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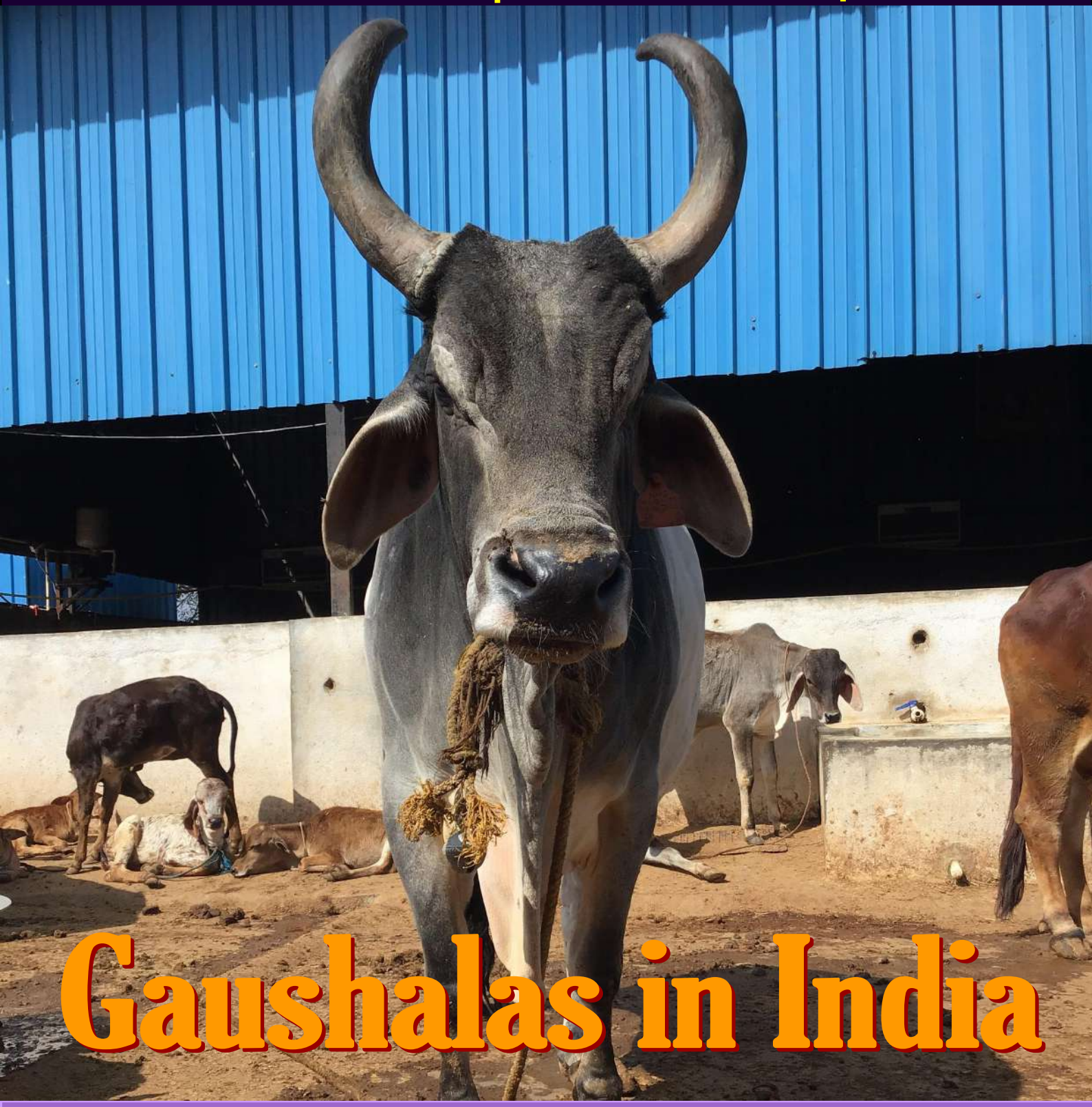

Gaushalas in India

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Employing environmentally safer and novel synthetic insecticides in organic farming for eco-friendly pest management

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ABSTRACT

The negative environmental impact of broad spectrum and highly persistent insecticides has led to a shift towards safer insecticides with novel modes of action, that include biopesticides and insecticides with mode of action other than nerve poisons. The biopesticides mainly include botanicals and microbials. These biopesticides have similar environmental impacts compared to conventional synthetic insecticides. Complete avoidance of synthetics in organic farming is a popular misconception. There is a need to evaluate the use of eco-friendly novel synthetic insecticides with newer mode of actions. The green labelled insecticides have increased toxicity towards target pests and safer to beneficial insects and environment. Novel insecticides like Spinosad and Emamectin benzoate are derived from actinomycetes. These insecticides with higher specificity and bio efficacy provide superior crop protection and serve as better alternatives in plant protection.

INTRODUCTION

In the last century, extensive use of persistent, broad spectrum and inexpensive pesticides in agriculture has led to severe concerns regarding public and environmental health. Then onwards, organic farming is gaining wider consumer acceptance and the acreage under organic farming is continuously increasing in the past few decades. This growth has substantial significance for plant protection. Despite preventive measures, pest outbreaks will significantly reduce the yield and quality of agriculture produce, thus making adoption of plant protection measures an important element of regulatory measures.

Pesticide free farming being considered as organic farming is a common misperception. The International Federation of Organic Agriculture Movements

(IFOAM) basic standards define organic farming as a systems approach resulting in 'a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice', which is 'more than a system of production that includes or excludes certain inputs. Organic farmers are allowed to use an array of synthetic chemicals, botanicals and microbial pesticides. Many sovereign organisations setting their own standards to define organic farming has resulted in such misinterpretation. For examples the European Union (EU) does not permit the nicotine-based products due to human toxicity, contrary to the United States (US) which allows the same.

Conventional biopesticides

The most commonly used biopesticides are grouped into two categories

1) Botanicals: derived from plants or their products
2) Microbials: derived from microorganisms or their products

Plants and plant derived products were extensively used in agriculture for insect pest management long before knowing the structure of chemicals present in them. The extracts from dried flowers of *Chrysanthemum cinerariifolium* or related Asteracae species contain active compounds (0.7-3%) which are known as pyrethrins and affect the insect's nervous system. Biopesticides are also derived from the Meliaceae family consisting of *Azadirachta indica* and *Melia azadirach*. The most active principle compound is 'Azadirachtin' which is a complex tetranortriterpenoid. Many beneficial effects of neem compounds such as pest repellence, feeding deterrence, disruption in growth and development, interference with reproduction and ovipositional deterrence have been observed against both sucking and chewing insect pests. Neemjal, Mahaneem, and Neem shakti are some commercially available neem-based pesticides.

The alkaloid derived from tobacco plants especially *Nicotiana tabacum* and *N. rustica* of Solanaceae is known as nicotine, which acts as a nerve poison and effective against many sucking pests. Derived from the roots or rhizomes of *Lonchocarpus*, *Derris* or *Tephrosia*, rotenone is an iso-flavonoid molecule which has insecticidal and acaricidal properties. It is available in 1-5 % dust formulations. It is a contact and stomach poison effective on a wide range of pests including caterpillars, aphids, thrips and other pests found on fruits and vegetables.

Majority of microbial biopesticides are derived from microorganisms like fungi, bacteria and viruses or their bioactive compounds. *Bacillus thuringiensis* (*Bt*) based insecticides such as Delfin and Dipel are the most popular biopesticides with almost 90% share in microbial pesticides market. *Bt* products have organic status and used on many vegetables, fruit trees and commercial crops. The virus based biopesticides are used to control caterpillars under field and greenhouse conditions. A few hours after pesticide application the larvae die of polyhedral diseases, their internal tissues are liquified, which contain a large number of polyhedral bodies. Many formulations based on NPVs of Helicoverpa (Biokill-H and Samstar-Ha) and Spodoptera (Spodocide and Biokill-S) are commercially available.

Fungi based formulations of *Beauveria bassiana* (Toxin and BB-Power), *Metarhizium anisopliae* (Metacide and Metawell) and *Lecanicillium lecanii* (Verticoz and

Verticill) are commercially produced and widely used. They attack insect pests belonging to Diptera, Hemiptera, Lepidoptera and Coleoptera by penetrating into and developing mycelium inside the insect host.

Limitations of biopesticides

Most of the biopesticides are used specifically for a target species or group of insects, and other types of insects may continue to cause damage. They rapidly breakdown when exposed to moisture, heat or bright sunlight and their effectivity gets reduced. Microbials like fungi require specific relative humidity to be effective. Proper timing of applications, storage conditions and method of pesticide application severely restrict their efficacy. Being target specific, the market for these products is limited. Some products may not be commercially available or relatively expensive. The most widely used *Bt* biopesticides had led to increased pest resistance, raising concerns of organic farmers.

Botanicals may have complex compositions and cannot be easily standardized. They also have slow effectivity leading to a situation where farmers think that the pesticides are inefficient in pest management. Most of the botanicals have not been fully characterized for their human and ecological toxicity. Besides the least toxic organic pesticides may have high dosage rates and frequencies. The use of pyrethrins is limited, as it has negative impacts on beneficial insects such as predatory mites and parasitoids. Insecticides such as rotenones are toxic to fishes, humans and other mammals.

ASSESSMENTS ON ENVIRONMENTAL IMPACTS OF BIOPESTICIDES

Most researchers claim that organic farming gave similar yields as compared to conventional agriculture and is more sustainable and has considerably lesser negative environmental impact. But critically reviewing the impact assessment results with many other assessment formulae indicated that results are highly subjective based upon the environmental risks being accounted for and may have similar impact scores. The selection of pesticides often stresses on naturally derived products and organic certified pesticides because of prevailing public opinion. Studies conducted on environmental impacts of several novel insecticides and certified organic insecticides to quantify pesticide impacts revealed that the later had reduced efficacies. Organic approved insecticides also had a comparable or even superior negative impact on many natural enemies under laboratory conditions and additionally detrimental to biological control organisms in field conditions along with higher environmental impact quotients.

