release hydrogen cyanide in a catalase-mediated reaction. A different mode of action involves hydrogen cyanide inhibition of catalase by direct binding to the heme group. The dormancy-breaking action of hydrogen cyanide has been proposed to reflect the generation of sublethal oxidative stress. Sublethal stress could be caused by a temporary release of hydrogen cyanide in the buds following Dormex application. Hydrogen cyanide treatment of dormant grapevine buds resulted in increased bud break rates compared with controls, demonstrating that hydrogen cyanide acts as a flower inducer in bud dormancy

Table No. 1: Some recommendations of Dormex for fruit crops

Crop	Mode of Action	Rate	Critical Comments
Apples	Regulation of bud dormancy and blooming	2-3L/100L water	Apply at 30 to 45 days before expected budburst (50% greentip on spurs) to advance budburst and flowering. Use the higher rate of application where more difficult budbreak conditions occur such as on varieties requiring higher chilling on warm northern slopes and/or where there has been a warmer winter. Do not apply to apples later than 25 days before expected budburst, as this will not result in advanced

			budburst and flowering and damage to buds may occur. Higher temperatures immediately before and in the 3-5 days following application will improve the response.
Plums and Prunes	Regulation of bud dormancy and blooming	1L/100L water	Apply between 35 and 45 days before expected budburst (commencement of flowering) of plums or prunes. Do not apply to plums or prunes later than 30 days before expected budburst, as this will not result in advanced budburst and flowering and damage to buds may occur. Higher temperatures immediately before and in the 3-5 days following application will improve the response. Conversely, cold weather following application will reduce the response.
Kiwi fruit	Regulation of bud dormancy and blooming	4-6L/100L water	Apply to dormant canes, cordons or trees, using sufficient spray volume to ensure thorough coverage of all buds. Do not apply the chemical within 2 weeks of anticipated natural bud break of kiwi fruit. Bud break will usually occur 30-35 days later, although if warm conditions occur after application, bud break could occur 14-21 days later. New shoots may be damaged by frost. If applied earlier than 35 days before natural bud break, low temperatures at flowering may reduce fruit set. Lower dose rates should be used when there has been a cold winter to naturally chill the crop.
Table grapes	Regulation of bud dormancy and blooming	3-5L/100L water	
Wine grapes	Regulation of bud dormancy and blooming	2-3L/100L water	

SAFE AND EFFECTIVE APPLICATION OF DORMEX

1. The spray should be applied 45 days prior to anticipated date of bud break or immediately after pruning in temperate fruits.
2. It is very important to provide a coarse type spray (lower pressure) that provides effective coverage of all fruiting branches. Do not apply spray as a fine mist under high pressure because of wind drift problems that could cause damage to adjacent plants.
3. Do not spray when there is a cloudy weather or probability of rain in that particular area.

4. Apply when current temperatures are between 10 to 20 °C. Do not apply when current temperatures are below 5°C., or if temperatures of 0 °C or below are forecast for the next morning.
5. Do not apply Dormex in combination with other chemicals such as pesticides and oil sprays other than surfactant within one week before or after Dormex application.
6. it is advisable to use mask while spraying as it directly affects the nervous system.

Silage: enriched feed for increasing milk production in dairy cattle during lean period

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India being a tropical monsoon country with bimodal rainy season, surplus green herbage is available at the flush growth periods during *Kharif* as well as *Rabi* (irrigated areas). It is desirable that these are preserved /conserved with minimum loss of nutrients. These can be conserved either as hay or silage or artificial dehydration for feeding to livestock during lean periods when availability of fresh forage is negligible (October-December and April-June). Ensilage has many advantages over the other methods of forage conservation. Conserving green fodder in the form of silage is one of the best options available to ensure regular supply of quality fodder through different seasons of the year.

WHAT IS SILAGE?

Silage is a fermented, high moisture stored fodder which can be fed to cattle's during lean period. The process of making silage is called ensiling, and it is usually made from grass crops including sorghum, maize, Napier and other cereals, using the entire green plant. Silage is the conserved green fodder having moisture content in the range of 65 to 70 per cent, crops rich in carbohydrates are fermented after chaffing into small pieces of (2-3 cm) and it is stored for 45-50 days under anaerobic conditions. Sugars present in the fodder are converted to lactic acid & acetic acid, which acts as a preservative and a good source of readily fermentable sugars for the ruminants. Under good management practices silage can be stored up to 1-2 years.

TYPES OF CROPS SUITABLE FOR SILAGE MAKING

Crops having good percentage of sugar and appropriate (30-35% dry matter; 60-70% moisture.) moisture are good for silage making.

Cereals crops: Maize, Jowar, Bajra, Hybrid Napier, & Oats are most suitable for silage making.

Leguminous crops: Berseem, Lucerne, Cowpea.

TIME OF HARVESTING FOR SILAGE MAKING

- Crops at pre flowering to flowering stage should be harvested.
- Crops should not contain more than 75% moisture while silage making.
- Crops with hollow stems like Maize, Jowar, Bajra, and Hybrid Napier should be chaffed to an inch size to prevent trapping of air and spillage of silage.
- High moisture crops can be dried in sunshine for 4 hours to reduce moisture content by (15%). Some dry hay or straw (5-20%) can also be added.

MATERIALS AND INFRASTRUCTURE REQUIRED FOR SILAGE MAKING

- **Type of Silo:** Surface or trench.
- **Machinery Required:** Tractor, fodder harvester & power chaff cutter.
- **Silo:** It should be decided on the following basis; Number of animals, Body weight of animals, Length of feeding period, Amount of fodder available. On an average, preparation of every 7.0 quintal silage requires one cubic meter silo pit. Say, for feeding 12 adult buffaloes for one month period we need about (30 Kg silage of 30% dry matter per head per d) 108 quintals silage and 16 cubic meter silo pit (2.6 meter diameter and 3 meter height). Silo pits should be easy to fill and easy to remove.

PROCEDURE OF SILAGE MAKING

- Construct a surface/trench/pit silo: one cubic meter silo can store 600-700 kg of green fodder.
- Harvest the crop at 40-45 per cent dry matter (DM) stage.
- Partial dried the harvested fodder to bring down DM to 30-35 per cent.
- Chop the fodder into small pieces of 2-3 cm size with the help of chop cutter.
- Chopped pieces are filled into silo pits layer by layer of 35-40 cm.
- Press/trampled the chopped fodder to remove the air present in between space.
- Filling and pressing should be completed as fast as possible.
- Sprinkling of additives/ preservatives during filling of fodder in the silo, if required.
- After filling and pressing, cover the silo with thick straw on top & seal with mud paste.
- Put weight through mud layer/ sand bags to prevent air flow beneath the sheet.
- Boundaries should be raised so that rain water cannot enter silo pit
- Open the silo for feeding, minimum after 45 days, as per need.

ADDING OF PRESERVATIVES IN SILAGE MAKING

1. **Molasses:** When legumes (Berseem, Lucerne, Cowpea etc.) and low sugar grasses are ensiled adding of molasses improves quality of silage and its palatability. Molasses may be added at the rate of (3.5-4 kg) per 100 kg of green weight of silage.
2. **Urea:** Cereal forages can be enriched for nitrogen (protein) content by spraying urea at the rate of (0.5 to 1.0 %) of green forage.

3. **Lime:** This can be added at a level of (0.5-1.0 %) to maize silage to increase acid production.
4. **Citrus pulp:** Pulp may be added at the rate of (4-5 kg) per 100 kg of green weight of silage.
5. **Broken Cereals:** Fine broken cereals may be added at the rate of (5-6 kg) per 100 kg of green weight of silage.

PROCESS CARRIED OUT DURING SILAGE MAKING

Fermentation is the major process carried out during silage making inside the silo pit.

Fermentation: Fermentation is a metabolic process that consumes sugar in the absence of oxygen. The products are organic acids, gases, or alcohol. It occurs in yeast and bacteria, and also in oxygen-starved muscle cells, as in the case of lactic acid fermentation. Initially aerobic bacteria is active for 5 days in which carbon dioxide releases & temperature get raised due to which anaerobic bacteria population increases and act on carbon dioxide, lactic acid & acetic acid.

1. **Lactic Acid Fermentation:** It occurs in warm condition when the fodder moisture is around (55-75%) with sufficient sugar is present in plant juice. The pH in this fermentation will be around (4.0-4.2 pH). Microorganism involved in lactic acid fermentation are; Lactobacilli & Streptococci etc.
2. **Butyric Acid Fermentation:** It occurs in cold condition when the fodder moisture is above (>75%) with high protein is present in plant juice. The pH in this fermentation will be around (4.0-4.5 pH). Microorganism involved in lactic acid fermentation are; Clostridium etc.

GOOD QUALITY SILAGE SHOULD BE?

- Bright, light green yellow or green brown in colour.
- Firm texture with softer material with Moisture content should be in range of (65-70 %).
- Lactic acid 3-14 per cent & Butyric acid less than (0.2 %).
- It should be low ammonia content (<2%).
- The pH of final product should be in the range of (4.5-5.0 pH).
- Odour should be, fruity & pleasant.

FEEDING OF SILAGE

- Silo can be opened from corner side of the pit as per need after 45-50 days and closed properly after taking out the silage needed for feeding to the cattle's.
- Make sure that, silage is taken out sufficiently to feed cattle for at least 8-10 days to avoid contamination due to repeated opening of silo.
- Feeding ratio of silage will be depending on availability of other feeding sources. On average silage is feed to cattle's @ 5 kg/animal initially to adjust the animals on it.
- Silage is an alternative/substitute of green fodder and can be fed like green fodder during lean period.

NUTRITION OF SILAGE

- During fermentation, the silage bacteria act on the cellulose and carbohydrates in the forage to produce volatile fatty acids (VFAs), such as acetic, Propionic, lactic, and butyric acids.
- Several of the fermenting organisms produce vitamins: for example, lactobacillus species produce folic acid and vitamin B12, which is beneficial for lactating animals which leads in increase in milk production.

ADVANTAGES OF SILAGE IN DAIRY FARMING

- Losses of the proteins, vitamins, and other nutrients are usually much smaller when plants are preserved as grass silage than when they are made into hay.
- Losses of nutrients occur in hay making at the time of harvesting, and during the curing and processing period.
- Losses in nutritive value in making hay may be as low as 15 per cent during favorable weather for curing and as high as 50 per cent or more when the weather is unfavorable.
- Livestock can be induced to consume forage preserved in the form of grass silage that they will refuse to eat as hay.
- Grass silage can be made when weather is unfavorable for making god hay.
- Many weeds are controlled or weakened when forages are harvested and made into grass silage.

DISADVANTAGES OF SILAGE IN DAIRY FARMING

1. The need for extra labor or alternative of making a heavy investment for expensive construction.
2. The need for re-enforcing existing silos to provide safeguards against greater side wall pressure.
3. The difficulty of controlling the moisture content of the forage.
4. The additional cost involved in purchasing preservatives.

FACTORS EFFECTING SILAGE MAKING

1. **Type of Silo:** Surface method of silo is best suitable for ensiling.
2. **Dry Matter of fodder:** Ideal dry matter for silage making should be 30-35%.
3. **Ideal size of the fodder:** Should be 2-3 cm, for effective fermentation process
4. **Pressing/Trampling of fodder:** As quick as possible to minimize aerobic fermentation.
5. **Sealing of silo:** To avoid entry of air and water inside silo.

HYBRID NAPIER CROP SUITABLE FOR SILAGE MAKING

Hybrid Napier (Yeshwant RBN-9)



Hybrid Napier (CoBN5)



CHOPPING OF FODDER WITH POWER CHAFF CUTTER



DIFFERENT TYPES OF SILO'S FOR SILAGE MAKING



Importance of soil organic matter in Agriculture sustainability

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Soil organic matter is important in terms of relation to soil fertility, sustainable agricultural systems and crop productivity and there is concern about the level of organic matter in many soils, particularly with respect to global warming. Since, 1843 long-term experiments at Rothamsted provide the longest data sets on the effect of soil, crop, manuring and management on changes in soil organic matter under temperate climatic conditions. The amount of organic matter in soil depends on: 1) input of organic material 2) rate of decomposition 3) rate at which existing soil organic matter is mineralized 4) soil texture and climate. All four factors interact so that the amount of soil organic matter changes, often slowly, toward an equilibrium value specific to the soil type and farming system. For any one cropping system, the equilibrium level of soil organic matter in a clay soil will be larger than that in a sandy soil and for any one soil type the value will be larger with permanent grass than with continuous arable cropping. Trends in long-term crop yields show that as yield potential has increased, yields are often larger on soils with more organic matter compared to those on soils with less. Benefits from building up soil organic matter are bought at a cost with large losses of both carbon and nitrogen from added organic material. Models for the buildup and decline of soil organic matter, the source and sink of carbon dioxide in soil, are presented.

Nature and determination of soil organic matter (SOM)

Soil organic matter consists of organic compounds containing carbon (C), hydrogen (H), oxygen (O), nitrogen (N), sulfur (S) and phosphorus (P). Most agronomic studies of SOM are interested in it as a possible source of N, S and P or its contribution to the biological and physical properties of soil. The constituents of SOM can range from unrecompensed plant and animal tissues through ephemeral decay products to fairly stable brown and black material often called humus. The latter is usually the largest proportion and it contains no trace of the anatomical structure of the material from which it was derived. Percent SOM is measured by multiplying percent organic C by the factor 1.724, derived from the % carbon in peat. The determination of % C includes C in the soil microbial biomass, but this usually accounts for less than 5% of the total soil organic carbon so this does not greatly affect the estimate of SOM. Throughout this chapter % C is percent total organic C. The surface layer of many soils growing arable crops contains 1–3% C as SOM while grassland and forest soils usually contain somewhat more. The ratio (by

weight) of organic C to organic N in SOM is relatively constant and ranges between about 9:1 and 14:1 for different soils under different management conditions, but excluding strongly acid and poorly drained soils. Why the ratio falls within such narrow limits is unclear. It may relate to the fact that SOM is largely a fairly uniform end product from the microbial decomposition of plant and animal residues together with material that is very resistant to such attack. The C: N ratio of material added to soil determines whether N will be released or fixed in SOM as the material decomposes. For example, the Market Garden experiment started in 1942 on the sandy loam at Woburn compared four organic manures. They and their C: N ratios were FYM, 13.0:1; vegetable compost, 13.8:1; sewage sludge (bios lids), 9.5:1; and a compost of bios lids and straw, 11.6:1. After 25 years, the C: N ratio of the differently treated soils ranged from only 10.0:1 to 11.1:1 (Johnston, 1975). All but the bios lids would have released some N as the result of their decomposition by microbial activity, but the biosolids would have fixed some mineral N. Similarly, straw with a C: N ratio of 100:1 requires mineral N from the soil for its decomposition but N-rich crop residues like those of Lucerne (*alfalfa*) or clover with a C: N ratio less than 40:1 release N as they are decomposed.

Current status of organic carbon in different district of Madhya Pradesh:

S.NO	District	Low (OC %)	Medium (OC %)	High (OC %)
1	Jabalpur	33	67	0
2	Katni	3	90	7
3	Seoni	2	92	6
4	Mandla	10	73	17
5	Narshingpur	26	64	10
6	Shahdhol	32	66	2
7	Indore	0	49	51
8	Bhopal	0	43	57

Effect of agriculture on SOM:

Agricultural practices contribute to the depletion of SOC through deforestation and biomass burning, drainage of wetlands, tillage, crop residue removal, summer fallow, cultivation, and overuse of pesticides and other chemicals. Cropland soils generally store less SOC than grazing land because cropland has greater disturbance from cultivation, lack of manure being returned to the system, has less root biomass and less biomass returned to the soil surface.

- ❖ Carbon sequestration
- ❖ Tillage
- ❖ Cropping rotation
- ❖ Fertilization

Factor affecting on SOC restoration

- Soil type

- Temperature & rainfall
- C/N ratio application
- Tillage and residue management
- C/N ratio and C pools
- Rate and method of OM application

How to increase organic matter in soils

- Compost
- Cover crops/green manure crops
- Crop rotation
- Perennial forage crops
- Zero or reduced tillage
- Agro forestry
- Add Organic Matter Inputs

CONCLUSION

Soil organic matter is a key for agriculture sustainability and acts as a store house for plant nutrients and building block soil particle. To works as an insulator and retards heat movement between atmosphere and soil and also minimize soil erosion.

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Identification of different orders of the class *Arachnida*

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The class Arachnida, consists of the eight legged minute creatures which may be parasitic, predacious, phoretic or phytophagous. These include mainly ticks, mites, spiders, scorpions etc. These being economic important to agricultural crops as pests and predators, need to be identified carefully.

Arachnids are a class (Arachnida) of jointed-legged invertebrate animals in the subphylum Chelicerata. Arachnida name was given by Chevalier de Lamarck in 1815. Arachnids are known as eight legged wonders and named after the Greek weaver goddess, Arachne, meaning 'spider'. Primarily terrestrial and predaceous, there are over 1,00,000 described species worldwide, belonging to 9500 genera and 650 families. Arachnids were the first arthropods to move into terrestrial environments. Scorpion fossils first appeared in Silurian deposits (420 million years ago). The adult body is divided into two body sections called the prosoma and opisthosoma. The prosoma is derived from the fusion of cephalon and thorax and is covered by a single and one segmented hard outer covering called carapace generally or with modifications. The prosoma carries six pair of appendages: the chelicerae, the pedipalpi and four pairs of legs. The opisthosoma is composed of twelve somites, but varying degree of fusion is seen in different orders. The class Arachnida consists of 11 living orders [Acari, Amblypygi, Araneae, Opiliones, Palpigradi, Pseudoscorpiones, Ricinulei, Schizomida, Scorpiones, Solifugae, Thelyphonida (=Uropygi)] and 5 extinct orders [Anthracomarti, Architarbi, Haptopoda, Kushtarachnae, Trigonotarbi]. The identification of arachnids belonging to major orders is thus important and is summarized with examples below (Table 1).

Acari

Mites and ticks are the most diverse arachnids and it has become common platform to recognize an acariform and a parasitiform group; the latter includes the predatory mites and ticks. All mites have a gnathosoma: a moveable unit at the front of the body containing mouth lips, chelicerae and pedipalpi. Adult body size ranges from a few 100 micrometers to about 40 mm in engorged ticks. They are found worldwide in a wide range of terrestrial and even in some aquatic habitats. There are approximately 55,000 described species. Fossil acariforms date from the Devonian and fossil parasitiforms have been recorded from the Cretaceous.

Amblypygi

These are also known as tailless whip scorpions, these have extremely long antenna-like front legs and raptorial pedipalpi.

Adult body size is varies from 20 to 60 mm. They are found in tropical and arid regions, often in caves. There are approximately 175 described species.

Araneae

Spiders have abdominal silk organs, male pedipalpi are modified into sperm transfer organs and venom is delivered through the chelicerae (secondarily lost in some spiders). Adult body size ranges from less than 1 to 100 mm. Worldwide with > 45,000 species are described.

Opiliones

These are also known as daddy long legs and are distinct from spiders in lacking venom and silk glands. Males transfer sperm through a penis rather than modified pedipalpi. Adult body size ranges from less than 1 to 25 mm. More than 6,500 species are described worldwide.