Thus, practically efficient pest management can only be achieved when synthetic environmentally safer insecticides are used in integration with other strategies. Use of most synthetic pesticides is prohibited by the organic standards. However, under unusual circumstances the National organic program allows use of synthetic pesticides under controlled applications. Synthetics are allowed if they are shown to be

1) Not harmful to human or environmental health.
2) Unavailability of natural or organic alternatives.

3) Comply with organic principles.

Novel insecticides

Novel insecticides are those newly discovered insecticides which affect specific insects, have a different mode of actions affecting specific biochemical sites and provide more desirable pest management. These novel insecticides have very less toxic effect on beneficial insects, mammals and environment due to their green chemical origin and minimal doses for their application.

Spinosad is an eco-friendly insecticide derived from the actinomycetes *Saccharopolyspora spinosa*. It was approved by EPA as a reduced risk pesticide in 1997 and is used to control lepidopteran pests in field and greenhouse such as bollworms in cotton, pod borers in legumes and fruit borers and thrips in chilli. Nereistoxin related compounds such as cartap hydrochloride are used as insecticides since its insecticidal properties were discovered in 1967. It is a contact and systemic poison and acts as a nerve poison. The avermectins are derived from a group of macrocyclic lactones isolated from fermentation products of *Streptomyces avermitilis.* The Emamectin benzoate is a novel insecticide of avermectin family. It acts on nervous system of the target pest. It leads to cessation of feeding and paralysis. The surface residues decompose rapidly in sunlight, ensuing less toxicity to beneficial arthropods.

One of the modern approaches in insect pest management is the use of analogues and antagonists of insect growth regulators. Insect growth regulators (IGRs) are extremely effective as components in IPM programmes as they control insects which are resistant to conventional insecticides. IGRs are environment friendly and low toxicity to mammals thus compatible with pest management systems. They have high insecticidal activity owing their capability to interfere with chitin deposition in the cuticle and moulting process in larvae leading to abnormal growth. They also affect the reproduction and egg viability. There are no reports of insect resistance and resurgence against IGRs. Some of the most common IGRs are Buprofezin, Diflubenzuron, Lufenuron, Novaluron and Hexythiazox. Pymetrozine and flonicamid are insecticides with novel mode of action. They prevent stylet penetration into the plant tissue, thus leading to cessation of feeding and death by starvation. The former belongs to pyridine azomethine groups while later is a pyridine carboxamide compound. They are highly specific against sucking pests and considered safe to natural enemies.

Chlorantraniliprole is a green labelled insecticide belonging to anthranilic diamide group which affects the muscle contraction in targeted pests. Specialized Pheromone and Lure Application Technology (SPLAT) containing synthetic pheromones (Methyl eugenol) along with insecticides (Spinosad) are approved by United States Department of Agriculture (USDA) to be used in organic certified farms. Sprayable liquid formulations of potassium salts of fatty acids (insecticidal soaps) are approved for use in organic farms to control aphids, mites and mealybugs. A single product based on sucrose ester allowed in organic farming, sold under the trade name Sucra shield is used as foliar spray to control aphids, leafhoppers, mites, mealybugs and thrips. It leads to formation of pores in insect cuticle, thus killing the pest through desiccation.

Synthetic pheromones used for mating disruptions are also allowed in organic farming as they are contained in dispensers and thus do not come into contact with crops. Synthetic pheromones are commercially available for major lepidopteran pests in India. The entire list of novel insecticides, their commercial formulations and their possible target pests are furnished in table 1.

Advantages of novel insecticides

The novel insecticides have a different structure over the existing groups and target different biochemical and physiological effects. These insecticides with unique mode of action are safer, and highly suitable for integrated pest management and insecticide resistance management. The risk of secondary pest outbreaks is reduced. They have higher bio efficacy compared to botanicals and have lower mammalian toxicity thus rendering them as attractive replacements. The only disadvantage of some of these novel insecticides is the comparatively higher cost but such disadvantages are subdued in high valued crops.

CONCLUSION

The plant protection products differ among countries depending on the pests, crops, cropping systems as well as standards and regulations. There has been a steady change to the pest management strategies over the past few decades and will continue to change. Pest management now requires knowledge among the farmers for agriculture production in an economically successful manner. A major approach is the use of safer insecticides to control the continuously evolving pest problems accompanied by economic realities of agriculture and changing methods of pest management. There is an increase in the number of low risk substances due to approval of candidates with less concern. Several substances may be considered to be allowed in organic farming. There is a need for new plant protection measures as there is no justification for completely abandoning these safer insecticides. There is a need to identify the benefits for increasing the use of these safer insecticides. Rigorous efforts in research and policy should be made to increase the competitiveness of alternatives.

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Table 1: List of novel insecticides in recommended crops against key pests.

Insecticides	Crop	Target pests
Spinosad 45 SC	Okra	Fruit borer
	Legumes	Pod borer
	Chilli	Fruit borer and thrips
Cartap hydrochloride 50 SP	Paddy	Stem borer and leaf folder
Emamectin benzoate 5 SG	Tomato	Fruit borer
	Brinjal	Shoot and fruit borer
	Legumes	Pod borer
Buprofezin 25 SC	Paddy	Brown planthopper
Lufenuron 5.4 EC	Cabbage	Diamond back moth
	Pigeon pea	Pod borer
Novaluron 10 EC	Cabbage	Diamond back moth
	Tomato	Fruit borer
	Chilli	Fruit borer
Hexythiazox 5.45 EC	Tea	Mites
Flonicamid 50 WG	Paddy	Brown planthopper
		Green leafhopper
Pymetrozine 50 WG	Paddy	Brown planthopper
Chlorantraniliprole 18.5%	Paddy	Stem borer and leaf folder
	Cabbage	Diamond back moth
	Okra	Fruit borer
SPLAT	Cotton	Pink bollworm
	Brinjal	Shoot and fruit borer
	Mango	Fruit fly
Sucra shield	Vegetables	Aphids, Leafhoppers, Mites, Mealybugs and Thrips.

Botanicals: Promising option for future pest management in Agriculture

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ABSTRACT

Indiscriminate use of chemical insecticides put forth a serious threat to the environment. It creates health hazard, residue problem in animals. To address the problem use of botanical insecticides is the best option which should be promoted among the farmers. It is very cost effective, ecofriendly and feasible which break the insecticide resistance among the insects and show the specificity within the insects group.

Key-words: Insecticides, Botanical insecticides, Resistance, Nerve poison, Muscle poison.

INTRODUCTION

With the initiation of primitive agriculture human being was solely depend upon the use of plant materials and other animal excreta as insect repellents. The antique concept was totally changed by the introduction of Green revolution which emphasized on the use of chemical pesticides. The indiscriminate uses of pesticides create lots of hazardous issues in our environment. In order to minimize the problem the vivid exploration of botanical pesticides in agriculture is now increasing. In nature more than 2,400 plant species are reported to have the pesticidal properties.

The plants having the insecticidal properties:

1. Indian Neem tree (*Azadirachta indica*): The main active ingredient is Azadirachtin which is present in seeds and leaves and varies from 2-4 mg / g of kernel. It shows various effects on insects' viz. antifeedant action, oviposition deterrent, insect growth inhibitor, repellent action.
2. *Lonchocarpus* spp. and *Deris eliptica* and *Tephrosia* spp.: Rotenone, the resinous compound which is derived from the roots of those plants. Rotenone is commonly sold as a dust containing 1 to 5% active ingredients for home and garden use, but liquid formulations used in organic agriculture can contain as much as 8% rotenone and 15% total rotenoids against the beetles and

caterpillars. Rotenone is a mitochondrial poison, which blocks the electron transport chain and prevents energy production (Hollingworth *et al*., 1994).

3. Tropical or South American lily (*Schoenacaulon officinale*): The alkaloid compound Sabadilla (Cevadine and Veratridine) is derived from the seeds of tropical lily plant. It has toxic effect on the nervous system of the insects causing the loss of nerve impulse, paralysis and death.
4. South American or Caribbean Shrub (*Ryania speciosa*): Ryanodine, the main alkaloid derived from the stem of the *R. speciosa*. It is a slow acting stomach poison and also interferes with the release of calcium ion from muscle cell. Ryanodine also inhibits the conversion of ADP to ATP. Best effective against Thrips, Worms and Coddling moth in apple (Weinzierl 2000; Isman 2006).
5. Tobbaco (*Nicotiana tabacum* and *Nicotiana rustica*): The main active compound Nicotine is obtained to the extent of 2-8%. It is the extremely fast acting nervous poison and bind with the acetylcholine esterase cause failure of nervous system. It is very much effective against sucking insects like aphids, thrips, mites, leaf hoppers, mealy bugs and leaf miners. It is commercially available as Nicotine sulphate 40% (Black leaf 40).
6. *Chrysanthemum cinerarifolium*: Pyrethrins are the toxic compound derived from the dried flowers of the *C. cinerarifolium* by the procedure of Kerosene extraction method. Pyrethrins are the ester compound by combination of two main acids like Chrysanthemic acid and Pyrethric acid and three esters namely Pyrethrolone, Jasmolone and Cinerolone. The insecticidal action of the pyrethrins is characterized by a rapid knockdown effect, hyperactivity and convulsions in most insects which block voltage-gated sodium channels in nerve axons. Kenya is the largest producer of pyrethrum.

SUPERIORITY OF BOTANICALS OVER THE CHEMICAL INSECTICIDES:

1. Break the resistance power in the insects for the synthetic insecticides.
2. No chance for the development of resurgence problem.
3. Extraction is easy.
4. Source is plentiful.
5. No toxic effect on natural enemies and other beneficial insects.
6. No residue problem in crop, soil and environment.
7. These biologically-occurring compounds generally utilize multiple modes of action against insect pests.
8. The botanicals are available in aqueous solution which reduces their sustainability in the environment.

CONCLUDING REMARKS

The plant kingdom offers a rich source of a wide range of structural biodiversity of natural secondary metabolites. Botanical insecticides can prove excellent result over the chemical insecticides. In spite of many research work on botanical pesticides there is a still lacking of awareness among the farmers to its acceptability. At this situation the

scientists and extension worker should take the initiative to make it more satisfactoriness among the village level farmers to make the environment healthier and hazardless.

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Income Generation Avenues of Gaushalas in India

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ABSTRACT

Gaushalas play a vital role in safeguarding the cattle wealth of our country. Even though the main aim of the Gaushala is to house the unproductive/uncared cattle, many of the fore-front Gaushalas maintained good quality indigenous cattle with huge economic potentiality. Further, it is noted from various studies that besides selling the Indigenous cattle milk for the higher price, most of the Gaushalas were also actively engaged in reaping economic returns through effective utilization of cattle by-products like 'cow-dung' as a source of fuel, bio-gas (Methane, LPG), bio-fertilizers (FYM, NADEP, Vermicompost), 'cow-urine' as bio-pesticide and raw-material for preparation of Jeevamirtha organic manure. Few Gaushalas also maintained the Panchagavya (a mixture of cow milk, curd, ghee, cow dung extract and Gomutra) manufacturing units as a micro-level business/enterprise and created an avenue for income-generating activities. The additional income generated in Gaushalas helps in compensating the labour cost, transportation, fodder requirement, water supply, electricity charges and healthcare expenses incurred by the Gaushala management.

Keywords: Gaushalas, income, cattle, cow

INTRODUCTION

Gaushalas are charitable non-profitable organizations whose main purpose is to enhance the productivity of indigenous cattle breeds and increase economic returns from animal products in a sustainable manner. Several Gaushalas in the country have followed innovative methods for raising additional income through various income generation activities viz. enhanced utilization of bull power for rural activities and electricity generation, production of young bulls for export to other States, production of gobar gas, and production of Panchagavya, vermin-compost and bio-pesticide for use

in natural and organic agriculture. Large scale practice of such value additions may lead to transformation of Gaushalas to play an additional but pivotal role in conservation of indigenous breeds of cattle.

Nevertheless, effective management of Gaushalas in the present context is posing a serious challenge to the Gaushalas, due to paucity of funds, inadequate financial aid from governments, inadequate fodder availability, non-availability of veterinary services, poor infrastructure facilities and poor management, as some of the chronic problems faced by Gaushalas. Therefore, the development of Gaushalas aims to improve the overall livestock keeping practices and animal welfare for the sheltered cows in a sustainable manner.

Cows and its progeny have been the backbone of our rural economy for ages and contribute significantly to the livelihood of millions of farmers. Cattle are the real wealth of our agriculture dominated country. The prosperity of this country does not lie in its industries and abattoirs; it does in agriculture based on the livestock. In developing countries, most milk is produced by small-scale producers with local or indigenous cattle breeds; however, in peri-urban areas the use of improved or cross-bred cattle is increasing to meet the rising urban demand for milk and milk products. Indigenous breeds are well adapted to local conditions (e.g., the thermal environment, available feed and water resources, endemic diseases and parasites), but have low production and usually need to be milked with the calf at foot. Most indigenous breeds in tropical regions are of the zebu type (*Bos indicus*) with the characteristic hump and dewlap. Some of the most widely distributed dairy breeds of zebu cattle are Sahiwal, Red Sindhi, Tharparkar, Kankrej, Gir, Kenana and Butana.

Fig 1. Gaushala

Importance of Indigenous Cattle

Desi cattle have been a part of the Indian lifestyle since ages unknown. It has helped mankind in farms to plough, on roads to carry loads, at home with milk and with urine & cow dung for several other uses in day to day life. Desi cow is not only looked upon as a source of benefit but also considered as a family member and revered with a motherly status & often called "Gau Mata". Indigenous cow's breeds are the kind of cattle whose products are churned for spiritual and social betterment. Well there are several benefits of consuming the milk of desi cows; mainly it contains amino acid such as proline. This proline is mixed with isoleucine, which is best to fight several diseases like asthma, mental disorder, joint pain, and obesity. Moreover, these indigenous breed cows contain hump, which is known to absorb Vitamin D from the rays of the sun.

BENEFITS OF INDIGENOUS COW PRODUCTS

- **Milk:** Cow milk touches practically all aspects of life. Men or a woman, kids or adults, rural or urban, milk is a wholesome food for all. It reduces acidity, increases immunity and sharpens the brain. Cow milk forms a base for many ayurvedic medicines. Desi Cow milk is A2 Type milk that helps fight diabetes in infants and adults. Many more products like curd, buttermilk, butter & clear butter (Ghee) are made from cow milk. These products have high medicinal & nutritional values.
- **Cow Urine (Go Mutra):** Urine of any animal is discarded as a waste product but when it comes to cow it's exact opposite. It's a boon to all mankind and farmers in particular. Cow urine is used to produce organic & natural fertilizers, insect repellents and other products in farming. It is not just used for external purposes alone but highly beneficial if consumed by humans. It has high medicinal value and is considered a super medicine. Several scientists conducted extensive research on indigenous cow urine and have proven its anti-cancerous properties.
- **Cow Dung (Go May):** Another cow excreta which has value of gold equal to its weight for farmers. Ancient scriptures mention "*Gomay Vasate Lakshmi*" literally meaning Lakshmi - Goddess of Wealth & Prosperity dwells in Cow Dung. Dung or Gobar - as called in Hindi has high micro-organismic value. This is helpful to increase the fertility and productivity of the soil. Cow Dung Compost is a natural fertilizer and many other organic fertilizers can be made from cow dung. Cow dung is deemed fit for consumption by humans and is part of many ayurvedic medicines.
- **Panchagavya (5 Cow Products):** Milk, curd, go ghrut (Ghee), gomutra, gomay form a holy union of panchagavya ayurvedic medicine. These, when mixed in different measures and with different other components, form a range of medicines. These medicines have proved to be effective to address a lot of medical problems. They have reportedly cured

Fig 2. Different by-products in Gaushalas

Cow dung cake

Farm Yard Manure

Jeevamrutha

Gomutra

Cow Dung Cake

Panchgavya Products

Curd

Desi Ghee

Milk

many chronic ailments and are the only alternatives to modern medical sciences. These medicines do not cost much dent to the pocket as they are made from all cow-based products that are easily available.

- **Jeevamrutha:** It is an organic fertilizer that enriches the soil and plant and provides all the nutrients required for the growth of the plant. It is a rich source of Nitrogen and valuable micro-organisms which naturally enhances soil fertility.
- **Bijamrita/beejamrutha**: It is a treatment used for seeds, seedlings or any planting material. Bijamrita is effective in protecting young roots from fungus as well as from soil-borne and seed-borne diseases that commonly affect plants after the monsoon period. It is composed of similar ingredients as jeevamrutha - local cow dung, a powerful natural fungicide, and cow urine, a strong anti-bacterial liquid, lime, soil.

CONCLUSION

A strong nation is built with the food it eats. It is the responsibility of every farmer in India to provide healthy and poison-free food to all citizens. The only way possible for the farmers to produce poison-free food is to lead a cow-based organic way of life. We as consumers and farm producers should support cow based organic farming in all possible ways. Gaushalas in this context can play an important role in the manufacturing of organic products as it houses the indigenous cattle population and also promotes organic farming. However; most of the Gaushalas are yet to adopt the improved management practices and effective utilization of by-products. Hence, emphasis should be given on providing adequate training and technical support in the scientific management of Gaushalas, proper resource utilization, value addition and eco-friendly energy generation for the sustainable economic viability of the Gaushalas.

Clean Milk Production: A Way to Healthy Milk Production

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ABSTRACT

The clean milk production following Good hygienic practices is an essential prerequisite for obtaining wholesome and superior milk quality. The concept of unpolluted milk production would be to develop sustainable, scientific and eco-friendly dairy animal management supported the principles of unpolluted, green and ethical practices. Main sources of contamination are udder infection, dirty udders and teats, milking prson and milking equipements. Sick animals and their milk should not be mixed with good milk or milk from healthy animals. Udder, teats and flank of the animals are washed with clean water preferably with a disinfectant. Milkman should be healthy and clean. Seamless utensils preferably made of stainless steel should be used. Milking should be done through a full hand method to avoid any injuries on animal teats. All milk should be drained out from the udder i.e. incomplete milking should be avoided. proper care must be taken regarding the preservation of milk, protection of milk constituents, protection against high temperatures and natural calamity.

Key words: Milk, Udder, Utensil, Animal, Production

INTRODUCTION

"Clean Milk" is usually defined as "milk drawn from the udder of healthy animals, which is collected in clean, dry milking pails and free from extraneous matters like dust, dirt, flies, hay, manure, etc. Clean milk features a normal composition, possesses a natural milk flavor with low bacterial count and is safe for human consumption" (Sinha, 2000). The clean milk production following Good hygienic practices is an essential prerequisite for obtaining wholesome and superior milk quality. The concept of unpolluted milk production would be to develop sustainable, scientific and eco-friendly dairy animal management supported the principles of unpolluted, green and ethical practices. Normal whole milk contains a balanced proportion of milk fat (4 percent), lactose (4.8 percent), proteins (3.5 percent), minerals (0.7 percent), vitamins and other minor constituents such as enzymes and hormones. The pH of normal raw milk is about neutral (pH 6.7) with a corresponding titratable acidity of 0.16-0.17 percent due to the

natural buffering capacity of milk proteins and salts. Wholesome milk should contain only a few bacteria and no extraneous matter if it has been produced hygienically.

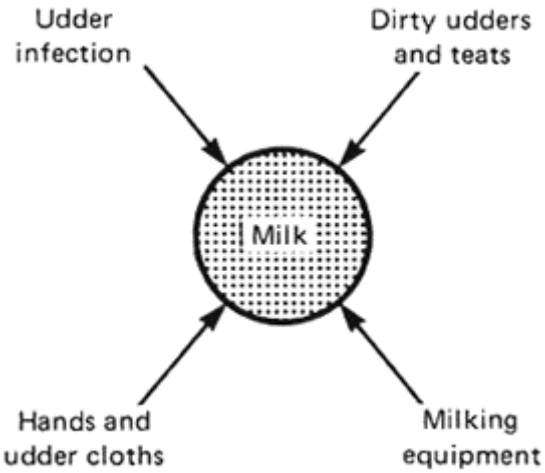

Fig. Sources of Contamination

The following are the pre-requisite for clean milk production and disposal.