Palpigradi

These small (1-3 mm) delicate arachnids are found in tropical leaf litter and caves. They have a thin, pale, segmented integument and a segmented abdomen that terminates in a whip-like flagellum. Fewer than 100 species have been described.

Pseudoscorpiones

Pseudoscorpions look like small (2-12 mm) scorpions without the tail. Their pedipalpi can have venom glands and the chelicerae have silk glands. There are more than 3,600 species described worldwide. They are typically found in leaf litter, caves and under tree bark.

Ricinulei

These small (3-10 mm) cave and soil-dwelling arachnids can be found in the African and New World tropics. Fewer than 80 species have been described.

Schizomida

These small (3-13 mm) tropical soil and cave-dwelling arachnids are moderately fast runners. More than 300 species have been described.

Scorpiones

Scorpions are easily recognized by their venom-tipped tail and large pinching pedipalpi. In addition to the arid ecosystems, scorpions occur in a wide range of habitats. Adult body size ranges from 1 to 20 cm. Nearly 2,000 species have been described.

Solifugae

Camel spiders, sun spiders or solifuges mostly dwell in arid habitats. Their size ranges from 20-70 mm. More than 1,100 species have been described worldwide.

Thelyphonida

The Thelyphonida (formerly Uropygi), are commonly known as vinegarroons or whip scorpions. Lengthwise size ranges from 25 to 85 mm. The largest species, of the genus *Mastigoproctus*, reaches 85 mm. Like the related orders Schizomida, Amblypygi and Solifugae, the vinegarroons use only six legs for walking, having modified their first two legs to serve as antennae-like sensory organs. Many species also have very large

scorpion-like pedipalpi (pincers). As of 2006, over 100 species have been described worldwide. Whip scorpions are carnivorous, nocturnal hunters feeding mostly on insects but sometimes on worms and slugs. The prey is crushed between special teeth on the inside of the trochanters of the front legs. They are valuable in controlling cockroach and cricket populations. Vinegarroons are found in tropical and subtropical areas worldwide, usually in underground burrows that they dig with their pedipalpi. They may also burrow under logs, rotting wood, rocks and other natural debris. They enjoy humid, dark places and avoid the light.

CONCLUSION

Arachnids are the four legged arthropods whose body is divided mainly into prosoma and opisthosoma. Araneae, Acari and Scorpiones are the major orders. From agricultural point of view identification of the arachnids of different orders is must because many of the arachnids are phytophagous or predatory in agricultural ecosystems.

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Table 1. Identification and peculiar characteristics of different orders of the Class Arachnida

Order	Identification and peculiar characteristics					Example
	Prosoma	Opisthosoma	Chelicerae	Pedipalpi	Legs	
Acari (ticks and mites)	Prosoma and opisthosoma fused, eyes absent		3 segmented, chelate	6 segmented, modified vigorously (leg like or sensory)	4 pairs, six segmented	<i>Acarus siro</i>
Amblypygi (tailless whip scorpions)	Broader than long, covered by uniform carapace, 8 eyes	12 somites, 1 st somite forms pedicel, tergites and sternites united by pleural membrane, last 3 sternites reduced, pygidium present	2 segmented, unchelate, spider like both in form and action	6 segmented, large, powerful, spinous, white coloured setae at tarsus	1 st pair long, thin, not used for walking, vital for courtship; other pairs have 7 segments with two curved claws, all legs have trichobothria on certain segments	<i>Phrynus levii</i>
Araneae (spiders)	Presence of undivided carapace, pedicel present between prosoma and opisthosoma, enabling abdomen to move freely to produce silk	Unsegmented, 1 st somite forms pedicel, pleopods of 4 th and 5 th somite serve as spinnerets for silk production	2 segmented, unchelate, carry venom duct	6 segmented, carry male organs, coxae carry ganothobases	6 segmented, tarsi carry paired claws having row of teeth on inner side	<i>Cyrtopholis potoricae</i>
Opiliones (harvestman)	Covered by undivided carapace, pedicel absent, 2 eyes	9 somites	3 segmented, chelate	6 segmented, coxae carry ganothobases	7 segmented, tarsi carry paired claws, spiracles on tibia of legs	<i>Paroligolophus agrestis</i>
Palpigradi	carapace present, 3	11 somites, long telson	3 segmented,	6 segmented with	1 st pair: 12	<i>Eukoenenia</i>

(micro whip scorpions)	segmented, covered by chitinous shields, eyes absent		chelate	terminal claws	segmented; 2 nd , 3 rd : 7 segmented; 4 th pair: 8 segmented, paired claws on all legs	<i>spelaea</i>
Pseudoscorpiones (false scorpions or book scorpions)	Carapace undivided, >2 pair of lateral eyes	12 somites, last somite reduced to circumanal ring, two pairs of spiracles on 3 rd and 4 th somite	2 segmented, chelate	6 segmented, large, chelate, venom gland open at metatarsus tip	7 segmented, terminal claws, aerolium present, no pedicel, no telson, sternum absent	<i>Chelifer cancroides</i>
Ricinulei (hooded tick spiders)	Carapace unsegmented, short pedicel, narrow tergites, hood present when lowered covers mouth and chelicerae	9 somites, 1 st somite absent, 2 nd forms pedicel, last 3 reduced to form pygidium	2 segmented, unchelate, spinneret on distal segment	6 segmented	7 segmented, trochanters and tarsi of last 3 legs sub-segmented, metatarsus and tarsus of third leg of male are modified to form accessory sex organs. In male 3 rd pair is modified to form copulatory organs	<i>Cryptocellus goodnighti</i>
Schizomida (short tailed whip scorpions)	Carapace 3 segmented with cucullus joined at for-edge, eyes absent	12 somites, 1 st is shortened, Last 4 form pygidium, telson present, last somite bear flagellum	2 segmented, unchelate (resembles to spiders)	6 segmented, pointed tarsi, broader than legs	Coxae are unusually long, claws absent, 1 st pair of legs not used for walking and are sensory in action,	<i>Stenochrus portoricensis</i>

					3 posterior pair of legs are normal (7 segments + 3 terminal claws)	
Scorpiones (scorpions)	Carapace undivided, 2 median and 2-5 pair of lateral eyes, pedicel absent	12/13 somites, Mesosoma (7-8 somites) and Metasoma (5 somites), 4 pair of book lungs open on 3 rd , 4 th , 5 th and 6 th sternites, sensory pectines present on 2 nd mesosomal segment	3 segmented, chelate	7 segmented, modified to pincers, large and powerful, tarsi carry two claws	7 segmented, tarsi carry paired claws	<i>Androctonus australis</i>
Solifugae (wind-scorpions, camel-spiders or sun-spiders)	Covered by propeltidium, pedicel absent, 2, 4 or 6 eyes	11 somites, no telson	2 segmented, very large, flagellum present in males,	6 segmented, leg like, carry suckers in tarsi, sensory in function	7 segmented, trochanters of last three pairs sub-segmented and 4 th pair carry 3-5 racket organs	<i>Ammotrichella pallida</i>
Thelyphorida (Uropygi) (whip scorpions or vinegarroons)	Prosoma longer than broad, unsegmented carapace present, 8-10 eyes	12 somites, 1 st reduced to pedicel, long whip like jointed telson, opisthomatic glands (12 th somite), secrete formic, octanoic and acetic acid or chlorine in defense, anal somite has sensitive ommatidia	2 segmented, unchelate,	6 segmented, modified to hold prey	7 segmented, 1 st pair with many segments of the tarsi	<i>Mastigoproctus proscorpio</i>

DNA Fingerprinting Methods and its Importance in Dairy Animals

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History

DNA fingerprinting has proven to be the most scientifically valid procedure for animals and human identification in forensic science and various fields. This technique was first developed by Professor **Alec Jeffrey's** at Leicester University in 1984 as a form of genetic analysis. It is a small set of DNA variations that is very likely to be different in all unrelated individuals, thereby being as **unique** to individuals as are fingerprints. He was focusing on methods to resolve paternity and immigration disputes by demonstrating the genetic links between individuals.

Invention

This technique was first used in the law courts of England in 1987 to convict a man in a rape case. In 1987, Colin Pitchfork was the first person in the world to be identified, captured and successfully prosecuted as a result of DNA evidence. He was arrested in 1986 for the rape and murder of two girls and was sentenced in 1998.



DNA Fingerprinting in India

Lalji Singh is an Indian scientist who has worked in the field of DNA fingerprinting technology in India, where he is popularly known as the "**Father of Indian DNA Fingerprinting**". He founded various institutes and laboratories in India, including the Centre for DNA Fingerprinting and Diagnostics lab in 1995. He established Bkm-derived probe that could be used to generate individual specific DNA Fingerprints of humans for forensic investigations and he used that probe for the first time to solve a case of parentage dispute in India in 1988. In 1991 Singh produced the first DNA fingerprinting based evidence in an Indian Court to settle a disputed paternity.

Synonyms of DNA Fingerprinting

- ✓ DNA Profiling
- ✓ DNA Typing
- ✓ DNA Testing
- ✓ Genetics Fingerprinting

Biological materials used for DNA profiling

- ✓ Blood
- ✓ Saliva
- ✓ Semen
- ✓ Body tissue fluids
- ✓ Vaginal fluids
- ✓ Skin and hair roots.

Steps of DNA Fingerprinting

1. The process of DNA fingerprinting starts with isolating DNA from any part of the body such as blood, semen, vaginal fluids, hair roots, teeth, bones, etc.
2. Polymerase chain reaction (PCR) is the next step in the process. In many situations, there is only a small amount of DNA available for DNA fingerprinting. Because of this



- in a test tube, DNA replication must occur to make more DNA. The DNA and the cells will undergo DNA replication in order to make more DNA to be tested.
3. After the isolation of DNA and more copies of the DNA have been made, the DNA will be tested. Then the DNA was treated with restriction enzymes (an enzyme that cuts DNA near specific recognition nucleotide sequences known as restriction sites) This will produce different sized fragments which are known as restriction fragment length polymorphisms (RFLPs). These fragments can then be observed doing an experiment called gel electrophoresis which separates DNA based on fragment sizes.
4. Gel electrophoresis is the next step in this process of DNA fingerprinting. During gel electrophoresis, an electrical current is applied to a gel mixture, which includes the samples of the DNA. The electric current causes the DNA strands to move through the gel. This separates the molecules of different sizes. The fragments of separated DNA are sieved out of the gel using a nylon membrane (treated with chemicals that allow for it to break the hydrogen bonds of DNA so there are single strands).
5. The DNA (single stranded) is cross-linked against the nylon using heat or a UV light.
6. The probe shows up on photographic film because the strands of DNA decay and give off light. In the end it leaves dark spots on the film which are also known as the

DNA bands of a person. What make up the fingerprint are the unique patterns of bands. The pattern of bands are different because we are all different and unique (other than identical twins).

7. Once the filter is exposed to the X - ray film, the radioactive DNA sequences are shown and can be seen with the naked eye. This creates a banding pattern or what we know as DNA fingerprints. This technique is called southern blotting.

METHODS OF DNA FINGERPRINTING

Restricted Fragment Length Polymorphism (RFLP)

This technique is very basic and first genetic test using DNA. In this technique DNA is cut at a specific short sequence using restriction enzyme called restriction digest. DNA fragments separated based on the length through a process known as agarose gel electrophoresis.

Disadvantages

- ✓ Considerable amount of DNA can be used
- ✓ Generally have low level of polymorphism
- ✓ Degree of variability will be less
- ✓ Low polymorphic information content (PIC)

Randomly Amplified Polymorphic DNA (RAPD)

RAPD technique is highly informative without prior knowledge of sequence information, very simple and low cost investment. DNA segments will be amplified randomly and distributed throughout the genome.

Advantages

- ✓ Genome mapping
- ✓ Species Identification
- ✓ Genetics relationship between the cattle population
- ✓ Estimation of genetic diversity in different livestock and poultry species
- ✓ Characterization of different cattle breeds
- ✓ Applied in different population

Disadvantages

RAPD markers are dominant and Co - dominant markers observed as different size of DNA segments. Laboratory dependent strict protocols has to be followed and also reproducibility will be very less due to sensitive to change the quality of DNA.

Amplified Fragment Length Polymorphism (AFLP)

- ✓ This method more efficient than RAPD'S which detect the low level or no polymorphism in cattle
- ✓ Analysis the Accurate genetic similarity between population and also two to four fold increase the detect the polymorphism in cattle

Microsatellite

STR (Short Tandem Repeat), SSLP (Simple Sequence Length Polymorphism). Short tandem repeated sequence are having 1-6 base pairs, Highly Polymorphic, Hyper variable , co-dominantly inherited and genetically conserved in nature.

Table1: Comparison between different methods

Criterion	AFLP	RAPD	SSR	RFLP
Quantity of information	High	High	High	Low
Replicability	High	Variable	High	High
Genetics difference	High	Moderate	High	High
Development time	Short	Short	Long	Long

Application in livestock

- ✓ Genetics relationship between breeds
- ✓ Parentage verification in field progeny testing program
- ✓ To differentiate cattle breeds(differentiate *Bos indicus* and *Bos taurus* in West Africa)
- ✓ Fetal sex determination
- ✓ Identification of the polymorphism in animals
- ✓ Wild life investigation
- ✓ Diagnosis of inherited disorders in dairy animals
- ✓ Individual identification
- ✓ Forensic investigation in animals

Value addition of perishables by dehydration

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Horticultural produce are nature's marvellous gift to the humankind; indeed, they are life-enhancing medicines packed with vitamins, minerals, antioxidants and many phytonutrients (plant-derived micronutrients). Fruits, whether fresh or dried, have always formed a part of the staple diet of human beings because they are rich in vitamins which help in curing from number of diseases in addition to providing some of the nutrients, essential minerals and with calorific value also. The production of vegetables in India is next only to China. The vegetable and fruit production contributes more than 30% of the agriculture GDP (Gross Domestic Product). The crop diversification has led to rise in horticulture production, which has reached 185.2 billion tonnes in 2010. But the real challenge starts after the production. Fruit and vegetable production in India goes waste due to lack of proper knowledge of post-harvest technology.

POST-HARVEST LOSSES

The post harvest losses in fruits and vegetables vary according to the nature of commodities, production season and production areas. However, overall these losses are in the range of 20 to 40% in different fruits in terms of money it comes around 60 to 70 thousand crores of rupees per annum. That is why; these perishable commodities need very careful handling at every stage so that deterioration of produce is restricted as much as possible during the period between harvest and consumption (Dhatt and Mahajan, 2007).

IMPORTANT SITES OF POST-HARVEST LOSSES

Important sites where post-harvest losses are: Farmer's field (15-20%), Packaging (15-20%), Transportation (30-40%) and Marketing (30-40%). Farmers and food sellers have been concerned about these losses since agriculture began. Cutting postharvest losses could, presumably, add a sizable quantity to the global food supply, thus reducing the need to intensify production in the future.

The main cause of perishability of fruits and vegetables are their high water content. That is why, if these commodities are not handled properly, a high-value

nutritious product can deteriorate and rot in a matter of days or hours. To increase the shelf life of these fruits and vegetables many methods or combination of methods had been tried. Dehydration is one of the best and suitable methods to increase the shelf life of fruits and vegetables. This process is preferred over others due to their vitamin and minerals, colour, flavour and taste retention property.

ROLE OF DRYING IN PRESERVATION

The reduction of losses and maintenance of quality of harvested products prior to consumption are extremely important. Drying is one of the widely used postharvest technologies which overcome problems related to over production, over supplied, postharvest handling and short shelf life. Throughout history, the sun, the wind, and a smoky fire were used to remove water from fruits, meats, grains, and herbs. The nutritional value of food is only minimally affected by drying. Vitamin A is retained during drying; however, because vitamin A is light sensitive, food containing it should be stored in dark places. Yellow and dark green vegetables, such as peppers, carrots, winter squash, and sweet potatoes, have high vitamin A content. Vitamin C is destroyed by exposure to heat, although pre-treating foods with lemon, orange, or pineapple juice increases vitamin C content. Dried fruits and vegetables are high in fibre and carbohydrates and low in fat, making them healthy food choices. It can either be an alternative to canning or freezing, or compliment these methods. Drying foods is simple, safe and easy to learn. With modern food dehydrators, fruit leathers, banana chips and beef jerky can all be dried year round at home. Drying removes the moisture from the food so bacteria, yeast and mold cannot grow and spoil the food. Drying also slows down the action of enzymes (naturally occurring substances which cause foods to ripen), but does not inactivate them. Because drying removes moisture, the product becomes smaller and lighter in weight. In drying, warm temperatures cause the moisture to evaporate. Low humidity allows moisture to move quickly from the horticultural produce to the air. Air current speeds up drying by moving the surrounding moist air away from the food.

List of fruits and vegetables which are suitable for drying are following:

Names of Fruits: Apples, Bananas, Cherries, Dates, Figs, Grapes, Peaches, Pears, pineapples and plums etc.

Names of Vegetables: Beets, Carrots, Sweet corn, Garlic, Mushrooms, Okra, Onions, Peas, Peppers (red, green, and chili), Pumpkin and Potatoes etc.

Drying methods: Dehydration is the most cost effective and a viable method for the removal of a great part of constitutional water. Drying can be applied to convert this perishable fruit into stabilised dehydrated products that can be stored for an extended period of time. There are various methods available for drying but the selection of drying method depends upon nature of commodities, environment, available equipments and economic factors. (Pareek & Kaushik, 2012). There are commonly four methods are available for drying. These are following:

1. Sun dryer
2. Solar dryer

3. Solar tunnel dryer

4. Oven dryer

1. **Sun Dryer:** Drying in the sun is very economical. The high sugar and acid content of fruits make them safe to dry in the sun. Vegetables are not recommended for sun drying. Vegetables are low in sugar and acid. This increase the risks for food spoilage. To dry in the sun, hot, dry



Fig. 1 Solar dryer

breezy days are best. A minimum temperature of 86°F is needed with higher temperatures being better. Fruits dried in the sun are placed on trays made of screen or wooden dowels. Screens need to be safe for contact with food. The best screens are stainless steel, teflon coated fibreglass or plastic. Avoid screens made from "hardware cloth." This is galvanized metal cloth that is coated with cadmium or zinc. These materials can oxidize, leaving harmful residues on the food. Also avoid copper and aluminium screening. Copper destroys vitamin C and increases oxidation. Aluminium tends to discolour and corrode. Most woods are fine for making trays. However, do not use green wood, pine, cedar, oak or redwood. These woods warp, stain the food or cause off-flavors in the food. Place trays on blocks to allow for better air movement around the food. Because the ground may be moist, it is best to place the racks or screens on a concrete driveway or if possible over a sheet of aluminium or tin. The reflection of the sun on the metal increases the drying temperature. Cover the trays with cheesecloth to help protect the fruit from birds or insects. Fruits dried in the sun must be covered or brought under shelter at night. The cool night air condenses and could add moisture back to the food, thus slowing down the drying process.