Hygiene and Precautions

With a strip cup or any other method case of mastitis is checked. Sick animals and their milk should not be mixed with good milk or milk from healthy animals. Udder, teats and flank of the animals are washed with clean water preferably with a disinfectant. After that, the body parts wipe with a clean cloth. Brooming and cutting the hair around the udder is necessary. Disposal of fore-milk and tying the tail of troublesome animals when milking is required.

Fig. Cleaning and washing milking animal teat

Milkman's Hygiene

Milkman should be healthy and clean. Maintenance short fingernails and haircutting is required and ladies can cover their heads while milking as a precaution. Smoking during milking time should be avoided. Interruptions during milking should be avoided.

Fig. Hand wash before milking

Milking Environment

The animal sheds should be cleaned regularly. Water should drain easily and far away from the shed. Providing animals, clean feed and water trough are essential. The shed should be located away from bad smells and odors.

Fig. Hygienic milking animal shed

Milking Utensils

Seamless utensils preferably made of stainless steel should be used. Cleaning utensils with a brush and hot water mixed with detergent is one of the major requirements for production of clean milk. After cleaning utensils, it should be kept in sunlight for proper drying.

Fig. Milking in a stainless steel utensil

Milking

For milking, squeezing the teat is required. Milking should be done through a full hand method to avoid any injuries on animal teats. All milk should be drained out from the udder i.e. incomplete milking should be avoided. Using a teat dip after milking is a good practice for the production of clean milk.

Fig. Full hand milking method

Milk Handling

a. Filtering

After milking, milk should be filtered through the sieve for removing suspended matter.

Fig. Filtering milk through the sieve

b. Storage

Milk should be stored in a cool and clean place and the room used to store milk should be without other materials such as chemicals.

c. Marketing or Disposal of Clean Milk

Milk should be delivered to the market as soon as possible. Closed mouthed cans should be used for transportation purposes. It is advisable to deliver milk early in the morning and evening to avoid hot periods of the day.

Fig. Stainless steel cans for transportation

Benefits of clean milk production

1. It is safe for human consumption
2. It has better keeping quality
3. It has high commercial value
4. It provides protection against diseases like typhoid, dysentery, diphtheria, septic sore throat, etc.

5. It helps to produce good quality dairy products
6. It can be transported over long distances

CONCLUSION

Milk once secreted becomes the target for transformation by a spread of host organisms at the farm itself. Hence, proper care must be taken regarding the preservation of milk, protection of milk constituents, protection against high temperatures and natural calamity. Strict protocols are to be observed and implemented both in hand and machine milking. The custodian of milk should never compromise on quality.

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Notes on Tea Mosquito Bug Infesting Cashew Plants and its Management

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ABSTRACT

Tea mosquito bugs (TMB) (*Helopeltis* spp.) (Miridae: Hemiptera) are serious pests of cashew during cropping season in India. Adults and nymphal stages of this mirid bug cause damage by sucking the plant sap from tender parts of the cashew. Pest damage begins during flushing stage of cashew and continues during flowering and fruiting. As such TMB is a low-density pest but causes reduction in nut yields ranging between 20 and 80 percent. Natural enemies, while playing an important role in controlling TMB in field, cannot maintain TMB population below economic thresholds. Proper pest surveillance and timely initiation of management measures are suggested for management of TMB.

Key words: tea mosquito bug, *Helopeltis* spp., cashew, management,

INTRODUCTION

In India, more than 190 pests are reported on cashew in different cashew growing regions including Andaman and Nicobar. Every part of cashew tree is infested by one or the other pest. However, depending on the climate, location and age of the plantation, each geographic region has its own distinctive pest complex. Among the pests, tea mosquito bug (TMB) is considered as most important in almost all cashew growing countries of the world besides cashew stem and root borer. There are 41 recognized species of *Helopeltis* distributed in the world (Stonedahl, 1991; Stonedahl, et al., 1995). In India, this pest is common in most of the cashew growing regions including Kerala, Karnataka, Goa, Maharastra, Tamil Nadu, Goa, Andhra Pradesh, Odisha, Madhya Pradesh. Three species (*H. antonii* Sign., *H. theivora* Wat. and *H. bradyi* Wat.) are recorded from India. *H. antonii* occurs in southern and eastern India, whereas, *H. theivora* exists in west coast, Western Ghats and north east India. H. bradyi is found in west coast and Western Ghat regions. Apart from *Helopeltis* spp., *Pachypeltis measarum* Kirk. (Miridae) also cause similar damage in certain areas. In most parts of cashew

growing region, Helopelits antonii is the dominant species infseting cashew (Saroj *et al.,* 2015).

	
Adult (*Helopeltis antonii*)	**Nymph**

Host plants

Helopeltis spp. infest a vast number of plants, of which, primary host plants are cashew, cinchona, cocoa, neem and tea. Other economically important host plants include cotton, cowpea, red gram, henna, apple, grapes, guava, avocado, drumstick, mango, ber, *Annona reticulate,* allspice, black pepper, *Ailanthus*, mahogany, annatto, *Thespesia populnea*, *Solanum nigrum*, Singapore cherry, ornamental *Acalypha* etc. *H. theivora* survives also on *Chromolaena odorata* during monsoon season, which is a common weed.

Biology of tea mosquito bug

Eggs of TMB are inserted inside the tender shoots, inflorescence stalks, developing nuts, petioles and ventral midribs of leaves either singly or in small groups. They are translucent white, ovo-elongate and laterally compressed with a pair of extra-chorionic processes (respiratory filaments) at their anterior end. Egg period lasts for 6-12 days, depending on the weather factors. The nymphal stage consists of five instars that vary in size and colour. The nymphal period is completed within 11-13 days. Adults survive for 8 - 12 days and a female bug can lay about 60 - 80 eggs during its lifetime. The entire life cycle is completed within 25-35 days.

Nature of damage

Typical feeding damage by TMB appears as a discoloured brownish necrotic lesion around the point of entry of the stylets into the plant tissue which becomes darker as the tissue around the stylet puncture dies, in response to the enzymatic action of the insect salivary secretions. Salivary enzymes of TMB cause phytotoxaemia on host plants as well as detoxification of defensive chemicals (Sundararaju and Sundarababu, 1996). The feeding lesions are elongate on shoots and roundish on fruits. Subsequently,

melanization and necrosis of feeding lesions appear clearly. Feeding by the nymphs and adults causes drying up of new flushes, panicles, shriveling of developing nuts and premature drop of immature nuts. Feeding lesions coalesce and the tender shoots and the entire panicles having tender immature apples and nuts wilt subsequently resulting in burnt-up appearance known as "shoot blight or blossom blight". The feeding injury by TMB predisposes the plant for infection with die-back disease leading to wilting of whole shoot or panicles during vulnerable period.



Seasonal incidence of TMB

Gradual increase in *H. antonii* population and its damage is noticed from September - October synchronizing with the emergence of new flushes after the cessation of monsoon rains in different agro-ecological regions. The population reaches a peak during January, when the trees are in full bloom. TMB prevails predominantly in the plantation till April - May and subsequently in low numbers during monsoon period (June-September) especially in the older plantations. In young cashew plantations, it can be noticed throughout with a peak during February - March. For deciding the management strategy, survey and monitoring of TMB population is most essential.

PEST MANAGEMENT MEASURES

As TMB is a low-density pest, regular survey and monitoring its population from initiation of flushing till fruit set, is crucial to initiate timely management measures. As an ad-hoc recommendation, 5 - 8% damaged fresh flushes/panicles) can be considered as the Economic Threshold Level (ETL) for adopting management techniques against tea mosquito bug. Botanicals tested so far were not very effective against TMB. As TMB polyphagous, it is necessary to keep proper surveillance on the nearby host plants as well. In east coast of India, particularly in Tamil Nadu, neem trees act as reservoir for TMB, besides guava and drumstick. Therefore, it is important to monitor TMB population in these plants to reduce the spread of TMB. Similarly, *H. theivora* multiplies in a common weed, *Chromolaena odorata* which is present in cashew plantations of West coast region. Thus, management of this weed is important to prevent spread of *H. theivora* to cashew during flushing period.

All the available recommended cashew varieties are found susceptible to incidence of TMB. However, matured shoots of cashew exhibit higher oviposition

repellence and feeding deterrence and this phenological stage helps to bring down the population build up of TMB during non-flushing period (June-September). It is reported that mid and late season flowering cashew varieties are able to escape from the severity of TMB infestation to some extent. Under moderate level of pest incidence, the cashew variety; 'Bhaskara' showed consistent performance with yields of 2.0 t/ha under unsprayed situations.

Though the eggs of TMB are laid deep in plant tissues, they are often attacked by a range of hymenopteran parasitoids Four species of egg parasitoids *viz*., *Telenomus cuspis* sp. nov. Rajmohana and Srikumar (Platigasteridae), *Chaetostricha* sp. (Trichogrammatidae), *Erythmelus helopeltidis* Gahan (Mymaridae) and *Gonatocerus* sp. are recorded on TMB. Besides, nymphal- adult parasitoid (*Leiophron* sp., [Braconidae]), ectoparasitic mite (*Leptus* sp.) and nematode parasitoids also occur on TMB. But, none of these parasitoids are amenable for mass laboratory culturing and hence cannot be exploited for controlling TMB at present. Among the predators, different species of ants, praying mantises, spiders and reduviids also help in minimizing TMB population to a certain extent. Besides, specific strains of the entomopathogenic fungi namely, *Beauveria bassiana* and *Metarhizium anisopliae* are also found effective against TMB. But in most instances, though natural enemies take care of TMB population to certain extent in field conditions especially at low pest density (Sundararaju, 1996), they could not minimize population of *Helopeltis* spp. to below economic thresholds levels.

Many groups of insecticides and several plant products (botanicals) have been evaluated against TMB, but none exhibited any ovicidal action. However, lambda-cyhalothrin 5 EC (0.6 ml/lit) showed longest residual action against nymphs and adults of TMB. Thiamethoxam 25 WG (0.2 g / lit) and acetamiprid 20 SP (0.5 g / lit) are found effective on TMB. In certain regions, profenophos 50 EC (2 ml/ lit) and triazophos 40 EC (1.5 ml/ lit) are also effective. Spraying of higher doses and repetition of same insecticide should be strictly avoided to prevent initiation of pest resistance. In the endemic areas, depending on the pest incidence, it is appropriate to spray insecticides during the vulnerable periods of crop stages coinciding with flushing, flowering and fruiting. Although cashew is an insect-pollinated crop, spraying of these insecticides during the flowering season did not significantly influence fruit-set. However, to avoid direct poisoning of bees, spraying need be avoided between 10.00 am and 1.00 pm, which is the peak foraging period of pollinating bees.

CONCLUSION

TMB is a low-density pest, but capable of causing serious damage within a short period in cashew. Hence, farm-based monitoring of TMB damage and its population growth from initiation of flushing till fruit set is important to initiate management measures against TMB in cashew.

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Ways to sustain pulses productivity

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THE PRESENT AGRICULTURE SCENARIO

Indian agricultural is typically characterized by small farm holdings. This small holding agriculture is the mainstay of food production and sustainability. It is believed that small farm holdings will be ensuring long-term global food security. It is postulated that the global population would approximately cross 9 billion by 2050. This burgeoning population increase demands more food production in these fragmented small farm holdings. It is estimated that there are 500 million smallholder farms worldwide and are producing approximately 80 percent of current food demand. Indian farming system too is not an exception. The responsibility of these small farm holdings are increasing because the enhanced demand would only be met from them. Because, the current food production level has to be increased to 60 percent by 2050.

Many of these small-hold farms are witnessing low productivity and thus realizing poor income per unit area. The attributable reason for this low productivity is non availability of quality inputs at affordable cost. Increasing food production with minimal usage of natural resource base is not a simple task in the era of global warming. Yields of major food cereals (wheat, rice and maize) are now attained plateau or reducing in few cases. This situation is due to small fragmentation of agricultural lands. Increase in food production in near future is feasible through adoption of advanced production technologies like improved varieties, farm mechanization and micro irrigation projects.

The notable characteristics of Indian agriculture sector are, **(i) Mainstay of livelihood:** Agriculture is the primary occupation which provides employment to nearly 61% of rural population and contributes approximately 25% to national income. **(ii) Influences by monsoon vagaries:** Majority of cultivable lands depends on monsoon for better productivity. Changes in rainfall pattern drastically influences the sustainability and thus livelihood. More often changes in monsoon pattern cause under employment of agricultural workers. **(iii) Man power dependant:** Exploding population growth and the tradition of land sharing between families made the earnable land as fragmented which does not permit adoption of improved techniques. This has forcing to practice agriculture as man power dependant. **(iv) Small sized farm holdings:** The average land holding size is getting reduced due to frequent land sub-

division and fragmentation of holdings. **(v) Adoption of conventional crop cultivation methods:** In India, precision farming techniques are less adopted due to poor literacy rate, webbed loans and poverty. Adoption of traditional technology leads to low production. **(vi) Inclination towards major food crops:** Major cereals like wheat and rice *etc*., covers 75% of the cultivated area, and other crops are cultivated in the remaining 25% of cultivated area.

IMPORTANCE OF PULSES

Human health depends on intake of a healthy diet. Healthy diet comprised of different recipe consisting of varied cereals, pulses, vegetables and fruits. Cereals are the main supplier of carbohydrate while pulses are the source of protein. Fruits and vegetables are supplying many vitamins and minerals. A healthy muscle demands intake of sufficient quantity of protein. Protein can be obtained from plant and meat. Because of phyto-origin plant protein assumes greater importance in Indian diet. Pulses are rich source of protein (20 to 25%) and they minimize the use of synthetic nitrogen fertilizer because of their ability to fix atmospheric nitrogen through root nodules. They fix approximately atmospheric nitrogen (30-150 kg ha^{-1}). In India, pulse crops are being grown almost in majority of States. In the world, pulses are grown by 171 countries. They sustain the livelihood and employment of small and marginal farmers in India. India is the largest producer of pulses contributing 25.7% to the world production. A variety of pulse crops *viz*., chickpea (Cicer arietinum L.), pigeonpea (Cajanus cajan L.), greengram (Vigna radiata L. Wilczek), blackgram (Vigna mungo L. Hepper), lentil (Lens culinaris L.) and fieldpea (Pisum sativum L.). Few other minor pulses like horsegram and math bean are also being cultivated as location specific. The average yield of world triennium ending 2010 was 890 kg/ha, whereas in the same period, the yield of India was 648 kg/ha. The gap is 242 kg or 27%. This yield gap is caused due to crop genetics and socio economic reasons.

CAUSES OF LOW PRODUCTIVITY IN PULSES

A. scientific reasons

(1) Low harvest index: Harvest index of pulses are hardly 15-20% as compared to 40-45% of high yielding cereals. More vegetative growth of pulses adversely affects the economic yield.

(2) More flower drop: Pulses, in general, have higher rate of flower drops. In pigeonpea, over 80% flower produced on plants are shed. So, there is a need for minimizing flower drops by breeding programme / use of hormones.

(3) Non availability of potential varieties for extreme weather conditions: Pulses perform yield better under ideal farming and weather conditions, any extremities in this drastically affects yield. Targeted breeding programs to breed varieties perform better in extreme weather will sustain productivity.

(4) Biotic stress: The pulse productivity are significantly challenged by many biotic factors. Among biotic constraints, pests are more grave. Pests are causing 30-40% yield

loss. The most important pests of pigeonpea, chickpea are Helicoverpa armigera and other pod borer complex. The disease include wilt in chickpea & lentil, sterility mosaic virus in pigeonpea. While, yellow mosaic virus, powdery and downey mildew are the dreaded disease in urd and mungbean.

(5) Abiotic stress: Abiotic stresses are leading to reduced nutrient uptake and hence are considered as the one of the major causes of low pulse production. Drought is the most important abiotic factor affecting the pulse crop yield significantly. Non availability of water during flowering, pod formation and maturity drastically cause yield loss, at extreme cases complete crop failure is witnessed. Salinity is the other important abiotic stress limiting the pulse yield.

(6) More resource demanding modern day varieties: The recent pulse varieties and hybrids are demanding more irrigation water and timely use of fertilizer which is not feasible in the traditional pulses farming as they are purely rainfed.

B. Socio economic causes

(1) Exploding population growth: Population growth is exponential in India. In 2050 India's population is projected to be 1.69 billion. The increasing population is largely responsible for fragmentation of land holdings. The marginal and small holdings account for 85% of the total operational holdings. Subdivision of lands poses problems for introduction of precision farming techniques that results in low productivity.

(2) Land degradation: Soil is considered as the base medium for crop cultivation in India. Owing to its importance it is given the status of Goddess. Continuous cultivation with improper fertilizer use leads to soil wealth erosion. Such usage accounts for changes in the soil fertility status of India. The average N: P: K ratio in the past two decades has been 7:3:1 against recommended 4:2:1

(3) Monsoon uncertainty: In India, more than 50% of agricultural land are rainfed. The factors of delayed onset of monsoon and resulting uneven distribution of rainfall are affecting pulses production in a greater magnitude. Erratic rainfall on the other hand disturbs the crop growth by posing water logging or drought stress. Pulses, cannot tolerate both of these stresses. Water logging or drought for few days significantly reduce the yield.

(4) Non availability of good quality seeds and other inputs: Good quality seed is the mainstay of agriculture. It is witnessed that good quality seeds assures 20-25 % of productivity. Timely available of quality and certified seeds at reasonable prices to farmers is the base for realizing higher productivity and production but which is seldom realized. Timely available also adds the crux to the situation. The use efficiency of other inputs e.g. fertilizers, pesticides and irrigation are depending on the quality of the seed used.

(5) Farm mechanization: Weather vagaries and frequent price fluctuations for agricultural produce make difficulty in realizing a profitable agriculture. This makes the rural youth to migrate for other urban based work options. Today, fifty percent of the world's population is urban and this is projected to rise to 70 percent by 2050. The burning truth behind this forced migration is that the efficient workable force is

drastically reduced. It is approximately estimated that in a typical Indian small holding agriculture, the total farm power requirement is catered principally by three ways; (1) manual labour (60 to 70%), (2) draught animals (20 to 25%) and (3) machines (less than 10 percent) comes from engine-powered sources. The forced migration, led the agriculture to be done by women, the elderly farmers and children. This is consequently lead to significant shortage in farm power which is having a sharp negative impact on farm productivity.

(6) Subsistence nature of farming: Most of the produce is directly consumed by producers, surplus is generally low and thus Indian agriculture is categorized by subsistence nature. This subsistence is caused by low literacy, less adoption of improved technology. This subdue adoption is due to in ability to afford for newer technologies. This results in low returns, which in turn means less savings and reinvestments.

(7) Availability of few targeted policies: The policy makers are naturally are concentrating on the main food crops. The strategies are being framed for rapid increase in production in such crops. Though few polices are framed recently on pulses are not sufficient to cater the demand and hence requiring few more devoted policies.

SUGGESTIONS FOR IMPROVING PULSES PRODUCTION

(1) Breeding high yielding climate resilient varieties: Pulses are highly climate responsive crops i.e., extremes in irrigation water, temperature would drastically reduce the yield. In acute extremities complete crop failure is the reality. Therefore, breeding pulse varieties having tolerance to drought, cold, flood and high temperature would sustain the pulses yield.

(2) Development of multiple pest and disease resistant varieties: The pulses yield is challenged by many pests and diseases. For example, Helicoverpa armigera and wilt are the major pests, damaging about 20-30% of the productivity in Pigeonpea and chickpea. Other pod borer complexes further worsen the productivity. Similarly, season dependant occurrence of foliar diseases such as yellow mosaic virus during summer and powdery & downey mildew during winter is reducing the crop yield in mung and urd bean. Sterility mosaic virus is the dreaded disease in arhar. Breeding and development of multiple disease resistant varieties would ensure better productivity and also it eco-friendly.