Disadvantages of Sun dryer:

- It takes several days to dry foods out-of-doors. Because the weather is uncontrollable, sun drying can be risky. Also, the high humidity in the environment is a problem. Humidity below 60 percent is best for sun drying. Often these ideal conditions are not available when fruit ripens.
- Fruits should be covered or brought in at night to prevent moisture being added back into the food. Somebody has to stay at home throughout the drying period to chase off domestic animals, to remove the produce when the weather becomes too windy and dusty, or when it rains.
- The dried product is often of poor quality as a result of grit and dirt.

- The product is often unhygienic as a result of microorganisms and insects such as flies.

2. Solar dryer: Solar drying (Fig. 2) is a low cost method of drying the produce and these are devices that use solar energy to dry substances (Sharma *et al.*, 2012). It is very important to understand moisture in produce and the properties of the air around us. The conditions of your solar dryer should also be checked regularly. You may do this by placing a thermometer in the drying chamber and monitoring the temperatures reached. The desired temperature range is 110-130°F. These temperatures are achieved through the sun's rays which are collected by the dryer at an optimum angle. This angle is determined by the latitude at which the dryer will be used. This heat is important because it lowers the relative humidity and increases the absolute humidity, so the air will attempt to reach this absolute humidity by taking moisture from the food. This coupled with proper air circulation is the mechanism of solar drying. To achieve these results you must maintain your solar dryer in good condition and replace any parts that break. Basically, there are two types of solar dryers; (a) direct solar dryers (b) indirect solar dryers.

(a) Direct solar dryers expose the substance to be dehydrated to direct sunlight. In these systems the solar drying is assisted by the movement of the air (wind) that removes the more saturated air away from the produce being dried. More recently, complex drying racks and solar tents were constructed as solar dryers. One modern type of solar dryer has a black absorbing surface which collects the light and converts it to heat; the substance to be dried is placed directly on this surface. These driers may have enclosures; glass covers and/or vents in order to increase efficiency.

(b) In indirect solar dryers, the black surface heats incoming air, rather than directly heating the substance to be dried. This heated air is then passed over the substance to be dried and exits upwards often through a chimney, taking moisture released from the substance with it. They can be very simple, just a tilted cold frame with black cloth to an insulated brick building with active ventilation and a back-up heating system. One of the advantages of the indirect system is that it is easier to protect the produce, or other substance, from contamination whether wind-blown or by birds, insects, or animals. Also, direct sun can chemically alter some produce making them less appetizing.



Fig. 2 Solar dryer

Advantages of solar dryers:

- Drying is faster because inside the dryer it is warmer than outside.
- Less risk of spoilage because of the speed of drying. The product is protected against flies, pests, rain and dust.
- It is labour saving. The product can be left in the dryer overnight or during rain.
- The quality of the product is better in terms of nutrients, hygiene and colour.

3. Solar Tunnel Dryer: The solar tunnel dryer is a polyhouse dryer suitable for drying of most of the product (Fig. 3). It consists of a tunnel type semi-cylindrical drying chamber provided with



Fig. 3 Solar Tunnel Dryer

windows to allow the ambient air to enter the dryer. An exhaust fan is provided to evacuate the moist air from the dryer. A sliding door is also provided to facilitate easy handling of the produce. Trolleys and trays are provided to hold one tonne chilli for drying. The maximum temperature of the air inside the dryer was observed to be 53-54°C. The drying time of 43-45 hours is required to dry one tonne chilli against 70 hours required for open sun drying. Saving in drying time was observed to be about 40 -60 per cent by using this dryer for drying chilli. The dryer can be used for drying grapes, sapota, figs, mango, amla etc.

4. Oven dryer: Everyone who has an oven has a dehydrator. By combining the factors of heat, low humidity and air flow, an oven can be used as a dehydrator (Fig. 4). An oven is ideal for occasional drying of fruit leathers, banana chips or for preserving excess produce like celery or mushrooms. Because the oven is needed for every day cooking, it may not be satisfactory for preserving abundant garden produce. Oven drying is slower than dehydrators because it does not have a built-in fan for the air movement (However, some convection ovens do have a fan). It takes about two times longer to dry food in an oven than it does in a dehydrator. Dry of produce in an oven that can be maintained at 140°F. Leave door 2 inches to 3 inches ajar. Place a fan in front of the oven to blow air across the open door. Spread the product in a single layer on racks or cookie sheets. Check product often and turn pieces every few hours to dry more evenly. Drying time will vary.

Disadvantages:

- Do not leave oven on when no one is in the house. It might be risky.
- Oven drying is not recommended in households where children are present.
- The oven is not as efficient as a dehydrator and uses more energy.



Fig. 4 Oven Dryer

PRECAUTIONS DURING DRYING OF HORTICULTURAL PRODUCE

- Cleanliness and hygiene are very important in the processing of dried fruit and vegetables.
- To minimise the possibility of contamination, any person who is unwell or has infected wounds or sores, is ill with a gastric disorder or suffering from diarrhoea must be excluded from the processing operations.
- All cuts have to be covered with waterproof dressing.
- Raw materials contaminated by moulds must not be used in processing.

FUTURE PROSPECTS AND NEEDS

There is a large amount of research, and available knowledge, carried out by academia, but the industry is not taking full advantages even in the more developed countries. A lack of interaction between researchers and industry is observed worldwide, as a consequence industrial advancement is slow because there is a mismatch between research and industrial needs. In less developed countries where industry is not very important there is a general feeling that drying is an easy operation and not too much input is needed and anybody can do it. A consequence of this attitude has been the failure of many drying projects. Drying of produce is a complex business and a mere translation from other fields is not often advisable.

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Recombinant veterinary vaccines

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A vaccine is a biological preparation containing attenuated or inactivated form of the pathogen that provides resistance to the infection or disease. They can be broadly classified into traditional and modern vaccines. Traditional vaccines include live attenuated and inactivated forms of pathogen. Most of these traditional vaccines owe their success against those pathogens that have less antigenic variation. Hence, a vaccine that is highly immunogenic and efficacious with the ability to induce both humoral and cell mediated immunity at fewer vaccine dose is considered ideal. This could be fulfilled partly with recombinant vaccines. A vaccine that is produced by manipulation of the gene of the pathogen by recombinant DNA (rDNA) technology or genetic engineering is called recombinant vaccine. Based on USDA classification, the recombinant vaccines can be classified into four categories as follows:

Category	Vaccine description	Vaccine type
I	Inactivated recombinant organisms and purified antigens from recombinant organisms	Antigen generated by gene cloning
II	Live organisms with gene deletion or heterologous marker genes	Genetically attenuated antigens
III	Live expression vectors containing heterologous genes	Recombinant live vaccine
IV	Polynucleotide vaccines	Recombinant DNA vaccine

Category I vaccines

This category of vaccines includes proteins and their subunits that are used for vaccination.

Recombinant subunit vaccines

Subunit vaccines are highly purified protective proteins or subunits of the immunogenic portion of the pathogen. The gene encoding antigenic proteins (specific B cell and T cell epitope) that elicits protective immune is identified and protein is produced in expression systems. The expression system to be used is chosen based on: expression

levels, need for post-translational modification, scale-up consideration and production costs.

Advantages

- As it contains only the protein component of the pathogen
- It is non-replicating and non-infectious to the host
- Safe to handle in viruses that are of zoonotic importance
- Feasible where viruses cannot be cultivated Ex. Hepatitis B
- Safer in viruses where persistent or latent infection possible

Disadvantages

- Less immunogenic
- Requires adjuvant
- Requires repeated vaccination

Subunit vaccines under research include:

Pathogen	Gene identified	Plasmid used	Expression system used
FMDV	VP1	pBR322 E.coli plasmid	E.coli (Bacteria)
	VP1, VP2, VP3 and VP4 of FMDV (O, Asia 1, A22 and C)	pET32	Pichia pastoris (Yeast)
	Empty capsids	pTT5	HEK293-6E cell (Mammalian cell)
	Capsid proteins	Baculovirus	Bm-N cells and silkworm (Insect)
	VP1	Tobacco mosaic virus vector	<i>Nicotiana benthamiana</i> (Plant)
NDV	HN and F	Baculovirus (Transfer vector)	Sf21 (Insect cell)
	HN and F	pGH	Agrobacterium-mediated transformation of tobacco (Plant)
IBDV	VP2	KIp3-MCS	Kluyveromyces lactis

Licensed subunit vaccines

Organism	Characteristics	Distributor
Porcine circo virus 2	Inactivated baculovirus expressed PCV2 ORF2 protein; adjuvanted	Intervet
Newcastle disease virus	Recombinant viral HN protein in plant cell lines via Agrobacterium transformation	Dow Agrosiences

Classical swine fever	Baculovirus recombinant E2 protein without emulsion	Intervet, Bayer
<i>Borrelia burgdorferi</i>	OspA protein expressed in <i>E.coli</i>	Merial
<i>Actinobacillus pleuropneumoniae</i>	Recombinant ApxII, TbpB, CysL, OmlA(1), and OmlA(2) proteins Extracted ApxI, ApxII, ApxIII, and outer membrane proteins	Novartis animal health Intervet

Category II vaccines

These are genetically attenuated vaccines or gene deleted vaccines. The gene that is responsible for virulence is identified. It is inactivated by inserting a non-coding fragment or deleted by inserting a deletion cassette. The inactivation or deletion of the identified gene should reduce the pathogenicity of the organism but should not alter the immunogenicity of the pathogen.

Advantages

- Highly safe
- Can be combined with live vectors
- Protection against the vector and the antigen included
- Administered through nasal route - mucosal immunity
- Marker vaccine

Licensed gene deleted vaccines

Organism	Characteristics	Distributor
Bovine herpes virus -1 Infectious Bovine rhinotracheitis	gE/tk deleted marker vaccine	Hipra biologicals
Pseudorabies	gE- and thymidine kinase-deleted marker vaccine	Fort Dodge
<i>Salmonella</i>	Double gene-deleted <i>S. enterica serovar Typhimurium strain</i>	Lohman animal health
<i>Sterptococcus equi</i>	Deletions in aroA gene	Intervet

Category III vaccines

This category includes recombinant vectored vaccine. In this vaccine, the immunogenic genes of a particular pathogen are cloned into bacteria / virus / yeast vector. The resultant recombinant organism would give protection against the vector and the immunogenic genes that are inserted into the vector.

The considerations in the selection of a vector includes: host range of the vector, replication in the target animal, expression of foreign antigen, induction of protective immunity, duration of immunity, cost of production, existing immunity and amount of

foreign DNA to be inserted. The site of insertion of immunogenic genes in the vector should not hinder its replication. Hence, a non-essential region should be chosen.

The construction of this recombinant vectored vaccine includes ligation dependent restriction cloning and ligation independent restriction cloning (restriction free cloning, In-fusion cloning, Gibson assembly). Lately, reverse genetics strategies have also been used in construction of recombinant viruses. It was initially developed for positive strand RNA viruses (Transmissible gastroenteritis virus, Classical swine fever virus, Foot and mouth disease) and later for negative strand viruses (Influenza virus and Newcastle disease virus).

The various vectors used in recombinant vaccine construction includes:

Bacterial vectors

Salmonella
Streptococcus
Lactococcus
Mycobacterium
Listeria
Bacillus subtilis

Viral vectors

Poxvirus
 Adenovirus
 Herpesvirus

Yeast vectors

Saccharomyces cerevisiae

Bacterial vectors – Advantages and disadvantages

Bacteria as vector	Target cell	Advantages	Disadvantages
<i>Salmonella sp.</i>	M cells	Humoral immune responses, serum IgG, secretory IgA antibody, both cytotoxic and memory T-lymphocyte responses	Pre-existing immunity to <i>Salmonella</i> and possible reversion to wild type
<i>Staphylococcus sp.</i>	Colonize oral, nasal and uro-genital mucosa.	Stable display and systemic immune responses against heterologous antigens	Pre-existing immunity
<i>Listeria sp.</i>	Intestinal epithelial cells and non-phagocytic cells	CD4+ and CD8+ T-lymphocyte responses	Possible reversion to pathogenic state
<i>Lactobacillus sp.</i>	Colonize gastrointestinal and uro-genital mucosa	Non-pathogenic bacteria, antigen specific immune responses	Unable to elicit cell-mediated immune responses
<i>Bacillus subtilis</i> spore		Greater resistance to adverse conditions for long periods, Probiotic effects, low cost	Poor immunogenicity, Short residence time in the GI tract

Viral vectors:

In general, pox virus, adenovirus and herpes virus have been used as viral vectors. Among these, pox viral vectors have gained importance because of, (i) large gene capacity for insertion of heterologous antigens of more than 20kb, (ii) broad tropism (iii) absence of insertional mutagenesis and other DNA toxicity issues (iv) proper glycosylation and membrane transport (v) activation of systemic and mucosal immune system (vi) administration of vaccine through various routes.

The advantages of various vectors are as follows:

Vaccinia virus

- Robust eukaryotic expression vectors
- Rabies virus G glycoprotein inserted into vaccinia vectors – neutralizing antibody produced and protective immune response conferred – Oral vaccination in wildlife
- Rinderpest virus – Haemagglutinin or Fusion protein
- Attenuation by inactivation of its thymidine kinase and hemagglutinin genes

Modified vaccinia virus Ankara

- Non-replicating pox virus vectors
- Local mucosal membrane immunity after oral vaccination

Canarypox virus

- Non-replicating pox virus vectors
- Antigen expression lasts only for 6 hours
- Not excreted in body fluids and cannot be transmitted through arthropods
- Overcomes blocking by maternal antibodies – Primes young animals
- West Nile virus, feline leukemia, canine parvovirus, canine distemper, equine influenza and rabies

Capripox virus

- Haemagglutinin and fusion gene of rinderpest virus
- Also effective against pseudo lumpy skin disease

Avipox virus

- Abortive replication in mammalian species
- Antibody and cytotoxic T-cell responses
- Widely spaced insertion sites and short promoter sequences – genome stability
- Species specific host range

Adenovirus

- High transduction efficiency
- High transgene expression
- Broad range of viral tropism
- Infects both dividing and non-dividing cells
- Deletion of E1A and E1B viral gene region –
 - Replication defective

- Strong tropism for liver parenchymal cells - hepatotoxicity
- Deletion of E2 and E4 – Reduced vector-derived immune response – lowered toxicity
- Deletion of E3 gene – space for transgene

Herpesvirus

- Long term expression of foreign genes
- High titer and infectivity
- Pre-existing immunity
- Shut off protein synthesis in cell
- Neurotoxicity and latency

Advantages

- Mimic a natural infection
- Induce potent humoral, cell mediated and mucosal immunity
- High immunogenicity without an adjuvant
- Can be administered through different routes
- Immunity to vector & heterologous antigen(s)
- DIVA strategy

Disadvantages

- Reversion of virulence
- Recombination with field type virus
- Spread in the environment
- Genetic stability
- Interference with pre-existing immunity
- Integration into host genome
- Risk of pathogenesis in immune compromised animals
- Cost effectiveness

Licensed vectored vaccines

Vector	Charateristics	Distributor
Fowlpox virus	Avian Influenza virus – H5 HA Newcastle disease virus – F and HN	Merial Biomune
Vaccinia virus	Rabies – Glycoprotein G	Merial
Newcastle disease virus – Lasota strain	Avian Influenza virus – H5 HA	Avimex
HVT – Live chimeric virus	Infectious bursal disease virus – VP2	Merial
ALVAC	Equine influenza virus - HA Canine distemper virus – HA and F West Nile virus – PreM-env Rabies virus – Glycoprotein G	Merial

Category IV vaccines

DNA that encodes foreign vaccine antigens is inserted into a bacterial plasmid. The antigen is placed under a strong mammalian promoter gene to ensure endogenous protein production. The DNA vaccine is administered along with adjuvants. It can

induce both humoral and cell mediated immunity. It is administered through intramuscular route or by gene gun delivery – DNA adsorbed with gold particles.

Advantages

- Elicit both humoral & cell mediated immunity
- Focused on antigen of interest
- Long term immunity
- Refrigeration is not required
- Stable for storage

Disadvantages

- Limited to protein immunogen only
- Extended immuno-stimulation leads to chronic inflammation
- Some antigen require processing which sometime does not occur
- Genetic toxicity - Insertional mutagenesis
- Auto DNA antibody production
- Antibiotic resistance may develop

Licensed DNA vaccines

- West Nile fever virus – Horses
- Infectious haematopoietic necrosis disease – Salmon
- Growth hormone Releasing hormone - Swine
- Melanoma - Dogs

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Black rice- The magic food

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Debatable black rice is of Japanese in origin and full of medicinal and therapeutic properties it is grown in Manipur area in India. But why it is not popularize in all over India?

Rice is the staple food of South Asia, in particular, the Indian sub-continent. Rice is preferred over wheat in countries like India, China, Japan, Philippines and other neighboring South and South East Asian populations. Indians have, in general, a fondness for the white color, whether it is skin tone or body wear. Unfamiliarity of black rice to the Indians is quiet not a surprise. In Imperial China, black rice (*Oryza sativa*) was illegal in China not because it looked poisonous because of its black color. The main reason for prohibition to the commoners was its high nutritional value, which is meant only eaten by the Emperor. Research on more sticky rice cultivars of black rice have begun to study and discovered its nutritional, medicinal and therapeutic properties. It has properties to fight against cancer and the bran of black rice also soothes inflammation due to allergies, asthma and other diseases. Price of black rice in local market is Rs. 300 per kg. Black rice is a native to north-east India which is extensively grown in Odisha, West Bengal and Jharkhand. It is commonly eaten in Manipur because of its medicinal value. Other name to black rice is *chak-hao*, where *chak* means rice and *ahaoba* means which is delicious. *Chak-hao kheer* is very popular dessert in these regions which is eaten during traditional feasts or festivals. Hair wash is also prepared after boiling black rice and water is extracted which makes hair strong.

Origin of black rice is in mystery as Japanese researchers found that the genetic traits of black rice is rearrangement of a gene named as *Kala-4*, which is having role to activate the anthocyanin production. Anthocyanin might show different colors such as red, purple, black in different cultivars depending upon the pH. Researchers concluded that the genetic rearrangement and makeup was originally happened in the tropical Japonica sub species of rice (*Oryza sativa. var. Japonica*). By cross breeding, the black rice trait was then transferred to other varieties, including those found nowadays. The findings of the origin of black rice help explain the history of domestication of black rice by ancient humans, during which they selected desirable traits, including grain color.

MEDICINAL PROPERTIES

Black rice is rich in Vitamins B and E, niacin, calcium, magnesium, iron and zinc as compared to white rice. Grains of black rice have nutty taste and more fibre. Anthocyanin is more in black rice it will not only act as antioxidants but also activate

detoxifying enzymes. The black rice seizes the growth of cancerous cells, by persuading death of cancerous cells (apoptosis) and has anti-angiogenesis effects (inhibition of the formation of new blood vessels which encourages tumour growth) as well as anti-inflammatory properties. Li-Ping Luo, a celebrated Chinese cancer specialist and his research team found that black rice has such properties which prevents the invasion of cancer cells and it induces differentiation. Hence, greater the differentiation in cancerous cells, the less likely they will spread. The research, in particular, shows that anthocyanins from black rice specifically arrest the growth of breast cancer cells.