(3) Breeding for more input use efficient cultivars: The precious input in pulses cultivation is water and fertilizer. Improper and excess usage of these inputs have caused soil health depletion and environmental pollution. The quantum of quality water available for pulses cultivation is getting reduced. Therefore, breeding for varieties with more water and fertilizer use efficiency would ensure proper usage of rare and scarce agricultural inputs.

(4) Breeding for short duration varieties: In India majority of pulse crops are being grown as rainfed. The main source of irrigation water is rain but the period of downpour is limited to few days. Long duration crop experience terminal drought

during pod maturity stage which drastically affect the yield. Development of short duration would ensure better yield in the rainfed pulses farming.

(5) Development of synchronized maturing varieties: The traditional pulse varieties are maturing at different intervals. This indeterminate habit add the burden of the pulses farmers as two or three harvests increase the cost of cultivation. Pod shattering habit does not permit the farmers to wait for complete pod maturity. Therefore, development of synchronized maturing varieties would reduce the cost of cultivation and also pave way for mechanical harvesting.

(6) Timely supply of quality seeds: It is estimated that approximately 20-25% area every year is sown with certified quality seeds. The remaining area is sown with self saved seeds of farmers. It is realized that pulses production may be enhanced by 10 - 20%. By adopting the three tier system of seed production viz., nucleus, breeder and certified seed would ensure distribution of quality seeds covering 50 % of the total pulses area every year.

(7) Formulation of best agronomic, IPM,INM and IDM packages: Providing adequate spacing, inter cultural operations and proper usage of plant protection chemicals ensures reduced cost of cultivation and safeguard the environment. Formulation of best agronomic practices, integrated nutrient, pest and disease management strategies guarantee the sustainable pulses cultivation in India. These package include micro irrigation technologies as well.

(8) Educating the farmers for growing pulses in the residual moisture: A major agricultural land segment in India is receiving rain for cultivation in the *kharif* season and in the *rabi* season there is no rain. For example, many rainfed rice fallow lands in Chhattisgarh, Madhya Pradesh, Jharkhand, Bihar, Odisha and Andhra Pradesh remain uncultivated during rabi season due to non availability of irrigation water. Therefore, those farmers are to be guided to grow pulses in Rabi season by utilizing the residual moisture as done in cauvery delta zone and thamirabharani river basin in Tamil Nadu. They sow short duration urd bean before harvest of paddy crop and realizing a good yield in 60-65 days.

(9) Providing processing machines on custom hiring basis: Mechanization of pulse production, processing and handling is very important to increase production and minimize losses. Non availability of updated processing machines yields less recovery of marketable pulses at processing. This improper processing affects the market value drastically. The recovery of marketable pulses can be improved if we use advanced processing machines. But majority of Indian farmers are belongs to low income group, they cannot afford to sole-purchase of processing machine. Therefore, there is a pressing demand to form policies for custom hiring of processing machines.

(10) Policy for inclusion of minor pulses under MSP category: Presently marketing of major pulses like Arhar, Moongbean, Urdbean, gram and Lentil are supported by Minimum Support Price (MSP). However, many minor pulses are being grown across Indian States whose marketing is not supported by MSP scheme. Policies for supporting them under MSP will augment their cultivation.

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Package of practice of new introduced Noni crop

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INTRODUCTION

Noni (*Morindacitrifolia*) is a small tree belonging to the coffee family, Rubiaceae. It is a tropical fruit also known as Indian mulberry, awl tree, cheese fruit, nino, nona, *etc.* For over 2000 years or more, the plant has been identified as a medicinal plant by Polynesians and Tahitians and they used it for therapeutic purposes. Almost all parts of the plant are used for one or other purposes. The fruits were used in food preparations and as medicine. Different parts of the plant such as leaves, stem and roots were also used as medicine. In Polynesia and Southeast Asia, application of plant is extended to cure cough, cold, pain, liver disease, malaria and blood pressure. Considering the medicinal value of the plant, list of plants approved for cultivation.It was widely used for it's health restorative properties , over the years of it's popularity diminished due to unpleasant smell from the ripened fruit .

USES

1. Noni helps in reducing high blood pressure and cures heart disease and stroke. This is because of presence of Scopoletin which has scientifically proven to dilate blood vessels resulting in lower blood pressure. Besides, it stimulates the body's production of Nitric oxide, a chemical which allows the blood vessel to dilate more easily and be more elastic. Xeronine system promotes a healthy structure with in the circulatory system. Scopoletin has an anti inflammatory and histamine inhibiting effects, both of which are excellent for the promotion of smooth joint movement.
2. Finally the cellular enhancing qualities of Noni may also minimize the damage to the joints and other involved tissues. It also helps to enhance the functioning of pancreas and the immune system. This is achieved by Noni acting as an adaptagen that aids in repairing themselves. This could apply to diabetes by either malfunctioning beta cells in the pancreas or by aiding the cells that are unsuccessfully trying to use the glucose in the blood.
3. Noni contributes more magnesium into the heart cells which helps in regulating a proper heart rhythm. It clears bronchitis infection by enhancing the cellular structures

of bronchioles. Noni helps in curing allergy and inflammation which are causes for asthma.

4. It also helps in menstrual migraine headaches by balancing the hormones through its action on the liver and effect of hormone receptors. It helps in numbness caused by nerve damage.

Noni tea helps in the treatment of Malaria, general febrifuge and analgesic. The decoction prepared from Noni's stem bark is used for curing jaundice. The seed oil is used in the preparation of scalp insecticide. Leaf or fruit poultices helps in curing tuberculosis, sprains, deep bruising and rheumatism. The fruits are believed to be used as an appetite and brain stimulant. The bark contains a red pigment and the roots contain a yellow pigment which is used in making dyes. Dyes from noni were traditionally and still are used to color clothing and fabrics. Oil obtained from noni seedis used as scalp insecticide or insect repellant.

ORIGIN AND DISTRIBUTION:

The plant is believed to have originated from South-east Asia, Oceania and tropical Australia, extending from Polynesia to India. It is now grown throughout the tropics and is cultivated on a commercial scale in Latin America, from Mexico to Columbia and Venezuela, including Costa Rica, Panama, Kenya, Florida and the West Indies. In India, the plant is growingwild in the coastal areas of Kerala, Karnataka, Tamil Nadu, and Orissa. The highest naturally grown populationsare seen in Andaman and Nicobar Islands.

BOTANICAL DESCRIPTION:

The genus name '*Morinda*' was derived from two Latin words *morus*means mulberry and *indicus*means India, in reference to similarity of fruit of noni to that of true mulberry (*Morus alba*). The species name indicates resemblance of plant foliage with that of citrus species. Noni is evergreen tree or shrub growing to a height of 3-6 m. Noni has a rooting habit similar to that of coffee and citrus with an extensive lateral root system and deep tap root. Leaves are opposite pinnately reticulate veined, and glossy. Blades are membranous, elliptic to elliptic-ovate, 20 to 45 cm long, 7 to 25 cm long and glabrous with prominent veins. Petioles are stout, 1.5 to 2 cm long. Flowers are perfect; funnel shaped, grouped in globose head or in small clusters, at the leaf axis. The corolla is white, 5-lobed with greenish white corolla tube, 7 to 9 mm long. The flowers give off a sweet fragrance. *Morindacitrifolia*fruits several times annually, producing multiple or aggregate fruits, oblong 5 to 7 cm long with circular scars, which are green when unripe and yellowish-white when fully ripe. The fruits have a soft, watery flesh, and a cheesy aroma which becomes increasingly pronounced and pungent during the ripening process. It is also called starvation fruit. Noni seeds are small, 4 mm long, reddish-brown, oblong-triangular, and have a conspicuous air chamber.They are buoyant and hydrophobic due to this air chamber and their durable, water-repellent, fibrous seed coat. The seed coat is very tough, relatively thick, and covered with cellophane-like

parchment layers. A single large noni fruit can contain well over 100 to 150 seeds. The seeds are edible when roasted.

Table; 1 Chemical contents of Noni Crop:

S. No.	Plant organ	Component	Effect of component
1.		Alkaloids (xeronine)	In theory, xeronine enhances enzyme activity and protein structure
2.		Polysaccharides (glucuronic acid; galactose; arabinose; rhamnose; glycosides; trisaccharide fatty acidester)	Immuno-stimulatory; immuno-modulatory; anti-bacterial; anti-tumor;anti-cancer
3.	Fruit and fruit juice	Scopoletin	Dilates vasculature and lowers blood pressure; anti-bacterial and antifungal;anti-inflammatory; analgesic; histamine-inhibiting; arthriticconditions; allergies; sleep disorders; migraine headaches;Depression; Alzheimer's disease.
4.		Vitamins and Minerals: magnesium; iron; potassium; selenium; zinc; copper; sulfur; ascorbic acid (vitamin C).	The positive medical effects of the vitamins and minerals in noni juiceare well documented. For any questions or medical and healthconcerns, consult a physician or dietician.
5.	Foliage	Anthraquinones (damnacanthal)	Antiseptic and antibacterial effects in digestive tract (*Staphylococcus,Shingela, Salmonella*).
6.		Glycosides (flavonol glycoside; iridoid glycoside, "citrifolinoside")	Anti-cancer effects: (DPPH free radical scavenging activity; inhibitionof UVB-induced Activator Protein-1 activity in cell cultures
7.	Roots	Anthraquinones (damnacanthal)	Inhibits formation of lung carcinoma in mice.
8.		Morindin and Morindone	Dyes, yellow and red colorants used for tapa cloth; anti-bacterial.

SOIL AND CLIMATIC CONDITIONS:

Noni is an unusual plant, because it can easily tolerate and thrive in a wide range of soils and conditions. The plant is highly tolerant to acidic, saline and alkaline soil conditions and grows well from a pH range of 4.4 to 9.It can grow under almost any soil conditions at low altitudes. Heavy, compact soils and flood prone areas should be avoided for noni cultivation. Noni can be grown in wide climatic conditions such as

tropical, subtropical, dry and humid climates. It grows naturally in wet to moderately wet conditions, also grown in brackish water. It comes up very well between 20-38°C temperatures. It can be grown from sea level to 2000 m above mean sea level. Noni tolerates a wide range of drainage conditions including seasonal waterlogging , but prefers well drained soils . It can withstand mean annual rainfall of 250 – 4000 mm .

FIELD CULTIVATION :

SITE SELECTION :

Avoid locations where other crops have been planted recently, due to the susceptibility of noni to root-knot nematodes. Select a site in full or partial sun with well drained, well aerated soil. Avoid heavy soils, compacted areas, and flood-prone sites. Prepare a hole about the size of the pot and transplant carefully. In rocky locations, "rip" the land (disturb or plow the sub soil) before grading to prepare a flat or gently sloping field.

WIND BREAKS :

Young noni transplants do not grow well where winds are strong. Such conditions may exist along windward coasts; on the Island of Hawaii parts of the Hamakua coast and Kau are very windy. If a windy site is selected for noni cultivation, windbreaks should be planted for protection. Trees such as eucalyptus, ironwood, or wili-wili planted 150 feet apart are excellent windbreaks for noni. Noni is not adversely affected by planting near ironwood.

PROPOGATION:

Noni is relatively easy to propagate from seeds , stem or root cuttings and air layering .The preferred methods of propagating are by seed and by stem cuttings. The primary disadvantage of seed propagation is that without seed treatment, germination takes 6-12 months or more, whereas stem cuttings can be rooted in approximately 1-2 months. Various sizes of stem cuttings can be used , but 20-40 cm cutting is manageable and effective .The disadvantage of producing plants vegetatively from cuttings is that they may not be as strong and disease-resistant as seedlings, and the trunk and branches may split and break during the first years of fruit production. Noni flowers and fruits round the year . Fruits are collected from plants that have desirable characteristics , such as large fruit for fruit production , vigorous leaf growth for hedges etc . Noni seeds are reddish-brown, oblong-triangular, and have a conspicuous air chamber. They are buoyant and hydrophobic due to this air chamber and their durable, water-repellant, fibrous seed coat. The seed coat is very tough, relatively thick, and covered with cellophane-like parchment layers. A single large noni fruit can contain well over 100 seeds. Only soft, ripened noni fruits should be chosen for seed collection. The seeds must be separated from the fibrous, clinging fruit flesh. First, split the fruit by hand into smaller pieces. Separate the seeds from the flesh using a strong spray of water and a firm screen or colander, washing the pulp through the screen while retaining the cleaned seeds. Rubbing the fruit fragments on the screen by hand or with a blunt object can help force the fruit flesh through the screen. It may take 15 minutes or more of vigorous washing and rubbing to detach most of the flesh from the seeds.

SEED SCARIFICATION:

Without pre treatment, Noni seeds germinate sporadically over 6 -12 months .Scarifying the hard seed coat by nicking or puncturing significantly reduces germination time, improves germination percentage, and promotes uniform sprouting. Scarification can be achieved by any physical method that abrades , damages , penetrates or cuts open the seed coat .Whereas in nature the seed coat must gradually decompose before water can enter, scarification overcomes this natural seed dormancy. Using a household blender to separate seeds from the ripened fruit flesh can also result in nicking the seed coats, or the seeds can be suspended in water and subjected to short pulses of blending. Germination time for scarified Noni seeds is 20 -120 days , depending upon temperature , environment and variety or genotype . Seed germination can be rapid and uniform (20 days) in full sun to partial shade and mean temperature of approximately 38°C .

PLANTING:

Fresh noni seeds can be planted immediately after extraction from the fruit. Some growers soak the seeds until they start to germinate, then plant them in containers, while others plant fresh seeds without presoaking treatment. The seedlings are usually grown for about nine months to a year before they are transplanted to the field. Some growers just plant fruit fragments containing seeds directly into the field soil.

GERMINATION:

Noni seeds require hot, wet conditions for optimum germination. Un-scarified seeds require several months to a year before natural germination takes place, but their germination can be reduced to a month or so using heat. The seeds can tolerate temperature of 100°F (38°C), perhaps even higher. Select the warmest spot in the nursery or greenhouse to germinate noni seeds. Or, heat can be supplied using nursery heating pads under the seed flats, or by placing the flats or containers in a special “hoop house” covered with clear plastic. If germinated outside, partial sun is preferable to full sun to avoid excessive drying of the medium.

PLANTING SPACING:

An appropriate interplant spacing for noni is 10–15 feet. At 12-foot spacing there are 290 noni plants per acre. Higher planting densities (closer plant spacing) result in crowding and may exacerbate certain pest or disease problems.

PRUNING:

Young plants less than 3 years old may be pruned back after or during their first production of fruit. In the following years, the pruned plants will become bushy. Because noni trees can reach a height of approximately 20 feet, growers may wish to prune the vertical branches of mature plants to facilitate fruit harvest. Pruning is an effective means of disrupting conditions conducive to pest and disease outbreaks.

NUTRIENT MANAGEMENT:

The amount of nutrients and frequency of fertilizer applications required by noni depends on the soil and rainfall. Noni trees growing in forests usually appear healthy without the benefit of any artificial fertilizers. This suggests that noni may require only small amounts of fertilizer to grow well. In general, however, if intensive fruit production is desired in an agricultural setting, a fertilizer program is recommended. Research is needed to develop the best fertilizer regimes for noni production in the various regions of Hawaii where noni might be grown. It is suspected that noni will do best with relatively frequent applications of small amounts of fertilizer. Noni, being salt-tolerant, will also tolerate high levels of fertilizer salts in the root zone without damage or burning to the plant. The strategy for providing nutrients to noni is similar to that for other fruit crops such as citrus of coffee. Young, non-fruiting noni plants are encouraged to produce lush vegetative growth with balanced fertilizers such as 14-14-14 or 16-16-16, whereas more mature or flowering/fruiting plants are encouraged to produce many large fruits by applying high-phosphorous fertilizers such as 10-20-20 or 1-45-10. Young seedlings and transplants are given controlled-release formulations, while older, mature plants are given rapidly available granular formulations. Fertilizer should be applied away from the trunk of the tree, at the "drip line" of the plant, the area where water drips from the edge of the leaf canopy. Noni plants of all ages respond well to sprays of foliar fertilizers. Noni flower and fruit production is very responsive to sprays of high-phosphorous foliar fertilizers (e.g., 10-45-10) and products (e.g., seaweed emulsions) containing nitrogen and minor elements. Noni should be fertilized frequently using smaller amounts of fertilizer, rather than infrequently using larger amounts. In high-rainfall areas, young plants up to a year old can be given _ pound per month of balanced fertilizer (14-14-14), and more mature plants can be given up to 1 pound per month. Effective organic fertilizers for noni cultivation include crushed coral, dolomite, K-mag, 7-7-7, and composted chicken manure and macadamia nut husks. Some locations will benefit from yearly applications of lime, about 1 pound per plant.

IRRIGATION:

Noni thrives with moderate irrigation and can survive extended periods of drought once established and mature. When plants are less than 2-3 years old and conditions are dry, irrigate once or more a week, and for older plants, irrigate less frequently. Over-watering can accelerate damage to noni from root-knot nematodes, cause root rot, and leach fertilizer nutrients beyond the root zone.

PLANT PROTECTION :

- Noni is susceptible to attack and damage by a range of insects, such as aphids (e.g., the melon aphid, *Aphis gosypii*), scales (e.g., the green scale, *Coccus viridis*), weevils, leaf miners, whiteflies (e.g., croton caterpillar, *Achaea janata*), thrips (e.g., the greenhouse thrips, *Heliothrips haemorroidalis*, and an unidentified species of eriophyid mite).

- Overused of fertilizer can attract sap-feeding insects (e.g., aphids, white flies, scales) that cause a buildup of sooty mold on noni leaves. Sucking pest may be controlled by spraying of systemic pesticides twice a year and caterpillars by contact pesticides.
- In damp, high-rainfall or flooded areas, noni is prone to certain plant diseases caused by fungi or fungus-like organisms: leaf spots (*Colletotrichum sp.* And others) and stem, leaf, and fruit blights (*Phytophthora sp.* and *Sclerotiumrolfsii*). The fungal leaf spot diseases are relatively minor nut can be a nuisance in some locations. They can be minimized by sanitation (picking up or removing severely diseased leaves) or by periodic application of approved fungicides (Copper based fungicides). Some foliar diseases caused by fungi (fungal leaf spots caused by the fungus-like Phytophthora) may significantly inhibit leaf growth and fruit development. The most common and severe pest problem for noni is rootknot diseases caused by root-knot nematodes *Meloidogyne spp.*Proper use of irrigation, fertilizer and composts can help minimize damage caused by root-knot nematodes.
- Medicinal plants require production involving minimal or no usage of chemical pesticides. Organic practices include control measures using neem based formulations; fish oil resin soap can be used to manage such sucking pests. Botanicals viz., extracts of garlic, *Vitexnegundo, Lantana camera, Clerodendroninerme, Calotropisgigantea* are often combined and sprayed periodically for controlling the pests.
- Diseases like damping off, root rot can be managed by application of *Trichodermaviridi* (2kg/ha)and *Psuedomonasflurescens* (2kg/ha).

HARVESTING AND HANDLING:

Under favorable growing conditions, noni plants may begin to produce small flowers and fruits about 9 months to 1 year of age. Fruits can be harvested at this early stage, although they are generally small and few. Some farmers choose to forego harvest during the first or second years in favour of pruning back the branches instead. In Hawaii, noni fruits are harvested year round, although there are seasonal trends in the amount of flowering and fruit production that may be affected or modified by the weather and by fertilizer and irrigation. Fruit production may diminish somewhat during the winter months. A given noni field is usually harvested from two to three times per month. Noni fruits can be picked at any stage of development, depending on the intended processing method. Some producers prefer green fruits, whereas other processors prefer the hard white noni fruits for processing. Most noni juice processors accept or prefer the “hard white” stage of fruit development for noni juice production, because the fruits ripen quickly once that stage of development is reached. Noni fruits are harvested by hand by picking the individual fruits from the branches. They are placed in baskets or bags or placed in bins for transport to the processing facility. Noni fruits do not bruise or damage easily, and usually no special padded containers or other precautions are needed to prevent fruit significant fruit damage. Green or unripe yellow

noni fruits are very hard skinned and durable, and therefore resistant to superficial damage and bruising during shipping and handling. Noni fruits at this stage of development will ripen overnight or in a few days at room temperature and can be processed for juice immediately thereafter. Furthermore, exposure of noni fruits to direct sunlight or to warm temperatures immediately after harvest is not a significant concern. So, noni fruits need not be refrigerated after harvest and are usually not refrigerated.