Scaling up

Black rice covers only 10% of the total cultivated rice area in Manipur. The main reason for this poor spread in acreage is its poor yield. It is best suited to organic farming, as it consumes much less water than the hybrid rice. But it is labor intensive, which works well under the System of Rice Intensification (SRI). SRI has now grown in popularity in parts of India where water is a constraint for rice cultivation. Black rice could become a new choice for future agriculture substitute provided that there is a rigorous effort made by the agricultural administration to promote it. Assam is encouraging the black rice production by looking the Manipur condition. Department of agriculture in Assam emphasizes the massive cultivation of black rice because it fetches good price as an organic product, and also has enormous potential in overseas markets.

Way forward

Other rice growing states also come forward to take on black rice cultivation. A function market need to be established primarily for export purposes. The recent successful scheme and example set by the Union Government at Amuguripara in Goalpara district in Assam, where a total of 12 tonnes of black rice was produced in 13.2 hectares, which comes close to a tonne per hectare, which is an inspiring example. It shows that black rice can, indeed, be good stake for Indian rice producers and consumers, domestic as well as foreign when provided with infrastructure, market support and financial incentives. Germplasm of black rice must be kept at All India Rice Research, Hyderabad to show the potential of black rice and it will also open the doors of innovation to the farmers. We need to adopt the black rice as a new thing out of the world first seem to be annoying but could be acceptable when we need for sustainability.

Biochar: A Powerhouse of Benefits

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Soil serves as the basic foundation for our food production system. Modern and intensive agricultural practices are deteriorating the soil health by cultivating it to more than its capacity. Moreover, the addition of inorganic fertilizers has lower down the soil's inherent capacity to recycle the nutrients naturally. In addition to this uncontrolled deforestation and continuous emission of green house gases from various activities has led to build up of dangerous level of carbon di oxide in the atmosphere that is leading to climate change. Therefore, there is a need of such techniques which can not only improve the condition of soil but can also increase agricultural productivity and also serves potentially to combat global issues like climate change.

What is Biochar?

Biochar is a form of charcoal that is produced from carbonization of biological matter. In simple words we can say it a 'biological charcoal'. It has an immense potential to serve as an excellent soil amendment. When it is applied to the soil it improves the retention of water and nutrients in the soil thus helps in increasing agricultural productivity.

How Biochar is produced?

A wide variety of materials can be used for preparation of biochar such as wood, wood chips, plant materials, straw etc. Further, we can say that agricultural wastes are the best material to make biochar. Biochar is produced by heating the raw material under controlled conditions. When raw material is heated in absence of oxygen the process is called 'Pyrolysis' and when low amount of oxygen is used it is known as 'Gasification' (Fig.1). The carbonaceous material left after the heating process is called 'Biochar'. When plant tissues are burnt for bio char production, heat produced during combustion volatilizes a significant portion of the hydrogen, oxygen and some of the carbon present in the tissues. The carbonaceous materials produced by this contain many poly-aromatic hydrocarbons, some of which may have functional groups with oxygen or hydrogen.

Role of Biochar in Carbon Sequestration:

Carbon sequestration is a process by which trees and crops takes up carbon di oxide from the atmosphere and locks it either in the form of biomass or in the soil system. It removes the excess concentration of carbon di oxide from the atmosphere and in turn reduces the risk of global warming and subsequent climate change. Talking about the

present scenario, carbon di oxide concentration in the atmosphere has reached to a value of more than 400 ppm and this is an alarming value. If the carbon di oxide concentration does not stabilize or reduce it will seriously affect survival of plants and animals on earth. Biochar serves as a bundle of benefits in combating these disastrous effects. Biochar is a carbon negative material; this quality makes it best for this purpose. Moreover, the ability of biochar to resist microbial degradation plays a very important role in carbon sequestration because it can serve as a store house of carbon for a longer period of time. The carbon in biochar resists degradation and can hold carbon in soils for hundreds to thousands of years.

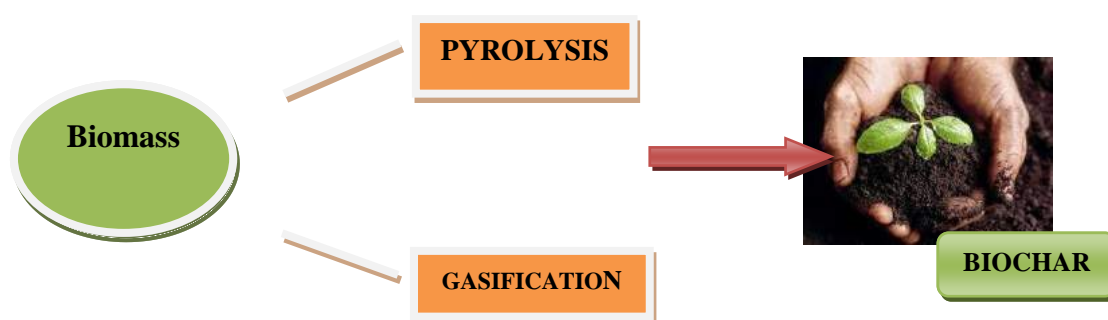


Fig.1.Process involved in the production of Biochar.

Role of Biochar in improving agricultural productivity:

Biochar serves as an excellent soil amendment. It has an ability to convert low fertile or low productive soils into cultivable ones. The main roles of biochar include:

- ✚ Organic matter content of the soil is considered as one of the most important determinant of soil properties which directly affects crop productivity. Biochar helps in increasing the organic matter content of the soil and makes it more fertile.
- ✚ Biochar improves the retention of water, increases the water availability to plants and increases the yield per unit of water applied. Due to this increased availability of water, quantity of irrigation water can be reduced to some extent.
- ✚ Biochar helps in reducing nutrient loss (e.g. leaching), holds the nutrients closer to the plant roots and improves the exchange of nutrients. Thereby, making them available for a longer period of time.
- ✚ Biochar is quite stable in nature and serves as a good source of carbon for growth of a wide range of microorganisms which are beneficial for improving the soil health.
- ✚ It improves the cation exchange capacity of soil.
- ✚ It helps in correcting the acidity of soils. The bases present in the biochar ash helps in correcting the acidity of soils.
- ✚ It helps in recycling the agricultural waste as in the production process waste material like straw, wood chips, small wood pieces and left over plant material is converted into useful material.

Limitations in the use of biochar:

Biochar does have some limiting factors in its use and the main factors are:

- ✚ Availability of feedstock/biomass to produce biochar.
- ✚ Availability of equipments and machines required for pyrolysis and gasification.
- ✚ Biochar is a bulky material and if the farmer is not producing it on his field then it includes transportation cost also.
- ✚ Wind loss: fine grained biochar is subjected to wind loss. This can be avoided by application of biochar in the favorable weather, by sprinkling water over it and by using biochar in the form of prills and pallets.
- ✚ Water loss: Biochar is subjected to loss along with flowing water. This can be easily avoided by properly incorporating it in the soil.

CONCLUSION

Application of biochar has many benefits like; it improves the structure and texture of soil, increases the soil fertility, and improves the retention of nutrients and water which in turn reduces the use of fertilizer and water. Biochar is very effective in increasing the crop production and productivity. Biochar's property to sequester the carbon helps in mitigating the ill effects of global warming and climate change. Biochar serves as a product with multiple benefits to environment and agriculture. Thus, use of biochar in agriculture will be of utmost significance.

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Potentials and Problems of Vegetable Farming in Coastal Odisha

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Vegetable farming is growing of vegetable crops primarily as human food. Vegetables are excellent source of vitamins, particularly niacin, riboflavin, Thiamin and vitamins A and C. They also supply minerals such as calcium and iron besides proteins and carbohydrates. Vegetables combat under nourishment and are known to be cheapest source of natural protective tools. However, the per capita consumption of vegetables in India is only around 130 grams against a minimum of about 300 grams of vegetables (75 - 125 g of green leafy vegetables, 85 g of other vegetables and 85 g of roots and tubers with other food) recommended by dietitians. Most of the vegetables, being short duration crops, fit very well in the intensive cropping system and are capable of giving very high yields and very high economic returns to the growers besides providing better health standards to the people. India is the world's largest producer of vegetable next only to China with an annual production estimated around 169.4 million tonnes from 9.5 million hectares (National Horticulture Board, 2014-15). However, vegetables occupy hardly 2 per cent of the total cropped area of the country which is very low in view of the national need. The farmer's crop cultivation depends on the market demand, soil and climate suitability. Profitable vegetable farming requires attention to all cultivation aspects, including soil, insect, disease, and weed control and efficient marketing. Coastal regions, home to a large and growing proportion of the world and national population. Coastal Odisha consists of the Baleswar, Bhadrak, Ganjam, Jagatsinghpur, Kendrapara, Khordha and Puri districts and coastal extended from east to southern, about 445 km. The coastal soils are formed mainly in the deltaic alluvium of the Subarnrekha, Brahmani, Baitarani, Mahanadi, Rushikulya and other minor rivers. These lands may be of low or high relief, sand bars running parallel to the coast and lacustrine sediment of Chilka Lake. In this coastal Odisha, Soils are generally fertile, but some nutrients deficient and problematic soils need proper management.

Status of vegetable production in Coastal Odisha

Among the states, vegetable production (2014-15) is the highest in West Bengal (26.35 million tons) and the highest productivity in Uttar Pradesh (21.6 tons/ha). Odisha is occupying 7th rank in vegetable production (9.43 million tons) and the productivity is

low in Odisha (13.8 tons/ha). In Odisha, Coastal districts have more area, production and yield than other part of the state (Table 1).

Table.1: Major vegetable growing district-wise areas and production of vegetables in Odisha (2013-14).

Districts	2013-14		
	Area (In '000 hectare)	Production (In '000 MTs)	Yield (In Kg/ha.)
Ganjam	33.65	475.62	14134
Balasore	27.32	346.42	12680
Khurda	22.42	335.00	14942
Bhadrak	22.39	301.55	13468
Jagtisinghpur	7.94	259.67	14474
Kendrapara	23.25	326.16	14028
Puri	4.45	196.15	13574
Dhenkanal	27.10	400.95	14795
Angul	23.48	340.55	14504
Keonjhar	50.25	734.46	14616
Koraput	28.46	390.90	13735
Mayurbhanj	34.13	480.51	14079
Odisha	677.33	9425.21	13915

(Source: Odisha Agriculture Statistics, 2013-14)

Factors affecting vegetables cultivation in coastal Odisha:

1. **Climate:** Involves the temperature, moisture, daylight, and wind conditions of a specific region. Climatic factors strongly affect all stages and processes of plant growth. The amount and annual distribution of rainfall in a region, especially during certain periods of development, affects local crops.
2. **Soil type and quality:** Growing vegetables requires types of soil that are rich in nutrients, good texture, neutral soil reaction and better water holding capacity. Therefore, soil type could influence the choice of vegetable to grow. For optimum growth and development, plants require soil that supplies water as well as nutrients dissolved in water. Optimum vegetable production is achieved on well-drained sandy loam soils. Although vegetables can be grown on a wide range of soil types, most vegetables are not well adapted to heavy clay soil types. Extremely wet soil also retards root growth by restricting aeration. The amount of slope influences the type of culture possible. A leveled soil site is generally most desirable,



although a slight slope may assist drainage. Exposed sites are not suitable for vegetable farming because of the risk of damage to plants by strong winds. Soil quality and soil health is viewed as the foundation to successful production.

3. Irrigation water availability and its quality

Water quality is equally as important as water volume in selecting a field site water source. Water source for vegetable irrigation should contain less than 400 ppm soluble salts. Therefore, avoid water sources containing high levels of toxic elements such as Sodium, Boron or Aluminum. But the major problem in coastal region is demand of good quality irrigation water as the water is more saline.

4. Fertilizer application

Fertilization is the addition of nutrients to the soil. Chemical fertilizers may be used to supply the needed nitrogen, phosphorus, and potassium. Chemical tests of soil, plant, or both are used to determine fertilizer needs, and the rate of application is usually based on the fertility of the soil, the cropping system employed, the kind of vegetable to be



grown, and the financial return that might be expected from the crop. Methods of fertilizer application include scattering and mixing with the soil before planting; application with a drill below the surface of the soil at the time of planting; row application before or at planting time; and row application during plant growth, also called side-dressing. Fertilizer is powerful tools that can help plants thrive if used appropriately. If applied incorrectly, it can not only harm plants, but also the environment. The ideal nutrient ratio of NPK usage is 4:2:1- however in most regions it is skewed against the ratio with a propensity to use larger quantities of N (urea) as it is cheaper. The current fertilizer consumption ratio is 6.7:2.7:1 (Indian journal of fertilizers, October- 2017).

5. Market availability for the produced crop

Effective management involves the adoption of techniques resulting in a steady flow of the desired amount of produce over the whole of the natural growing season of the crop. Many vegetables can be grown throughout the year in some climates, although yield per acre for a given kind of vegetable varies according to the growing season and region where the crop is produced.

Potential problems and their management

1. Soil Erosion

Soil erosion, caused by water and wind, is the major problem in many vegetable-growing regions of coastal Odisha, because the topsoil is usually the richest in fertility and organic matter. Soil erosion by water can be controlled by various methods like mulching, terracing, contouring and strip cropping. Terracing divides the land into separate drainage areas, with each area having its own waterway above the terrace. The

terrace holds the water on the land, allowing it to soak into the soil and reducing or preventing gullying. In the contouring system, crops are planted in rows at the same level across the field.



Water erosion in Chilli cultivated field



Bench terracing of vegetable cultivation

2. *Fusarium wilt (Fusarium oxysporum sp.capsici)*

Fusarium wilt mainly affects chilli, brinjal and tomato plants. *Fusarium* is a soil borne fungus. Once a field is infested, the pathogen may survive in the soil for many years. The fungus can be transported by farm equipment, drainage water, wind, or animals, including humans. Warmer and drier climates (>25°C) will favour disease infestation and also when crop rotations are not practiced.

Symptoms

Fusarium wilt is characterized by wilting of the plant and upward and inward rolling of the leaves. The leaves turn yellow and die. Generally appear localized areas of the field where a high percentage of the plants wilt and die, although scattered wilted plants may also occur. Disease symptoms are characterized by an initial slight yellowing of the foliage and wilting of the upper leaves that progress in a few days into a permanent wilt with the leaves still attached. By the time above - ground symptoms are evident; the vascular system of the plant is discolored, particularly in the lower stem and roots.



Patch of wilt symptom in Chilli field



Infected root symptom of Brinjal crop

Management

Fusarium wilt can be controlled by use of wilt resistant varieties, crop rotation, changing irrigation method (ridges of raised beds). Drenching with 1% Bordeaux mixture or Blue copper or Fytolan 0.25% may give protection. Seed treatment with 4g Trichoderma viride formulation or 2g Carbendazim per kg seed is also effective. Mix 2kg T.viride formulation mixed with 50kg FYM, sprinkle water and cover with a thin polythene sheet. When mycelia growth is visible on the heap after 15 days, apply the mixture in rows of chilli in an area of one acre.

3. Lack of Cold Storage

Coastal Odisha is one of the major vegetables growing zone of the state. When the peak season of tomato, cabbage, cauliflower and chilli etc are getting poor price, therefore if they have one cold storage in one block, where major vegetable growing zones, will be more beneficial for keeping commodities and getting maximum price in surplus time.



Tomato left in field itself due to poor price



Harvested cabbage in field

4. Crop Insurance

Coastal districts of Odisha are near to of Bay of Bengal Sea, due to that always chances are there to get affected by natural disaster (flood, drought, unseasonal rain, cyclone (Phailin) and sea coast erosion etc.,). It will cause crop loss and inversion of farming community condition. Therefore all vegetables grower should have crop insurance package which will keep farming and farmers live.

5. Bore Well Irrigation



Major irrigation activity in coastal Odisha

During monsoon (June to September), the coastal Odisha is getting excess rain, which will fill the well, ponds and lake. These water can be used for regular vegetable cultivation but in winter and summer period, lack of surface irrigation is the big issue. Even though, medium and large farmers are using well and bore well irrigation for vegetable cultivation. If the government offers water storage and rain harvesting structures in the local area, which could able make more vegetable growing area cum production in coastal part of Odisha.

6. Excess use of fertilizer and pesticide

After green revolution, the fertilizers and pesticides are used excessively to meet the increasing production need of our day to day life. Especially vegetables are consuming much more fertilizers than other crops. Now a day farmers are thinking use of chemical fertilizers is the only option for more produce in less time to get good returns.



Round spray of pesticide to vegetables



Excess application of fertilizer on soil

Repeated use of chemical fertilizers and chemical pesticide will degrade the soil and environment quality and also reduce the agricultural yields. Therefore farmers have to follow Soil testing based fertilizer recommendation for specific crops and give more emphasis to biological method to control the pest and disease. Crop rotation and integrated nutrient management should be followed to maintain the soil sustainability.

7. Market availability

The marketing of vegetables in India is in bad situation due to poor efficiency of marketing channels and poor marketing infrastructure, which leads to high fluctuation in consumer prices. Due to the market intermediaries, major part of the consumer price is going to the marketing channel, only small portion reaches the farmers. The location is the most important, followed by go-down facility, yard maintenance, weighing, price display, and banking facilities.



The fact that most vegetable crops are highly perishable; the need to develop markets

for produce should be established prior to planting the crop. For whatever reason one chooses to commercially produce vegetables organically, profitability is the driving force that keeps him in business. To achieve profitability, a producer must have a well thought out production and marketing plan based on sound scientific and business principles. Most startup vegetable operations generally fail due to the lack of market development or marketing skills.

CONCLUSIONS

Vegetables are unavoidable in our regular life since they are filled with nutrients and minerals. Vegetable always prefers good climate condition, fertile soils with good irrigation facility. Keeping these in view, vegetable farming should be enhanced with better technology and management practices to resolve the potential constraints in Coastal Odisha which will make sustainable vegetable production and healthy environment in long term.

Mosquito borne viral diseases- a threat to life

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Virus, the leading biological agent affecting living creatures, since its ability to adopt and undergo genetic alteration which favors its growth in the variety of host. They can be spread by any means from the affected one to healthy individuals. However, mosquitoes being the nastiest creature with wide distribution all over the world play very important role in the spread of deadly viral diseases. Mosquitoes can transmit the disease without being affected themselves from infected human or animal to healthy one. The mosquito and virus exhibit mutualism or symbiotic relationship wherein they do not harm each other. Moreover, they can transmit the viruses from an individual to other while feeding. Worldwide, mosquito-borne illnesses affect more than 700 million people and more than a million casualties are experienced every year. The tropical and subtropical region is endemic for the many viral infections which can be transmitted by the mosquitoes. In the Indian continent, mosquito-born viral infections are creating great havoc but viral diseases like Dengue, Chikungunya and Japanese encephalitis have special significance owing to its incidence and casualties.

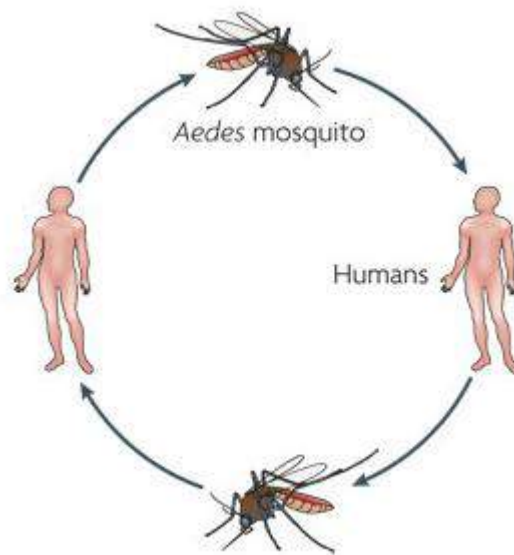
Dengue - World's fastest growing vector-borne disease

The causative agent of Dengue is a RNA virus belongs to *Flaviviridae* family. There are 4 distinct, but closely related serotypes of the virus that cause dengue (DEN-1, DEN-2, DEN-3, and DEN-4). Dengue virus is transmitted by the bite of infected female mosquitoes mainly of the species *Aedes*. About 40% of the world's population is at risk of Dengue and the infection occurs in more than 100 countries with about 390 Million dengue infections each year. WHO currently estimated that there may be 50–100 million dengue infections worldwide every year. In 2012, it ranked as the most important mosquito-borne viral disease with epidemic potential in the world (CDC, 2014).

Symptoms

Symptoms of dengue fever include severe joint and muscle pain, swollen lymph nodes, headache, fever, exhaustion, and rashes. The presence of fever, rash, and headache (the "dengue triad") is characteristic of dengue fever. Dengue hemorrhagic fever (DHF) is a specific syndrome that specifically tends to affect children

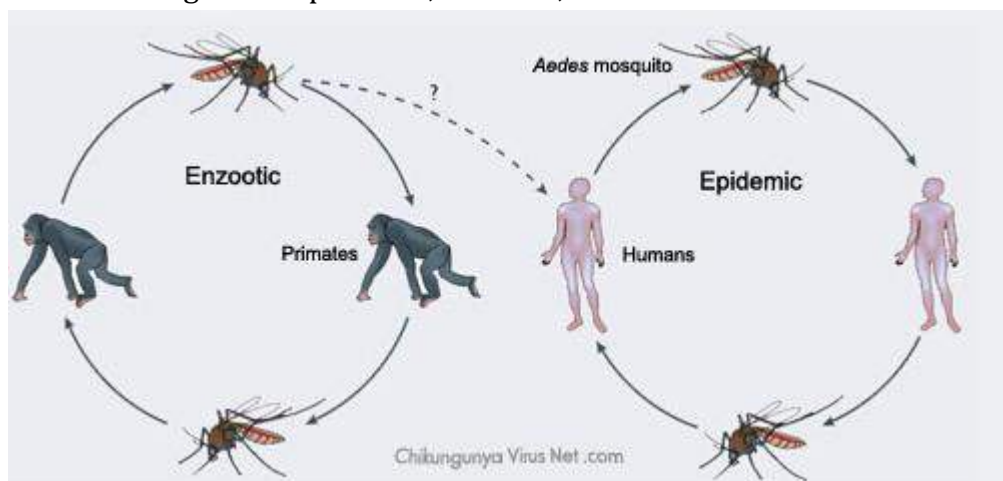
under 10 years of age. This complication of dengue causes abdominal pain, hemorrhage (bleeding), and circulatory collapse (shock).



Transmission cycle of Dengue

Chikungunya – (Means, “that which bends up”)

Chikungunya, important mosquito-born disease caused by a virus of *alphavirus* genus and *Togaviridae* family. It spread through bites from infected female *Aedes* mosquitoes. People at risk for the more severe disease include new-borns infected around the time of birth, older adults (≥65 years), and people with medical conditions such as high blood pressure, diabetes, or heart diseases.



Transmission cycle of Chikungunya

Symptoms

Symptoms usually begin in 3–7 days after the bite of an infected mosquito. The most common symptoms are fever and joint pain. Other symptoms may include headache, muscle pain, joint swelling, or rash. These symptoms do not often result in death but can be severe and disabling. Most patients feel better within a week, but, in some cases, the

joint pain may persist for months, hence called as a disease which bends up. Once a person has been infected, he or she is likely to be protected from future infections.

Japanese encephalitis- An emerging menace in India

Japanese encephalitis is one of the most important mosquito-borne viral disease responsible for causing viral encephalitis in Asia. Japanese encephalitis virus (JEV) is a RNA virus belongs to the family *Flaviviridae* and transmitted by the bite of mosquitoes of *Culex* species. Horses are the primary affected domestic animals of JE though essentially a dead-end host. Other equids (donkeys) are also susceptible. Pigs act as important amplifiers of the virus-producing high viraemias which infect mosquito vectors. Also, the natural maintenance reservoirs for JE virus are birds of the family Ardeidae (herons and egrets). Although they do not demonstrate clinical disease they do generate high viraemias upon infection.

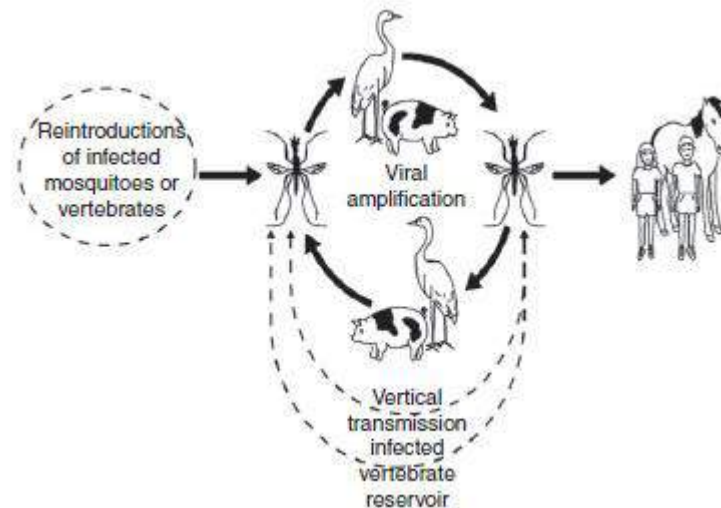
Humans are vulnerable and this disease is a primary public health concern in Asia. Humans are considered as a dead-end host because they usually do not develop high enough concentrations of JE virus in their bloodstreams to infect feeding mosquitoes and cannot transmit the disease to others. JE is mostly a disease of children and young adults. Rates of infection in the 3 to 15 year age group are five to ten times higher than in older individuals. Approximately 597,542,000 people in India live in JE-endemic regions, and 1,500 to 4,000 cases are reported every year. Less than 1% of people infected with Japanese encephalitis (JE) virus develop clinical illness. Other sub-clinically infected animals which likely do not contribute to spreading include cattle, sheep, goats, dogs, cats, chickens, ducks, wild mammals, reptiles, and amphibians, etc.

Symptoms

In persons who develop symptoms, the incubation period (time from infection until illness) is typically 5-15 days. Initial symptoms often include fever, headache, and vomiting. Mental status changes, neurologic symptoms, weakness, and movement disorders might develop over the next few days. Seizures (Uncontrolled brain activity causing physical convulsions) are common, especially among children. Among patients who develop encephalitis, 20% – 30% die. Although some symptoms improve after the acute illness, 30%-50% of survivors continue to have neurologic, cognitive, or psychiatric symptoms.

Treatment

There is no specific antiviral drug treatment for the viral diseases. Treatment is directed primarily at relieving the symptoms and supportive care should be provided for quick recovery.



Transmission cycle of Japanese encephalitis

Prevention and control

- Keep body surface covered and minimize skin exposure
- Exposed skin should be protected by applying skin mosquito repellents
- Keep a check on surroundings
- Keep surroundings clean and check for overflowing garbage bins
- Don't let water accumulate because mosquitoes lay their eggs in still water
- Change the water in flower vessels regularly to avoid mosquito breeding
- Stay extra safe during daytime
- Use nets to avoid mosquito bites
- Keep toilet seats down when not in use
- Shower daily and use unscented shampoos because mosquitos are believed to be attracted to smells like perfume and sweat
- Purchase mosquito repellent that contains DEET (N, N-diethyl-3-methylbenzamide), IR3535 (3-[N-acetyl-N-butyl]-aminopropionic acid ethyl ester) or icaridin (1-piperidine carboxylic acid, 2-(2-hydroxyethyl)-1-methylpropylester)
- Do not use Aspirin in Chikungunya as it increases the risk of bleeding
- Vaccination: for JE live-attenuated vaccine using SA14-14-2 strain is available, for Dengue and Chikungunya also vaccine is available

Infectious laryngo-tracheitis (ILT) in commercial layer chicken

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Infectious laryngotracheitis (ILT) is an acute and highly contagious disease of chickens caused by a member of the *Herpesviridae* family, *Gallid Herpesvirus 1*, of sub family *Alphaherpesvirinae*. This disease leads to serious economic losses due to decreased growth rates, reduced egg production and varying levels of mortality. In the recent years, occurrence of ILT episodes were continuous in Namakkal where nearly 11680 million eggs per year are being produced and the disease causes heavy economic losses to the poultry industry and reduces the net profit of the poultry farmers.

EPIDEMIOLOGY

The incidence of ILT was observed in the age group between 5 and 60 weeks in layer chicken. The maximum incidence was noticed in the age group of 10 to 20 weeks (40.47 %) followed by 20 to 30 weeks (26.19 %). The maximum mortality was observed in 10 to 20 weeks age group (41%) followed by 20 to 30 weeks (35 %) and the average mortality per cent recorded in layer was 28.60.

The season wise pattern of occurrence was studied. The incidence peaked during mid-summer of 2011 where the mortality rate increased from 5 to 25 per cent in birds raised under intensive system. The incidence decreased in winter season and mortality rate was up to 10 per cent. Mechanical transmission is one of the major vectors to spread the infection and can occur via contaminated equipment, vehicle used to litter removal and feed supply, egg trays and poultry workers. Vertical transmission of ILTV has not been demonstrated. Infectious laryngotracheitis can be transmitted directly by inhalation, ingestion or through the conjunctiva. Transmission studies determined that four days were required for the virus to replicate and transmit to other birds and the infection spreads slowly across the shed.

PATHOGENESIS

Following inhalation, virus replicates locally in the upper respiratory tract. Spread along sensory nerves results in localization in the trigeminal ganglia.

CLINICAL SIGNS

Characteristic clinical signs include lacrymation, matting of eyelids, nasal discharge and moist rales followed by coughing, gasping, sneezing, depression and conjunctivitis.

When severe epizootic forms of the disease occur, signs also include labored breathing and expectoration of blood-stained mucus; and upon gross examination of the trachea, severe haemorrhages, diphtheritic membrane and mucus plugs are characteristic and usually appear within 6 -12 days after natural infection.

Mild form of ILT include depression, reduced egg production and weight gain, conjunctivitis, swelling of the infraorbital sinuses (almond shaped eyes), and nasal discharge. Morbidity for the mild form is about 5 per cent and mortality 0.1-2 per cent. Generally, it takes 10 to 14 days for recovery, but with some strains the clinical signs may extend for 1-4 weeks.

Respiratory sound is distinctly audible particularly at night when the birds are at rest on the roosts. Occasionally, tracheal exudate gravitates to the lower larynx where it interferes with the vocal organs and the individuals in attempting to clear the accumulation from these parts utter a loud, sharp distinctive sound.



ILT infected bird showing swollen eye lid



ILT affected bird showing ocular discharge



ILT affected bird showing crust adhering onto the eyelid



Trachea showing plug occluding the lumen

DIAGNOSIS

Clinical signs and post-mortem lesions are the basis for diagnosis of the disease. Confirmatory test is done through embryo inoculation method. Suspected virus material

collected from tracheal swab of infected birds is inoculated in chick embryos of 11 to 12 day of age. The route of inoculation is chorioallantoic membrane (CAM). Three days post inoculation, thickening and sometimes plaques can be observed on CAM. These plaques have opaque edges and depressed central area of necrosis. The size of surviving embryo also gets reduced.

PREVENTION AND CONTROL

- Infectious Laryngotracheitis virus can survive for 10 days or more in droppings and up to 70 days in carcasses at ambient temperature of 13 °C to 23 °C.
- The virus lasts longer in winter. It appears that the virus may survive up to 80 days in tracheal mucus on non-conductive material such as wood. However, the disease keeps perpetuating on the farm because of healthy carriers.
- To get rid of Infectious Laryngotracheitis virus from a poultry farm, it is necessary to practice following after cleaning the empty shed:
 - Sunlight, heat and drying (virus gets inactivated at 38 °C within 48 hours)
 - A mist created by 5% hydrogen peroxide in the shed
 - Cresol 3% solution- apply on floors and walls
- Apart from this, biosecurity should also include restricted entries, cleaning up of surfaces, disposal of carcasses, rodent control, insect and pest control, personnel hygiene, disinfection of vehicles, egg trays etc
- Live attenuated vaccines adopted in Embryonated chicken eggs and Tissue cultures are available in western countries. Chickens aged 5 weeks or older are vaccinated with these vaccines.

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A2 milk and its health benefits

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ABSTRACT

Now a day's A2 milk is gaining popularity in India. Indigenous breeds of India produce more A2 protein in their milk, which is beta casein having great health benefits to humans. A2 milk is naturally occurring with high calcium content than soya milk and maintains gastric health. Basically in milk proline is very firmly attached to its neighbor isoleucine but histidine is not that firmly associated, therefore it breaks easily during human digestion of milk protein and forms casomorphin called BCM7. Generally, Indian cow milk does not contain BCM7 and is of A2 type. This milk has beneficial properties which help to cure heart problems, mental disturbances and type 1 Diabetes. This review envisages the different health benefits of A2 milk which will be helpful for usages in all individuals.

Key words: A2 Milk, Milk protein, Heart disease.

INTRODUCTION

Milk act as a complete source of energy for the infant having all the essential micro-nutrients needed for growth and development of human health as well as for the neonate animal. Milk contains about 85% of water and 15% is the milk sugar *i.e.* lactose, protein, fat and minerals. Beta-casein contribute about 30% of the total protein (Prasantaboro, 2016). Beta-casein is a type of protein that makes up one third of the protein in milk. It is a high quality milk protein that is a source of essential amino acids, as well as peptides. It assists with natural calcium absorption. A2 is a cow's milk that contains only a2 type of beta casein protein rather than A1 which is commonly found in regular milk. It is characterized by a distinct golden colour. Some animals *i.e.* crossbreed and European breeds of cattle commonly produce A1 protein in their milk. Indigenous cows and buffaloes of India produce more a2 protein (Prasantaboro, 2016). A2 beta-casein is the beta-casein from cows which has beneficial effects on for human health. Beta casein is a chain 229 amino acids in length; cows that produce this protein in their milk with a proline at number 67 are called A2 cows, and are older breeds of cows [i.e Guernsey]. A2 Milk is completely real and naturally occurring milk which contains about 6 times the natural levels of calcium as soy milk, approximately 8 times the natural protein levels of almond milk and 6 times the potassium levels of most rice

milks. A natural mutation occurred in cows of European breeds which produce casein variant called as A1 beta-casein. Further this dominates in the milk called as A1 milk. Changing in gene encoding pattern of beta-casein so that 67th amino acid in the 229 amino proteins was switched from proline to histidine. This new kind of beta-casein mostly found in the milk of crossbred animals such as Holstein, jersey and Friesian. Because of this many alternative milk are then fortified with additional vitamins and minerals like calcium and protein. The A2 milk is good for health and is naturally occurring which maintain the gastrointestinal health.

Proteolytic digestion of A1 variant of β -casein in gastrointestinal tract leads to production of bioactive peptide, beta casomorphin 7 (BCM7). Infants are capable of absorbing BCM-7 due to an immature gastrointestinal tract whereas in adults it deposits activity on the intestinal brush boarder. Hydrolyzed milk with variant A1 of beta-casein have 4- fold more level of BCM-7 than in A2 milk. Previous studies on indigenous cow (Zebu type), buffalo and exotic cows (taurine type) revealed that A1 allele is more frequent seen in exotic cattle while Indian breeds native have only A2 allele and hence are a source for safe milk (Mishra *et al.*, 2009).

BCM7 is suggested to cause serious human health hazards as it possibly affect opioid receptors in the nervous, endocrine and immune system. It is also known to be potent oxidant of low dietary lipoproteins (LDL). Oxidation of LDL leads to development of arterial plaque, which causes increase in cholesterol. Consumption of A1 milk is associated as a risk factor for type-1 diabetes, coronary heart disease, arteriosclerosis, sudden infant death, autism and schizophrenia. (Sodhi *et al.*, 2012). Neurological dysfunction occurs when BCM7 crosses blood brain barrier (Woodford, K.B., 2006. Our cows are not treated with growth hormones and is free from antibiotic. A2 Milk is pure, natural milk that anyone can drink (unless they have been clinically diagnosed with lactose intolerance or a milk protein allergy). Because it may be easier to digest for those who are milk sensitive.

A2 milk looks like ordinary milk, tastes like real and natural milk and contains the same amounts of calcium and other important minerals and nutrients as ordinary cows' milk. This milk has approximately 6 times the natural calcium levels as that of soya milk.

GENETIC EFFECT

The A1/A2 status of a cow is determined by a pair of genes on the sixth chromosome (Rijnkels, 2002). There are two major alleles of the gene i.e A1 and A2 beta-casein alleles. A cow carries two copies of the beta-casein gene in which she can carry either of A2A2 homozygous, A1A2 heterozygous or A1A1 homozygous alleles. None of the allele are dominant over the other, as they are co-dominant i.e. their effect is co-dominant. Therefore, an A1A2 cow will produce A1 and A2 beta-casein in equal amounts. An A2 cow will only produce A2 beta-casein and an A1A1 cow will only produce A1 beta-casein. These genetic variation helps in classification of different breeds for producing A1 or A2 milk.

HEALTH BENEFITS

The major health problem including Type 1 Diabetes can be caused due to presence of BCM7 in the blood stream, as the human immune produces antibodies against the peptide. Those antibodies recognize a specific peptide present at the end of the BCM7 chain in order to destroy that peptide. However, the same one is also found in GLUT2, which is produced by the body to transport glucose. As the antibodies do not only tackle BCM7, but also GLUT2, the transport of glucose to the cells is affected, leading to diabetes.

Heart disease is directly linked to BCM7, and thus to A1-milk. Epidemiological studies conducted which showed a relation between consumption of A1-milk and deaths in individuals due to heart disease. This effect has proven in a study with rabbits, in which they fed feed with high A1-beta casein showed a thickening of artery walls, which is identified as a factor responsible for various heart diseases. In further studies two trials have been performed on humans to assess the effects of A1- and A2-beta casein (Dusting *et al.*, 2006; Venn *et al.*, 2005). Autism and schizophrenia effects of BCM7 is mainly because of its opioid properties. As it passes through cell walls followed by bloodstream, it can also reach brain cells and connect to opioid receptors, causing mental illnesses (Woodford, 2007). The experiments were further conducted on laboratory animals i.e. rabbit, mice and rats to find out other health concerns.

CONCLUSION

A2 milk is beneficial, it is similar to normal milk produce from certain breeds which have health benefits in humans. A2 milk prevents from health related complication which are developed due to consumption of A1 milk. Most of humped breeds in India are producing A2 milk so it has a heavy chance to export this milk and gain foreign currency. Future studies should be conduct to know other benefits and development of standard related to consumption.

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Proso millet or (cheena) is a important crop in indian farmer to unique nutrinalional qualities, health beneficial and doubling farmers income by 2022 **(*panicum miliaceum*)**

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Millets are minor cereals of the grass family, Poaceae. They are small seedbeds, annual cereals grasses, many of which are adapted to tropical and arid climates and are characterized by their ability to survive in less fertile soil millets include sorghum (jowar), pearl millet (bajra), finger millet (ragi), foxtail millet (kakun), proso millet (cheena), little millet (kutki), kodo millet (kodon), barnyard millet (sanwa) and browm top millet .

The total area of small millets in India is about 0.798 M hectare and production is 0.451M tons with the productivity of 565 kg per hectare (2011-12). Madhya Pradesh account 35.34% area of total small millets and 21.66% production of total small millets of India and productivity is 331 kg/ha. (2011-12).

Proso millet, with many common names including proso millet, broomcorn millet, common millet, broomtail millet, hog millet, red millet, and white millet, is a grass species used as a crop. Both the wild ancestor and location of the original domestication of proso millet are unknown, but it first appears as a crop in both Transcaucasia and China about 7000 years ago, suggesting it may have been domesticated independently in each area. It is still extensively cultivated in India, Russia, Ukraine, the Middle East, Turkey and Romania. In United States, proso is mainly grown for birdseed. It is sold as health food, and due its lack of gluten, it can be included in the diets of people who cannot tolerate wheat.

Proso millet is an annual grass whose plants reach an average height of 100 cm (4 feet).The seeds heads grow in bunches. The seeds are small (2-3 mm or 0.1 inch) and can be cream, yellow, orange-red, or brown in colour. Proso millet is well adapted to many soil and climatic conditions; it has a short growing season, and needs little water. It is an excellent crop for dryland and no-till farming.

HISTORY

Unlike the foxtail millet, the wild ancestor of the proso millet has not yet been satisfactory identified. Weedy forms of this grain are found in Central Asia, covering a widespread area from the Caspian Sea east to Xinjiang and Mongolia, and it may be that these semiarid areas harbour” genuinely wild P.miliaceum forms. This millet has been

reportedly found in Neolithic sites in Georgia(dated to the fifth and fourth millennia BC) by Linear Pottery culture(Early LBK, Neolithikum 5500-4900 BCE), as well as excavated Yangshao culture farming villages east in China.



Fig.1. Proso millet

Proso millet appears to have reached Europe not long after its appearance in Georgia, first appearing in east and central Europe however the grain needed a few thousand more years to cross into Italy, Greece, and Iran, and the earliest evidence for its cultivation in the Near East is a find in the ruins of Nimrud, Iraq dated to about 700 BC. While proso is not member of the Neolithic Near East crop assemblage, it arrived in Europe no later than the time these introductions did, and proso millet as an independant domestication could predate the arrival of the Near East grain crops.

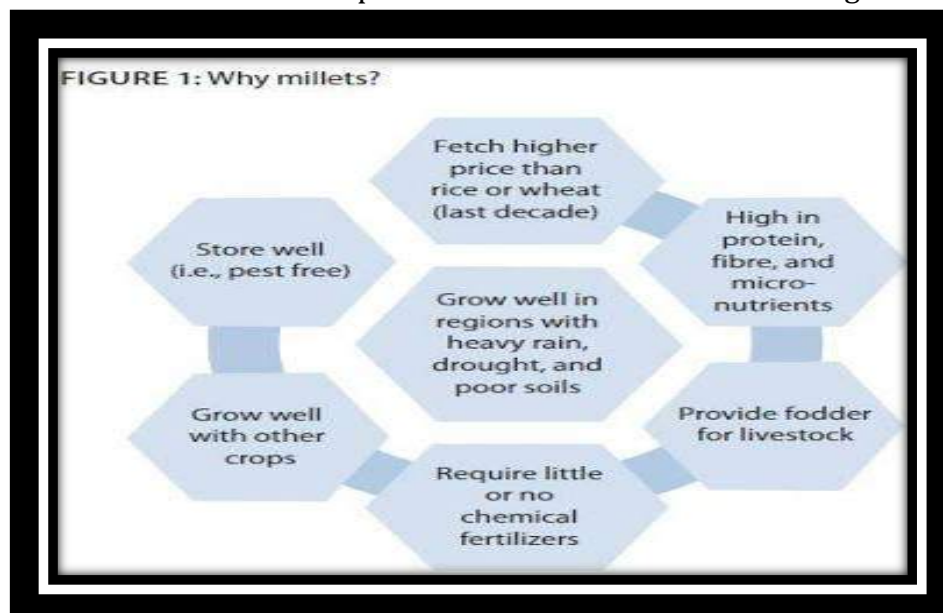


Fig.2. Shows about millets characteristics

NUTRIENT COMPOSITION OF PROSO MILLET

The proso millet seed coat contain calcium and protein more about 8mg and 12.5g. It also contain iron (0.8mg), fibre (2.2g), fat (3.5g) and minerals (1.9g). The proso millets consist of energy 364kcal. The important protein like thiamine, riboflavin and niacin also present in its seed coat. The concentration of thiamine, riboflavin and niacin is 0.41mg, 0.28mg and 4.5mg. In this fig proso millet Nutritional contents is shows to @ 12.5 protein and @ 14 calcium contents to crop nutrition in millets .

Crop/Nutrituent	Protein (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1		15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Fig.3. Nutritional contents in millets

PROCESSING AND UTILIZATION

There are various processing and utilization methods for small millets (Proso, Finger, barnyard, kodo etc). A brief discussion on are as given below:

Milling, roasting, soaking, malting, germination and fermentation have been found to reduce phytic acid and tannin contents of millets. The nutrient content of millet grain is relatively poor after milling but the bioavailability of certain nutrients, such as iron improves considerably.

Milling:

Milling to separate the seed coat or decortication reduces protein, dietary fibre, vitamins and mineral contents of the grains to some extent but this is compensated by better consumer acceptability, improved bioavailability of the nutrients and enhanced product making qualities. The bran fraction from pearl millet and some of the small millets is very good source of dietary fibre and edible oil. Hence, it can serve as an extender to the rice bran for oil extraction. The deoiled millet bran may be used as source of dietary fibre in formulating high-fibre foods as it contains negligible or less of silica compared to de-oiled rice bran.

Popping:

Popping is one of the traditional and popular dry-heat (high temperature short time – HTST) processing methods followed to prepare ready-to-eat products. Popped grains serve as snacks after seasoning and can be used for preparation sweet meats such as laddu or sattu and chikki etc. Popped grains can be blended with toasted or puffed legumes, oilseeds and jaggery or sugar to prepare delicious and nutritionally balanced convenience supplementary foods. The snacks and supplementary foods from them will be nutritionally superior over similar products from rice and wheat.

Expanded grains:

Expanded products which resemble rice poori or murmura are the new generation snacks from millets. Expanded grains are novel and high value products and can find application as ingredients for snacks and crispy in confectioneries as well as thickener in soup mixes.

Flaking:

Cereal flakes are of three kinds in India and their methods of preparation include use of edge runner, roller flaker and extrusion cooker and flaker. The process of flaking gelatinizes the starch and also inactivates the lipase. Hence, the flakes are RTE products. They normally have better shelf-life.

Malting and Brewing:

Malting is one of the very early biotechnological processes adopted for cereal processing for food and brewing. Although, barley has the place of pride for malting, sorghum and finger millet malting is also practiced extensively. Finger millet malting is mostly followed in India for specialty food product formulations. Pearl millet has very limited scope for malting as the malt will have poor keeping quality; likewise, other minor millets are at disadvantage because of the low level hydrolytic enzymes in their malts. Malted finger millet being a good source of amylases and micro-nutrients is termed as “Amylase Rich Food” (ARF).

Pasta/Vermicelli/Noodles:

Pasta and vermicelli/noodles are generally prepared from wheat because of the beneficial properties of gluten. Hence, the flours or the fine semolina from millets need special pre-treatment to partially gelatinize the starch to extrude into strands. Very often some kinds of functional ingredients such as gums are also used to facilitate binding. However, efforts to prepare noodles from these grains have not been fruitful till date and the composite flour consisting of wheat and millets are used for the purpose. Such products are marketed in Karnataka and Tamil Nadu.

Bakery products:

Composite flours consisting of wheat blended with 20 - 30% millets could be used for preparation of such products without affecting the texture and taste. In fact, the products from the composite flour would be nutritionally superior to wheat-based products due to the phytochemical content of millets.

Papad and Such Other Meal Adjuncts:

Papad, sandige, murukku, chakkuli and such other products prepared normally at home or cottage industry level are important adjuncts in the Indian diets. Papads

from finger millet are popular. Millets flours suitably blended with legumes (moong bean or horse gram) can be sheeted and cut into products of required shape and size, and can be toasted or deep oil fried or blistered in hot air to prepare ready-to-eat multi-grain snack products.

Extrusion Cooking:

Extrusion-cooked products being of RTE nature will have greater scope for use as weaning and supplementary foods. With these technologies, it is possible to prepare multigrain snacks or supplementary foods or health bars. Extrusion cooking has very high potential for production of pet foods, the demand for which is expanding in the country.



Fig.4. Uses of proso millet

HEALTH BENEFITS

There are many health benefits in proso millets. They are as follows:

- Lignans, an essential phyto nutrient present in millet, are very beneficial to the human body. Under the action of interstitial friendly flora, they are converted to mammalian lignans, which act against different types of hormone-dependent cancers, like breast cancer and also help to reduce the risk of heart disease.
- Regular consumption of millet is very beneficial for post menopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels.
- Children's intake of whole grains like millet and fish has been shown to reduce the occurrence of wheezing and asthma.
- A high source of fiber, millet is very beneficial against breast cancer in post-menopausal women.
- According to research and recent studies, consumption of millet can help women combat the occurrence of gallstones, as they are a very high source of insoluble fiber.

- This form of cereal grain is very high in phosphorus content, which plays a vital role in maintaining the cell structure of the human body. The key role of this mineral is that it helps in the formation of the mineral matrix of the bone and is also an essential component of ATP (adenosine tri-phosphate), which is the energy currency of the body.
- A single cup of millet provides around 24.0% of the body's daily phosphorus requirement. This mineral is a very important constituent of nucleic acids, which are the building blocks of genetic code.

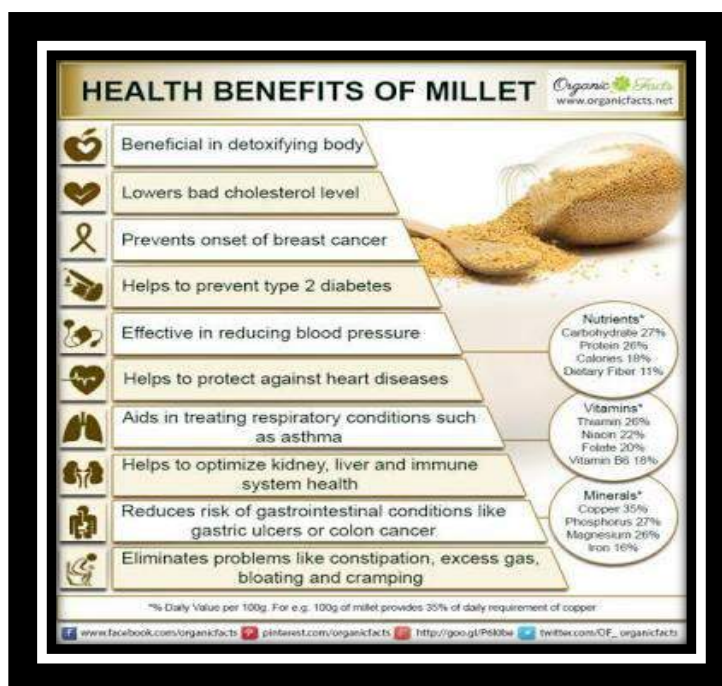


Fig.5. Shows health benefits of millet

CONCLUSION

Proso millets, which are a treasure trove of health-promotive phytochemicals, have invited lot of attention for their potential role as functional foods. Being non-glutinous, proso millets are safe for people suffering from gluten allergy and celiac disease. They are non-acid forming, and hence easy to digest. They are also non-allergenic. Processing methods like soaking, malting, decortication, and cooking affect anti-oxidant content and activity. Proso millets have potential for protection against age-onset degenerative diseases. This is an area where more work is needed since these diseases are increasing in India. As the largest producer of proso millets, India can capture world market with appropriate, well-tested foods.

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Vegetable seed production: a remunerative business

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Seed is a key component amongst all inputs for sustainable crop production. It's the foremost important commodity for the superior vegetable production. As Indian population is increasing abruptly, to meet the demands of ever increasing population we have to increase the production and productivity of vegetable crop which can be achieved by use of quality seed for vegetable production. The growth of urbanization and industrialization ultimately put high pressure on the land so it's not possible to increase the area under vegetable cultivation but we can put our best efforts in the production of high quality vegetable seeds. The availability of quality seeds at time and with affordable price is still a matter of great concern. So, to overcome these problems we have only one way is to enhance our vegetable seed production.

PRESENT SCENARIO

Indian seed industry has been growing amazingly in quantity and value over the past fifty years. Both public and private sector are actively involving in quality seed production. The private sector comprises around 150 seed companies of national and foreign origin. Indian seed market has grown at 12% rate while the Indian vegetable seed market is growing at a rate of 10-15% in a year.

Factors promoting vegetable seed industry in India

- 1) **Easy and cheap labor availability:** India is having huge human resources availing at reasonably cheaper rates. This is attracting various corporate sectors of national and international origin to invest in seed business in India.
- 2) **National and International market:** High profits in vegetable cultivation create huge demand for vegetable seed in the market. Vegetable seeds of either OPV or hybrids from India are having cosmic demand in foreign countries
- 3) **Different Climatic Conditions:** India is blessed with assorted agro climatic conditions ranging from tropical to temperate which make possible the cultivation and seed production of all vegetables belonging to different temperature regimes.
- 4) **Good Income generation:** Seed production of vegetables is a highly remunerative business. Hybrid seed production of sweet pepper is generating an

income of 136000 INR per 0.75 acre followed by hot pepper generating an income of 41500 INR per 0.25 acre.

Employment generation through hybrid seed production in tomato and okra (M-Male, F-Female)

Operation	Tomato					Okra				
	Own		Hired		Total	Own		Hired		Total
	M	F	M	F		M	F	M	F	
All cultural	45.4	10.3	55.8	67.6	178.9	57.9	21.4	18.1	69.1	166.5
Emasculatio & crossing	5.5	21.3	11.3	275.5	313.6	6.67	11.6	1.4	257.2	276.9
Processing & packaging	3.6	5.8	37.1	73.9	120.4	7.6	10.8	2.4	85.9	106.8
Total	54.4	37.7	104.2	416.9	613.3	72.2	43.8	21.9	412.2	550.2

Maintaining proper isolation distance is a must for obtaining pure seeds of any particular variety. The isolation distance is decided based on the nature of pollination in a particular crop and the class of seed being raised. The recommended isolation distances for different vegetables are provided in the following table:

Sr. No.	Vegetable Crops	Minimum isolation distance (m)	
		Foundation seed	Certified seed
1.	Tomato	50	25
2.	Brinjal	200	100
3.	Cucurbits	1000	500
4.	Carro	1000	800
5.	Onion	1000	500
6.	Colecrops, Radish	1600	1000
7.	Pea, cowpea	10	5
8.	Chili, capsicum, okra	400	200

The method of cultivation for seed production is nearly the same as that of cultivation for vegetable production. However, the care must be taken to maintain the specified isolation distance, about sowing and transplanting time, seed rate, planting distance & fertilizers. Rouging of seed crop throughout the crop period is must to maintain true to the type plants.

Time of nursery sowing and transplanting in transplanted seed crops in Northern Plains

S.No.	Vegetable crop	Time of nursery sowing	Time of transplanting
1.	Tomato	September	October
2.	Brinjal	July	August
3.	Chilli	July	August

4.	Cauliflower Early	June-July	July- August
	Cauliflower Mid	Aug.- Sep.	Sep.- Oct.
5.	Onion Kharif	June	August (Bulbs are harvested and planted in Nov.)
	Onion Rabi	November	January (Bulbs are harvested in April-May, stored for about 5-6 months and planted in Nov.)

HARVESTING STAGE AND SEED EXTRACTION

Individual plants with good fruiting should be marked and ripe fruits be collected for seed purpose.



Tomato extraction



Brinjal fruit fermentation



Pea planting for threshing



Optimum harvest stage



Okra ready for harvest



Umbels of carrot crop

Important roging stages & permitted off types for production of different vegetable seeds

Vegetable Crops	Min. number of field inspections and roging stages	Off type (%) Max. permitted	
		F	C
Tomato	3: 1 st before flowering, second during flowering and the immature fruit stage and third at mature fruit stage	0.10	0.20
Brinjal	3: First before flowering, second during flowering and the immature fruit stage and third at mature	0.10	0.20

	fruit stage		
Cucurbits	3: First before flowering, second during flowering and the immature fruit stage and third during mature fruit stage	0.10	0.20
Okra	3: First before flowering, second at full flowering and fruiting and third at mature fruit stage.	0.10	0.20
Carrot	4: First 20-30 days after sowing, second at lifting and replanting, third at flowering and fourth at maturity to verify the true nature of umbels	0.10	0.20
Onion	4: (When seed crop is raised by the transplanting method) First early (2030 days after sowing), second when bulbs are lifted, third when bulbs are replanted and fourth at flowering	0.10	0.20
	3: (When seed crop is raised by seed to seed method) First 20-30 days after sowing, second when bulbs are formed and third at flowering		
Chilli & Capsicum	3: First before flowering, second at flowering and third at the mature fruit stage	0.10	0.20

So, it can be concluded that vegetable seed business will ever have huge scope to success and will play an important role in economy in countries like India where the occupation of majority of the people is agriculture. There is a greater need to make available quality seeds to the farmers in time and in sufficient quantity at reasonable prices. Seed laws are to be implemented strictly to ensure supply of quality seeds and to protect the farmers from spurious seeds. Government has to reduce limits on import and export of quality seeds and planting materials. Policy making and implementations shall be free from political motivations. Strengthening of public sector in R&D is needed to compete with private seed companies so as to provide good quality seeds to the farmers at cheaper rates.

Goat and Goat milk production as source of Indian farmers

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Goat (*Capra aegagrus hircus*) is one of the first domesticated animals for rural people. Goats are mostly kept for meat and milk production because these products have high nutritional qualities, providing high quality protein, fat, carbohydrates, vitamins and several minerals. These animals play a crucial role in the rural economy of India as well as in many tropical countries. Goats are recognized as the most effective livestock for promoting health and economy of poor people in the developing countries of the world (Mandal *et al.*, 2005). Goats are considered as the poor man's cow (Haenlein, 2004). A family with just two goats, can have sufficient milk throughout the year.

GOAT PRODUCTION IN INDIA

It is estimated that there are 102 descript breeds and types of goats in the world, 95% of them are in developing countries (Banerjee, 2006). There are 20 breeds of goats in India (Banerjee, 2006) although 70% of their population are non-descript and meat type, however, some of the Indian breeds such as Jamunapari, Barbari, Beetal, Surti and Jarkhana produce fair amount of milk in India (Pal *et al.*, 2011). For production of meat are Black Bengal, Sirohi, Jhakrana, Osmanabadi, Sangamneri etc. Goat manure is rich in nitrogen, phosphorus and potassium and is excellent manure for agricultural production. Dairy production from goats has become a more commercialized in some regions such as Europe, Oceania, North and South America (Silanikove *et al.*, 2010).

FEEDING SYSTEM

Goat feeding management is very important and big challenging task from birth of goat to end. If you are raising goat on commercial scale, it is very important to choose goat feed which covers all proteins, nutrient and minerals in correct direction. If organic feed is provided for goats, they raise very healthy and produce fair amount of milk and meat. The following feed can be fed to goats:

The fodder crops: Maize, Jower, Cowpea, Pea

Tree leaves: Kodukapuli, Arasu, Jackfruit, Mango, Subabool, Mulberry, Neem etc.

Concentrate feed ingredients: Sorghum, Maize, Broken rice, wheat, Groundnut cake etc.

Agricultural by-products: Cabbage, Carrot, Radish, Cucumber etc.



Feeding equipment

Feeding equipment can be used to reduce the losses of feed. There are different feeding equipment as follows

Feed storage containers: Food buckets, Water buckets, Hay manager, Mineral feeder

GOAT MILK AND ITS IMPORTANCE

Goat milk can be considered as a replacement for human milk or cow milk, especially if there are signs of allergy to cow milk. In some cases where the baby has reacted adversely to mother's milk, the replacement of cow milk by goat milk in the diet of the mother has been beneficial (www.dairygoat.co.za). Goat milk proteins are digested more readily and their amino acids absorbed more efficiently than amino acids of cow milk (Jenness, 1980).

Some physico-chemical properties of goat milk such as smaller fat globules and have a greater surface area, higher percent of short and medium chain fatty acids and softer curd formation of its proteins are advantageous for higher digestibility and healthier lipid metabolism relative to cow milk (Park, 1994; Jandal, 1996). Therefore, goat milk is recommended for infants and people who are allergy and difficulty in digesting in cow milk. In India, goat milk is either consumed as such or mixed with cow or buffalo milk and then sold. As a result, surplus goat milk is rarely available for processing into different milk products. However, goat milk has been used successfully for preparation of various products like cheese, yoghurt, butter *etc.*

MEDICINAL ASPECTS OF GOAT MILK

1. Goat milk is very useful for people suffering from problems such as acidity, eczema, asthma, migraine, colitis, stomach ulcer, digestive disorder, liver and gallbladder diseases and stress-related symptoms such as insomnia, constipation and neurotic indigestion (Babayan, 1981; Reddy *et al.*, 2014).
2. Patients suffering from these diseases may turn in future to goat milk and its products to solve their problems.

Cosmetic products of goat milk

1. Recently a high volume of cosmetic products are produced from goat milk, including soaps, creams, body lotions, shampoos, hair conditioners and after shave lotions, which are marketed in countries such as USA and Switzerland (Reddy *et al.*, 2014 Reddy *et al.*, 2014; Ribeiro and Ribeiro, 2010), but not in India.



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Heat Stress in Dairy Cattle- a challenge to animal production

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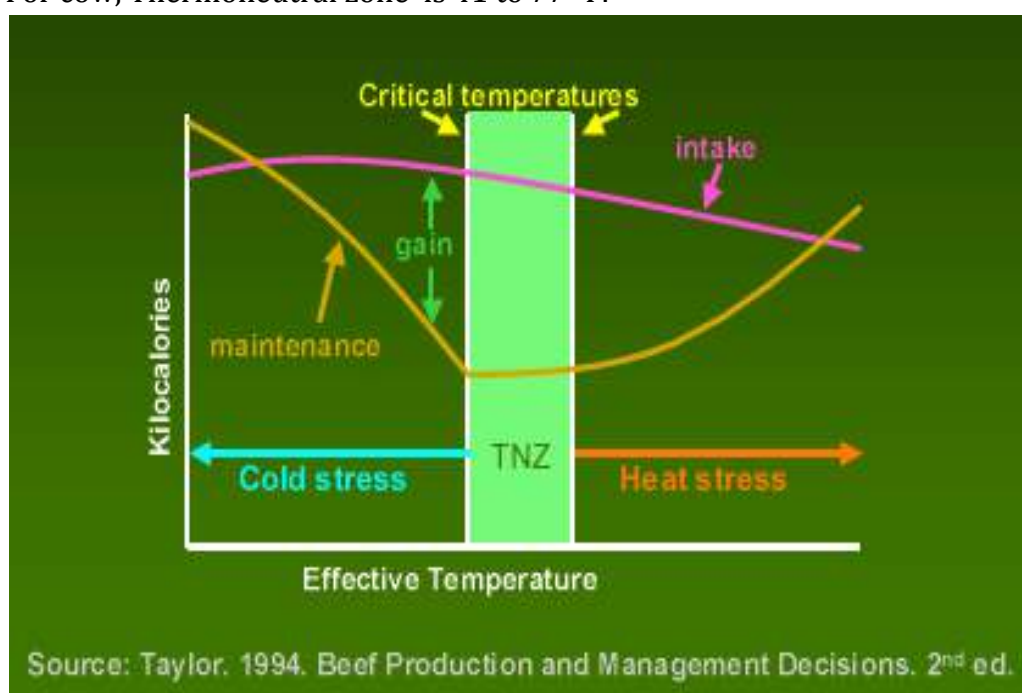
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It is now accepted that heat stress is one of the main factors that is causing huge loss in animal production and profits. Due to global warming day by day it is emerging as a big challenge to animal production in the livestock sector.

INTRODUCTION

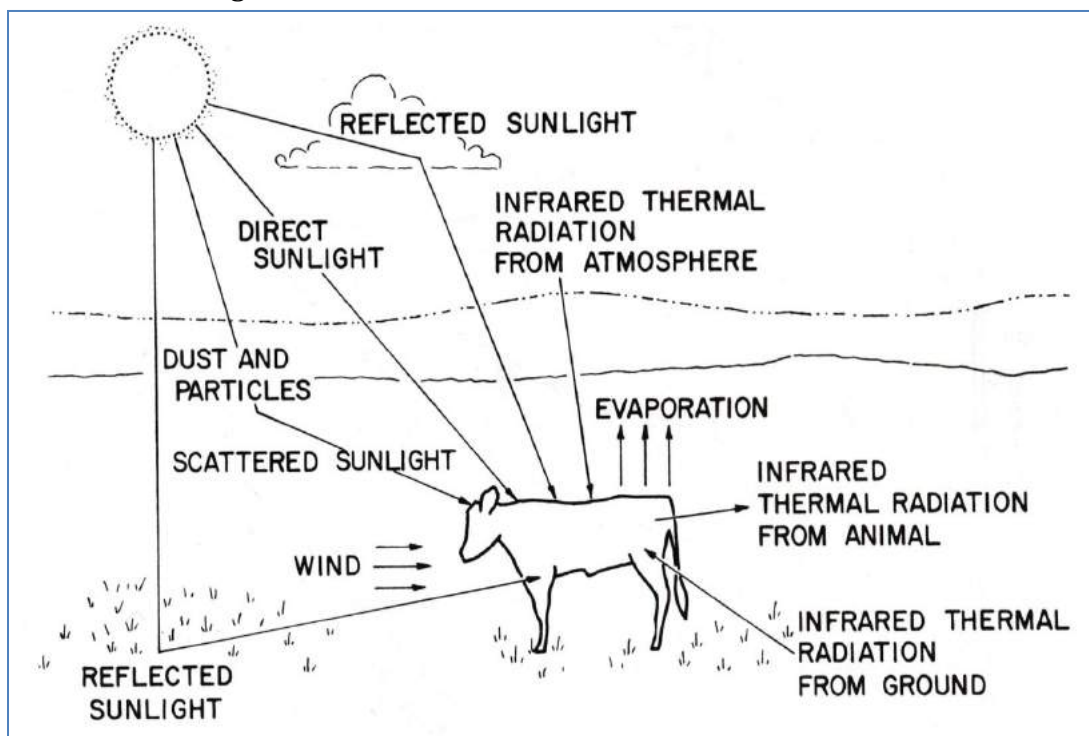
Heat stress occurs when physiological strain is placed on the body due to overexertion and overexposure to any combination of excessive environmental factors (such as temperature, humidity, radiation and wind producing conditions) that are higher than animal's thermoneutral zone.

- ❖ Thermoneutral zone - Environmental temperature at which an animal's body is at equilibrium; i.e., neither tends to gain or lose heat.
- ❖ For cow, Thermoneutral zone is 41 to 77° F.



What is heat stress?

- The point at which a dairy cattle cannot dissipate an adequate quantity of heat to maintain body thermal balance or normal body temperature, is called heat stress.
- Heat stress occurs when heat is absorbed from the environment faster than the body can get rid of it.
- In it rate of heat gain is faster than the heat loss.



Temperature Humidity Index (THI)

It accounts for the combined effects of environmental temperature and relative humidity.

$$\text{THI} = 0.72 (C_{\text{db}} + C_{\text{wb}}) + 40.6 \text{ (NRC, 2001)}$$

where, C_{db} = dry bulb temperature ($^{\circ}\text{C}$)

C_{wb} = wet bulb temperature ($^{\circ}\text{C}$)

- THI should be **below 72**.
- THI **exceeds 72**, cows are likely to begin experiencing heat stress and their **calf rates will be affected**.
- THI **exceeds 78**, cows **milk production is seriously affected**.
- THI rises **above 82**, very significant losses in milk production are likely, cows show signs of severe stress and many **ultimately die**.

FACTORS THAT CONTRIBUTE TO HEAT STRESS

- Types of work activity
- Surrounding air temperature/humidity level
- Physical condition of animal
- Inadequate cooling off or rest period
- Insufficient water consumption

- Climatic conditions (such as low air movement, high humidity levels and high air temperature.)

BEGRADED PHYSIOLOGY OF HEAT STRESS

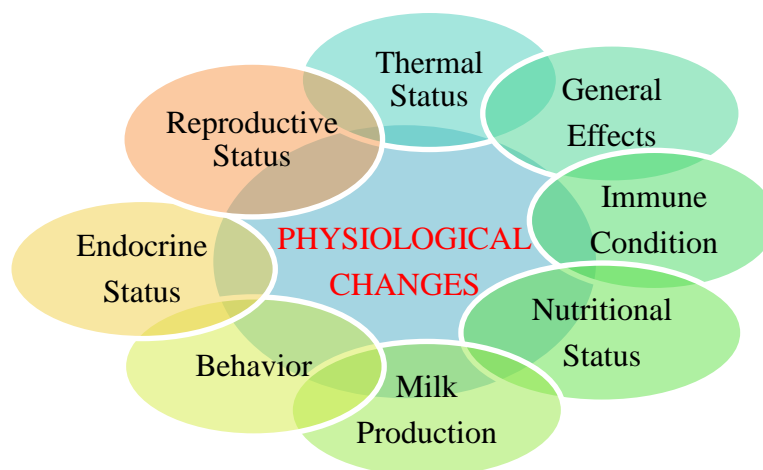
The body reacts to heat by increasing blood flow to the skin surface, and by sweating. The heat is carried to the surface of the body from within by the increased blood flow and sweat evaporates from the surface of the body and results cooling. If the body is gaining more heat than it can lose, the deep body temperature will continue to rise. Eventually it reaches a point of body's control mechanism itself fails, leads to disturbance in various systems of body.

HEAT STRESS IN DAIRY CATTLE

- The **optimal temperature range for dairy cows in Indian condition is between 15 and 28°C.**
- Heat stress starts at 24°C , and above 28°C there are significant physiological changes in the cattle.
- Milk production may decrease as 50% .
- Reproductive proficiency of cows is greatly diminished.
- 10 to 20% of inseminations in heat stressed cows result in pregnancies.
- The cow generates heat + **water vapour (15litre water vapour per day at 1°C and 30 lit. water vapour at 26° C).**

PHYSIOLOGICAL CHANGES DUE TO HEAT STRESS IN DAIRY CATTLE

Heat stress causes disturbances in the physiological mechanism of the animal's body which brings various changes in the animal regarding its health and performances. They are menti



Problems from heat stress

Physiological changes due to heat stress causes several problems in the dairy cattle. They are –

THERMAL STATUS	GENETIC EFFECTS
<ol style="list-style-type: none"> 1. ↑ Core Body Temperature – rumen – tympanic – intraperitoneal <ol style="list-style-type: none"> A. Total Body Heat Content 2. ↑ Respiration Rate and Respiratory Evaporative Heat Loss 3. ↑ Skin Temperature, Blood Flow, and Sweat Rate <ol style="list-style-type: none"> A. Blood Flow to Internal Organs 4. Salivation, Drooling, and Panting Rates 5. ↓ Metabolic and Heat Production Rates 6. ↓ Heat Loss via Radiant, Conductive, and Convective Avenues 7. ↑ Dehydration 	<ol style="list-style-type: none"> 1. ↑ Impact Other Stressors 2. ↑ Heart and Pulse Rates 3. ↑ Hyperventilation - <ol style="list-style-type: none"> A. ↓ Blood Carbon Dioxide B. ↓ Blood Bicarbonate C. ↓ Blood Buffering Capacity D. ↑ Respiratory Alkalosis 4. ↑ Urinary Sodium and Bicarbonate Excretion 5. ↓ Hepatic Portal Blood Flow 6. ↑ Hepatic Vitamin A Storage 7. ↑ General Vitamin E Deficiency
ENDOCRINE STATUS	IMMUNE STATUS
<ol style="list-style-type: none"> 1. ↓ Hormones Linked to Metabolism – Thyroxine, Somatotropin, Cortisol 2. ↑ Hormones Linked to Water and Electrolyte Metabolism – Antidiuretic Hormone, Aldosterone 3. ↑ Catecholamines – Epinephrine and Norepinephrine 4. ↑ Prolactin and ↓ Prolactin Receptor Numbers 5. ↑ Leptin 6. ↑ Insulin >> ↓ Blood Glucose 	<ol style="list-style-type: none"> 1. ↓ Immune Function 2. ↑ Susceptibility to Parasitic and Non parasitic Diseases 3. ↑ Mastitis 4. ↑ Somatic Cell Count 5. ↑ Plasma Antibody - Immunoglobulin Concentration 6. ↑ Death

MILK PRODUCTION	BEHAVIOUR
<ol style="list-style-type: none"> 1. ↓ Milk Production 2. ↓ Mammary Blood Flow 3. ↓ Mammogenesis 4. ↓ Lactation Peaks 5. ↓ Milk Component Levels 	<ol style="list-style-type: none"> 1. Grazing Time 2. ↑ Lethargy 3. ↑ Shadow or Shade Seeking 4. ↑ Body Alignment with Solar Radiation 5. ↑ Standing Time 6. ↑ Crowding Water Trough and Splashing 7. ↑ Agitation and Restlessness
NUTRITIONAL STATUS	REPRODUCTIVE STATUS
<ol style="list-style-type: none"> 1. ↓DMI, Weight Gain or Growth, Condition Score, and Blood Glucose Level 2. ↑Energy Requirement for Maintenance 3. ↑Salivation <ol style="list-style-type: none"> A. ↓Saliva to Rumen B. ↓Salivary Bicarbonate Pool for Rumenal Buffering C. ↓ Rumen pH D. ↑Acidosis 4. ↑Potassium Loss from Skin 5. ↑Dietary Requirements for Potassium and Sodium 6. ↑Urinary Nitrogen Loss 7. ↑Water Intake 8. ↓Rumination <ol style="list-style-type: none"> A. ↓ Gut and Rumen Motility B. ↓ Gut Passage Rate C. ↑ Gut Fill D. ↓ Rumen Volatile Fatty Acid Concentration E. ↑ Acetate to Propionate Ratio 	<ol style="list-style-type: none"> 1. ↓ Breeding Efficiency and Conception Rate 2. ↑ Fetal and Postnatal Mortalities + ↓ Calf Birth Weight 3. ↓ Semen Quality <ol style="list-style-type: none"> A. ↓ Spermatogenesis B. ↓ Sperm Motility C. ↑ Percent Abnormal and Aged Sperm 4. ↓ Estrous Activity <ol style="list-style-type: none"> A. ↓ Estrous Duration B. ↓Heat Detection 5. ↓ Uterine Blood Flow <ol style="list-style-type: none"> A. ↓ Placental Weight and Growth + ↑ Retained Placenta B. ↓Gestation Period C. ↑ Labor and Delivery Difficulties 6. ↓ Follicular Development <ol style="list-style-type: none"> A. ↓ Oocyte quality B. ↑ Multiple Ovulations and Twinning ↓ Corporea Lutea Size 7. Biochemical Changes <ol style="list-style-type: none"> A. ↓ Plasma LH, B. ↑ Ketone and NEFA Levels at Calving C. ↓ Thyroxine During Pregnancy D. ↑ Plasma Progesterone During Late Gestation

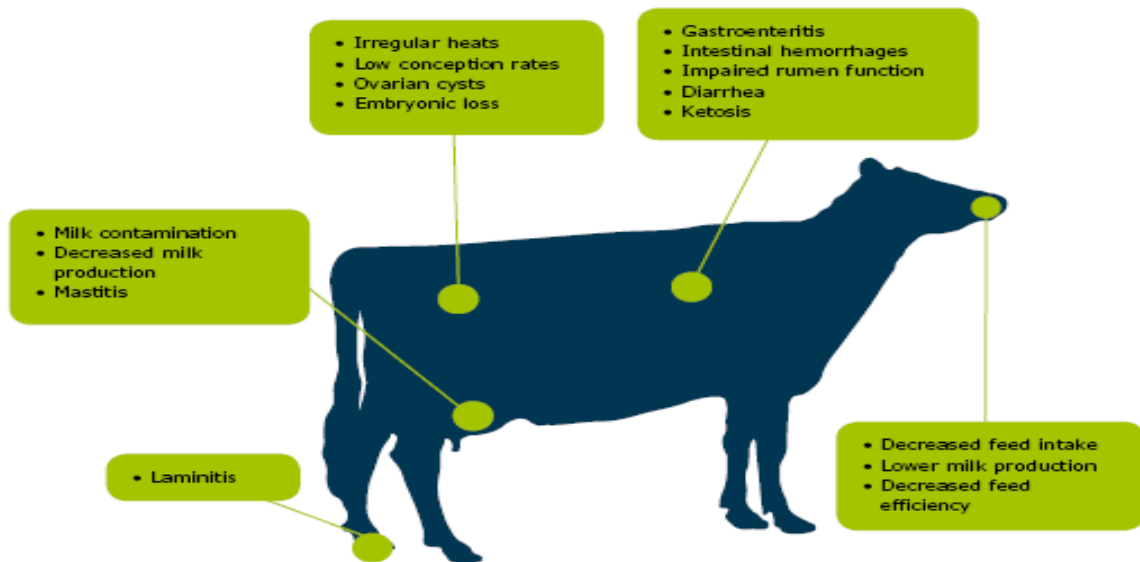


Fig. 1: PHYSIOLOGICAL CHANGES DUE TO HEAT STRESS IN DAIRY CATTLE

CONCLUSION

Heat stress makes an uncomfortable environment for the dairy cattle which hampers its production, performances and health. It is really a challenge for the livestock owners to maintain their animals during severe hot (high environmental temperature) and humid conditions.

Eat more carrots: a way to healthy life

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India is one of the fastest growing countries in terms of economics and population, with population of 1.34 billion and rising at 1.5%–1.7% annually. With the increasing population and with limited land area it is very difficult to feed the abruptly growing population. Due the lack of food as well as nutrients in food a group of people living below poverty line, mostly suffered from malnutrition which leads to various diseases. Malnutrition refers to the situation where there is an unbalanced diet with respect to nutrients. In spite of India's 50% growth in GDP since 1991, more than 1/3rd of the world's malnourished teenagers live in India.



According to the report of Global Hunger Index (GHI) 2017 India ranked 97th out of 118 countries with a severe hunger condition and within South Asian nations, it ranks 3rd after only Afghanistan and Pakistan with a GHI score of 29.0. India is one of the top ranking countries in the world in terms of number of children suffering from malnutrition according to World bank and it is nearly double that of Sub Saharan Africa.

It's the need of the hour that we have to produce more from the less land with the use of high productive varieties and hybrids. Our food products should be full of nutrients which can eradicate malnutrition from India. Vegetables have the potential to overcome the nutrient deficiency in the human diet. There are number of vegetables which can be use as raw or can be cooked, out of these carrot is one of the important root crop grown mostly on all the parts of India

So, as the winter is coming and there are many food items available in this season. The seasonal fruits and vegetables are more nutritive than if they consume in

odd season. Likewise it's the season for the growing of different colored carrots. In this season carrot can be consume in various forms like cooked, juice, pickle and *kanji*. The carrot is an herbaceous plant containing about 87% water, rich in mineral salts and vitamins (B, C & E). Carrots are an excellent source of vitamin A, vitamin C, calcium and iron. The health benefits of carrots include reduced cholesterol, prevention from heart attacks, warding off of certain cancers, improved vision and reduced signs of premature aging. Carrots also contain fiber, vitamin K, potassium, folate, manganese, phosphorous, magnesium, vitamin E and zinc. In order to assimilate the greatest quantity of the nutrients present in carrots, it is important to chew them well - they are the exception to the rule - they are more nutritious cooked than raw.

As carrot have immense nutrients and can be very helpful for the human to overcome the hunger as well as malnutrition from the diet so here **given below are some benefits of this vegetable** to improve the overall health of the population.

- **Carrot juice:** It is an excellent drinkable source of potassium. Potassium is very important in helping to maintain a healthy electrolyte balance and fluid level in the cells of your body. It's also necessary in muscle movement, such as contraction, as well as neurotransmission. Potassium deficiencies are very bad for your body, with such effects as Hypokalemia, acne, muscle spasms, dry skin, and elevated cholesterol levels. Carrots juiced with celery or turnips can provide your body with a large intake level of potassium.
- **Strong immune system:** Carrots are rich in alkaline elements which purify and revitalize the blood. Carrot contains many such nutrients which helps to keep the immune system strong out of these vitamin A is one of the essential nutrient for the proper functioning of the immune system. This nutrient keeps the skin and cells in proper functioning, digestive tract and urinary tract healthy, so they action as obstacles and form the body's first line of defense against infection.
- **Prevention from Diabetes:** Carrots are good for blood sugar regulation due to the presence of carotenoids in this delicious vegetable. Carotenoids inversely affect insulin resistance and thus lower blood sugar, thereby helping diabetic patients live a normal, healthy life. They also regulate the amount of insulin and glucose that is being used and metabolized by the body, providing a more even and healthy fluctuation for diabetic patients.



- **Carrots are naturally low in salt:** High or low blood pressure is the very common problem at present caused by several factors. To stay fit and to

decrease risk of getting high blood pressure, nutrition specialists recommend having no more than 6g of salt a day. Carrots are naturally low in salt. An 80g serving of cooked carrots contains just 0.1g salt, providing you haven't added salt to the cooking water.

- **Carrots are low in saturates and fatty content:** According to health experts, to keep our heart healthy we should eat less saturated and fat meal. This makes carrots a great option to maintain healthy heart. An 80g serving of cooked carrots contains 0.1g saturates and 0.3g fat only.
- **High fiber content:** The high soluble fiber content in carrot, it reduces cholesterol by binding Low Density Lipids (LDL), the bad cholesterol, and also increases the High Density Lipids (HDL) which helps in reducing blood clots and heart diseases. High fiber content in food is very essential for the healthy digestive system. Fiber also helps you to feel filled for longer so that you find it easier to maintain your weight. An 80g serving of cooked carrots contains 2g fiber – more than a 10th of the recommended daily amount for adults.
- **Boost intake of vitamin A:** Carrots are filled with a nutrient called beta carotene, which is converted into vitamin A by the body. Vitamin A helps in the growth of healthy bones and teeth. Many children and adults have poor intakes of vitamin A nutrient. Carrots are actually one of the best sources of beta carotene. An 80g serving of cooked carrots contains more than twice the Recommended Daily Amount (RDA) of vitamin A equivalent needed by adults.
- **Improve dark vision:** Carrots have the properties which enables the eyes to make a clear vision in the night. Beta-carotene found in huge amounts in carrots which are further converted into vitamin A in the body and this vitamin is vital for strong vision. Vitamin A works its eye health by being transformed into a purple pigment called rhodopsin in the retina, and this pigment is essential for vision in dim light.
- **Get younger-looking skin:** Carrots, when consumed on a daily basis, beta-carotene can help to shield skin from extreme ultra-violet (UV) radiation and sunburn. Carrots are rich in beta carotene which is a powerful antioxidant which helps in maintaining a healthy skin and also keep one away from many diseases. Antioxidants are very essentials to destroy the free radicals in the body which leads to ageing.
- **Cooking of carrots:** If your family members only want to eat crushed carrot, its good from nutritional point of view *i.e.* it's a nutritional bonus. Study shows more beta carotene is absorbed from cooked carrots than from raw ones.

Carrots have antiseptic qualities and can, therefore, be used as laxatives and as a remedy for liver conditions. Carrot oil is good for dry skin because it makes the skin softer, smoother and firmer. Furthermore, carrot juice improves stomach and gastrointestinal health. Thus, carrots, as raw fruits, juice or in cooked form, are always a good choice for your health. Now, you know the health, beauty and hair benefits of carrots, so you must include it in your diet routine.

Proso millet or (cheena) is a important crop in indian farmer to unique nutrinalional qualities, health beneficial and doubling farmers income by 2022 **(*panicum miliaceum*)**

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Millets are minor cereals of the grass family, Poaceae. They are small seedbeds, annual cereals grasses, many of which are adapted to tropical and arid climates and are characterized by their ability to survive in less fertile soil millets include sorghum (jowar), pearl millet (bajra), finger millet (ragi), foxtail millet (kakun), proso millet (cheena), little millet (kutki), kodo millet (kodon), barnyard millet (sanwa) and browm top millet .

The total area of small millets in India is about 0.798 M hectare and production is 0.451M tons with the productivity of 565 kg per hectare (2011-12). Madhya Pradesh account 35.34% area of total small millets and 21.66% production of total small millets of India and productivity is 331 kg/ha. (2011-12).

Proso millet, with many common names including proso millet, broomcorn millet, common millet, broomtail millet, hog millet, red millet, and white millet, is a grass species used as a crop. Both the wild ancestor and location of the original domestication of proso millet are unknown, but it first appears as a crop in both Transcaucasia and China about 7000 years ago, suggesting it may have been domesticated independently in each area. It is still extensively cultivated in India, Russia, Ukraine, the Middle East, Turkey and Romania. In United States, proso is mainly grown for birdseed. It is sold as health food, and due its lack of gluten, it can be included in the diets of people who cannot tolerate wheat.

Proso millet is an annual grass whose plants reach an average height of 100 cm (4 feet).The seeds heads grow in bunches. The seeds are small (2-3 mm or 0.1 inch) and can be cream, yellow, orange-red, or brown in colour. Proso millet is well adapted to many soil and climatic conditions; it has a short growing season, and needs little water. It is an excellent crop for dryland and no-till farming.

HISTORY

Unlike the foxtail millet, the wild ancestor of the proso millet has not yet been satisfactory identified. Weedy forms of this grain are found in Central Asia, covering a widespread area from the Caspian Sea east to Xinjiang and Mongolia, and it may be that these semiarid areas harbour” genuinely wild P.miliaceum forms. This millet has been

reportedly found in Neolithic sites in Georgia(dated to the fifth and fourth millennia BC) by Linear Pottery culture(Early LBK, Neolithikum 5500-4900 BCE), as well as excavated Yangshao culture farming villages east in China.



Fig.1. Proso millet

Proso millet appears to have reached Europe not long after its appearance in Georgia, first appearing in east and central Europe however the grain needed a few thousand more years to cross into Italy, Greece, and Iran, and the earliest evidence for its cultivation in the Near East is a find in the ruins of Nimrud, Iraq dated to about 700 BC. While proso is not member of the Neolithic Near East crop assemblage, it arrived in Europe no later than the time these introductions did, and proso millet as an independant domestication could predate the arrival of the Near East grain crops.

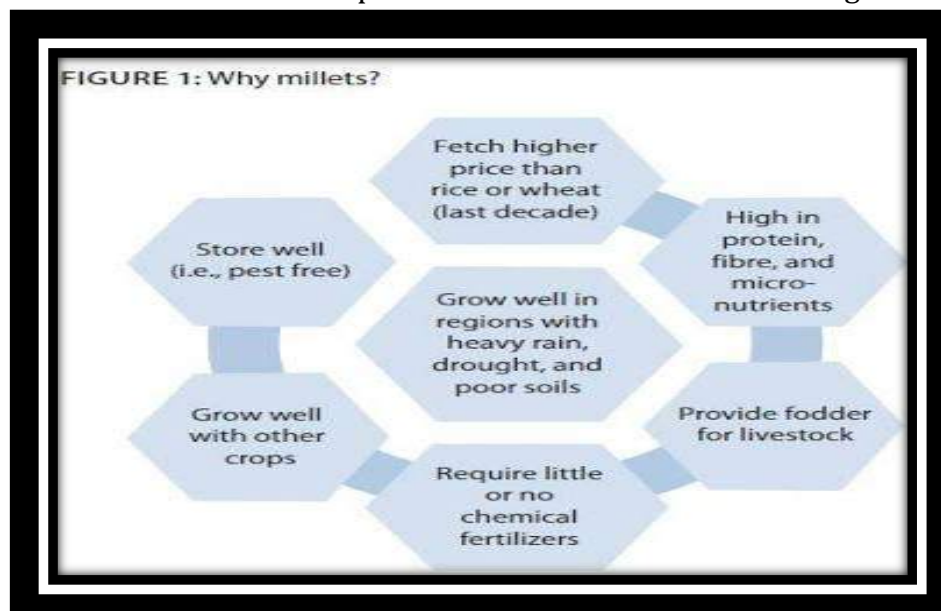


Fig.2. Shows about millets characteristics

NUTRIENT COMPOSITION OF PROSO MILLET

The proso millet seed coat contain calcium and protein more about 8mg and 12.5g. It also contain iron (0.8mg), fibre (2.2g), fat (3.5g) and minerals (1.9g). The proso millets consist of energy 364kcal. The important protein like thiamine, riboflavin and niacin also present in its seed coat. The concentration of thiamine, riboflavin and niacin is 0.41mg, 0.28mg and 4.5mg. In this fig proso millet Nutritional contents is shows to @ 12.5 protein and @ 14 calcium contents to crop nutrition in millets .

Crop/Nutrituent	Protein (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1		15.2	11
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Fig.3. Nutritional contents in millets

PROCESSING AND UTILIZATION

There are various processing and utilization methods for small millets (Proso, Finger, barnyard, kodo etc). A brief discussion on are as given below:

Milling, roasting, soaking, malting, germination and fermentation have been found to reduce phytic acid and tannin contents of millets. The nutrient content of millet grain is relatively poor after milling but the bioavailability of certain nutrients, such as iron improves considerably.

Milling:

Milling to separate the seed coat or decortication reduces protein, dietary fibre, vitamins and mineral contents of the grains to some extent but this is compensated by better consumer acceptability, improved bioavailability of the nutrients and enhanced product making qualities. The bran fraction from pearl millet and some of the small millets is very good source of dietary fibre and edible oil. Hence, it can serve as an extender to the rice bran for oil extraction. The deoiled millet bran may be used as source of dietary fibre in formulating high-fibre foods as it contains negligible or less of silica compared to de-oiled rice bran.

Popping:

Popping is one of the traditional and popular dry-heat (high temperature short time – HTST) processing methods followed to prepare ready-to-eat products. Popped grains serve as snacks after seasoning and can be used for preparation sweet meats such as laddu or sattu and chikki etc. Popped grains can be blended with toasted or puffed legumes, oilseeds and jaggery or sugar to prepare delicious and nutritionally balanced convenience supplementary foods. The snacks and supplementary foods from them will be nutritionally superior over similar products from rice and wheat.

Expanded grains:

Expanded products which resemble rice poori or murmura are the new generation snacks from millets. Expanded grains are novel and high value products and can find application as ingredients for snacks and crispy in confectioneries as well as thickener in soup mixes.

Flaking:

Cereal flakes are of three kinds in India and their methods of preparation include use of edge runner, roller flaker and extrusion cooker and flaker. The process of flaking gelatinizes the starch and also inactivates the lipase. Hence, the flakes are RTE products. They normally have better shelf-life.

Malting and Brewing:

Malting is one of the very early biotechnological processes adopted for cereal processing for food and brewing. Although, barley has the place of pride for malting, sorghum and finger millet malting is also practiced extensively. Finger millet malting is mostly followed in India for specialty food product formulations. Pearl millet has very limited scope for malting as the malt will have poor keeping quality; likewise, other minor millets are at disadvantage because of the low level hydrolytic enzymes in their malts. Malted finger millet being a good source of amylases and micro-nutrients is termed as “Amylase Rich Food” (ARF).

Pasta/Vermicelli/Noodles:

Pasta and vermicelli/noodles are generally prepared from wheat because of the beneficial properties of gluten. Hence, the flours or the fine semolina from millets need special pre-treatment to partially gelatinize the starch to extrude into strands. Very often some kinds of functional ingredients such as gums are also used to facilitate binding. However, efforts to prepare noodles from these grains have not been fruitful till date and the composite flour consisting of wheat and millets are used for the purpose. Such products are marketed in Karnataka and Tamil Nadu.

Bakery products:

Composite flours consisting of wheat blended with 20 - 30% millets could be used for preparation of such products without affecting the texture and taste. In fact, the products from the composite flour would be nutritionally superior to wheat-based products due to the phytochemical content of millets.

Papad and Such Other Meal Adjuncts:

Papad, sandige, murukku, chakkuli and such other products prepared normally at home or cottage industry level are important adjuncts in the Indian diets. Papads

from finger millet are popular. Millets flours suitably blended with legumes (moong bean or horse gram) can be sheeted and cut into products of required shape and size, and can be toasted or deep oil fried or blistered in hot air to prepare ready-to-eat multi-grain snack products.

Extrusion Cooking:

Extrusion-cooked products being of RTE nature will have greater scope for use as weaning and supplementary foods. With these technologies, it is possible to prepare multigrain snacks or supplementary foods or health bars. Extrusion cooking has very high potential for production of pet foods, the demand for which is expanding in the country.



Fig.4. Uses of proso millet

HEALTH BENEFITS

There are many health benefits in proso millets. They are as follows:

- Lignans, an essential phyto nutrient present in millet, are very beneficial to the human body. Under the action of interstitial friendly flora, they are converted to mammalian lignans, which act against different types of hormone-dependent cancers, like breast cancer and also help to reduce the risk of heart disease.
- Regular consumption of millet is very beneficial for post menopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels.
- Children's intake of whole grains like millet and fish has been shown to reduce the occurrence of wheezing and asthma.
- A high source of fiber, millet is very beneficial against breast cancer in post-menopausal women.
- According to research and recent studies, consumption of millet can help women combat the occurrence of gallstones, as they are a very high source of insoluble fiber.

- This form of cereal grain is very high in phosphorus content, which plays a vital role in maintaining the cell structure of the human body. The key role of this mineral is that it helps in the formation of the mineral matrix of the bone and is also an essential component of ATP (adenosine tri-phosphate), which is the energy currency of the body.
- A single cup of millet provides around 24.0% of the body's daily phosphorus requirement. This mineral is a very important constituent of nucleic acids, which are the building blocks of genetic code.

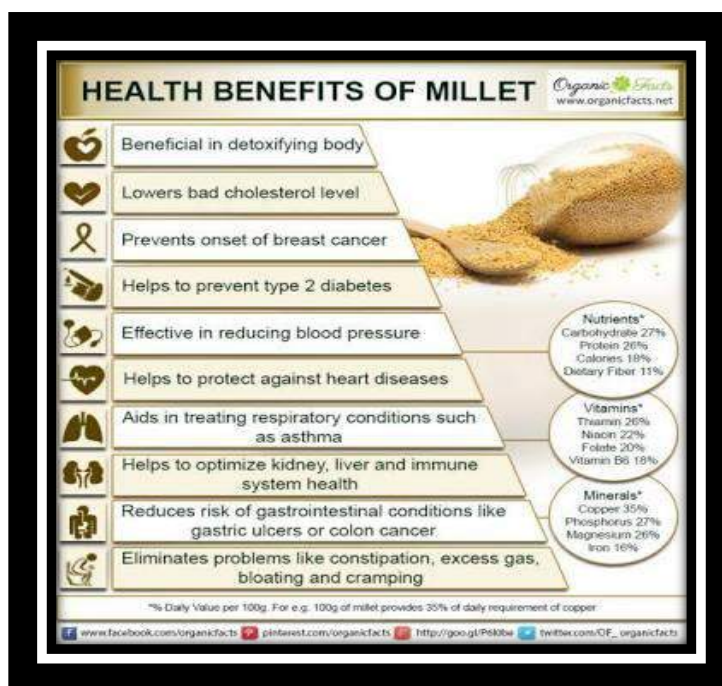


Fig.5. Shows health benefits of millet

CONCLUSION

Proso millets, which are a treasure trove of health-promotive phytochemicals, have invited lot of attention for their potential role as functional foods. Being non-glutinous, proso millets are safe for people suffering from gluten allergy and celiac disease. They are non-acid forming, and hence easy to digest. They are also non-allergenic. Processing methods like soaking, malting, decortication, and cooking affect anti-oxidant content and activity. Proso millets have potential for protection against age-onset degenerative diseases. This is an area where more work is needed since these diseases are increasing in India. As the largest producer of proso millets, India can capture world market with appropriate, well-tested foods.

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