Table: 2, PROPOSED YIELD OF NONI CROP OF 10 YEARS

Years	Yield per Tree per year	No Trees for	No of Kgs Yield per acre	
3	20 Kgs	1450	29,000	
4	50 Kgs	1450	72,500	
5	80 Kgs	1450	1,16,000	
6	110 Kgs	1450	1,59,500	
7	150 Kgs	1450	2,17,500	
8	200 Kgs	1450	2,90,000	
9	250 Kgs	1450	3,62,500	
10	300 Kgs	1450	4,35,000	

SEED DRYING AND STORAGE:

Noni seeds can be dried and stored, but the length of time they will remain viable is not known. After cleaning, spread the seeds out on newspaper and dry them in the shade or indoors for two or three days. Store the seeds in an air-tight container at room temperature.

PROCESSING OF NONI:

Traditional noni juice

Freshly picked noni fruits after washing are allowed to airdryon raised tables before they are processed for juice.The most efficient noni juice extraction by weight isobtained when ripe, soft, translucent fruits are placed intothe juice collection vessels. Ripe noni fruits are placedinto a juice collection vessel for two months or longer.During this time, the noni juice separates (drips) gradually from the pulp. The juice collection and fermentationvessels should be made of glass, stainless steel or foodgradeplastic. The noni juice collects inside the containersand ferments as it gradually seeps and sweats from thefruits. The juice appearance is initially an amber or golden colored liquid that gradually darkens with age.After the collection and fermentation process is complete,the juice is drained from spigots at the base of containers(and filtered). Fresh air is excluded from thesecontainers, and contact between the juice and fresh air

isminimized throughout the process. The final noni juiceproduct is decanted, filtered and bottled.

Fig. Images of Noni plant

Livestock Auction Practices in Kashmir: An Appraisal from Public Health Perspective

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ABSTRACT

Routine auctioning and emergency procedures as practiced in field and farms in Kashmir are quite problematic from public health perspective. Most disease conditions necessitating partial or complete condemnation of carcass later which could be encountered and are not ruled out in routine procedures followed before deciding the individual cases for auction. These include, among others, cases of septicemia, tetanus, pyemia, toxemia or viremia, pleurisy, peritonitis, metritis, arthritis, pericarditis, enteritis, acute brucellosis, generalized sarcocystosis, cysticercosis,, advanced anemia, emaciation, multiple tumours, multiple abscesses and febrile animals. Threats to the consumer come from not only pathological lesions but from such mircro-organisms as *Salmonella,Campylobacter, Listeria, Giardia, E., coli*etc. which are usually involved with a carrier state in the animal and with serious fecal contamination. The paper calls for the need of strict scientific appraisal of current practices in field and farm and seeks to draw attention towards the grave problem of absence of required number of slaughter houses where scientific antemortem examination could have been done.

Key words: Kashmir, Auction, Zoonoses, Antemortem examination

INTRODUCTION

It is a fact that mortalities in some of the departmental farms, even if granting the veracity of official records and assuming that there is no discrepancy between the projected and the actual figures, are abnormally high. Finding a fault with management has been usually the only response from the concerned authorities. One can grant the need of improvement in management but singling it out is unwarranted. There has been a great thrust towards minimizing mortalities or at least pretending that mortality rate is minimal in government farms and govt. livestock in the field due to strong pressure from the higher authorities. Farm officers have been compelled to resort to certain other measures to show decreased percent mortality. Amongst the measures taken for decreasing projected mortality percentage routine auctioning and especially emergency

auction of govt. livestock has been perhaps the most important one. But it is sad to note that zoonotic diseases such as brucellosis have recently emerged as quite significant diseases in our state for medical community. T. B. is another important concern. Listeriosis and a host of other zoonotic diseases are threats and the role of mortality cum auction policy that the department has been following must be dispassionately examined. The present paper identifies current auction practices of govt. livestock and privately owned livestock as one of the factors contributing to this scenario and seeks to evaluate the logic and implications of this culling for auction and emergency culling policy.

MATERIALS & METHODS

Postmortem examination reports, mortality and auction record registers of government sheep breeding farms and field organizations of Department of Sheep Husbandry of Kashmir Valley were screened for analyzing auction practices from public health perspectivein Kashmir. Further, discussion was held with doctors and officials/ officers posted in the field and farms on current auction practices and their public health implications thereof. Both official and nonofficial information was kept in consideration to warrant the critical analysis.

RESULTS & DISCUSSION

I. Culling of animals which precedes routine auctioning on the basis of prolonged wasting disease, chronic mastitis, metritis, enteritis, prolonged respiratory trouble, unthriftiness and orchitis – to name the most often encountered conditions -without getting a confirmatory diagnosis involves a definite risk of zoonoses and allowing wide spread of infectious disease. Prolonged diarrhoea is associated with many important zoonotic and infectious diseases to need enumeration. Mastitis is many times a cause of culling for slaughter despite the fact that it is manifested in such diseases as caseous lymphadentis due to *Corynebecteriumpsudotuberculosis* which is zoonotic. Mastitis and atrophy of udder occurs, for instance, in contagious agalactia caused by *Mycoplasma agalactia.* Auctioning such an animal will spread the infection to other animals. Milker's hands also spread it. Mastitis and diarrhea can be features of T. B. also which is an important zoonotic disease. There are in fact tubercular meningitis, tubercular orchitis besides tubercular enteritis. *Corynebecteriumpsudotuberculosis* is also responsible for abscesses in lymph nodes and internal organs. Animals with neurological signs, paraplegia etc. are often selected for emergency auction though these are features of many serious infectious and zoonotic diseases. Orchitis is a feature of not only brucellosis but may be manifested in many other zoonotic diseases such as Caseous lymphadenitis. A perusal of postmortem reports shows pneumonia which is a feature of many important infectious and zoonotic diseases as very important cause of death. Animals showing pneumonic signs which don't respond to routine treatment are also proposed for emergency auction. This means

uninvestigated and possibly zoonotic disease (e.g., Yersiniosis) could have been the culprit. Salmenollosisaffected animals are also not fit for slaughter but it goes undiagnosed in field conditions. And it occurs in different forms and is difficult to rule out its presence in many cases of enteritis. Enteritis, along with pneumonia, is officially amongst the top rankers in postmortem reports as postmortem finding.

II. Many a time it is hard to suspect of zoonotic/infective disease and which test to carry for confirmation. So unwittingly spread of diseases goes on.

III. Routine practice of going for emergency auction after waiting for a few days following unsuccessful symptomatic treatment most often means that a sick animal with certain systemic involvement has been proposed for auction.

IV. Auctioning while recumbent and thus strong concomitant possibility of septicemia is, generally speaking, not advisable to go for slaughter and allow meat consumption.There are numerous diseases which necessitate total condemnation of carcass especially if there are evidences of general signs, weakness, toxemia, septicemia. Thus, as a rule we may assert that sick animals in general (which are often recumbent/depressed/showingnervous symptoms/febrile/hypothermic/pneumonic/weak/almost dying), the cause of whose sickness is not clear, involve a definite risk for emergency auction.

V. What happens generally in farms or even field is that all of a sudden animal is found dead, perhaps due to some per-acute disease. Animal dies within a day or two or sometimes what is clinically presented is only inappetance and one hardly suspects any serious thing but the animal soon succumbs. When it is a case that in humans even with the use of best facilities only a small percentage of cases get quickly and perfectly diagnosed what to speak of our livestock in the farms or field? The only tool we have in many cases is guess work in the vacuum and then you hardly ever know whether your hunch has been right or not. There is hardly any arrangement to house diseased animals for detailed investigation here in the valley and we have great difficulty in admitting our animals at any Disease Investigation Labs. Better diagnosis may cost a great deal as it does in case of humans. So disease investigation and mortality control is a question of money. Making exact diagnosis on the basis of clinical picture is, barring a few exceptional diseases in which typical symptoms of well known diseases or pathognomic lesions are present, impossible. But this is what is usually demanded. This implies that diseased animal will be somehow disposed off if mortality is to be saved. If investigative efforts are geared up (and please note that it will not be possible without a great deal of money) new revelations will surface up. In recent months the isolation of hitherto unsuspected infective agents by FVScscientists illustrates my point. This means it may be dangerous, in most cases, to declare animals safe for slaughter on mere antemortem observations especially if there is some undiagnosed health problem.

VI. Credibility of record making, flock books, lambing records, record of auctions, mortalities in the department has been sometimes questioned. What we want to

emphasize is why should there be any need in the first instance for any supposed manipulation? The role of utopian and unscientific policies regarding disease management in terms of fixing the targets, limitation of options of measures of control etc. needs to be reexamined. The theory and practice of so-called adjustments that certain incharge officers are sometimes supposed to resort if correct is partly a result of certain compromises made at the fundamental level with strict enforcement of disease control measures. There is a need of open debate on these issues.

VII. Antibiotic selection takes certain time as hit and trial method is often a practical necessity. If one goes for AST still it takes some time. This may often be long enough and until that time disease may have worsened or claimed the animal. This leads to laxing of measures to identify and diagnose the disease. Sporadic cases thus go undiagnosed. This in turn leads to more and more cases over time and if there is certain variation in clinical picture our attention doesn't turn to seeing its possible infectious nature or to its endemicity or even its status as a possible or potential outbreak. Those diseases which affect only a few cases and claim little actual mortality though other lingering factors or morbidity may be significant are thus left untreated, unidentified and unexplored with the result that certain pooling of infectious agent occur.

VIII. As there is no standard scientific inspection of meat shops of local butchers which supply the bulk of meet to the public (and the public includes we ourselves as consumers) it is left to the jurisdiction of farm or fielder officer to perform antemortem meet inspection. The farm officer's choice to go for emergency auction is often dictated by immediate consideration to save the mortality. It is also, strictly speaking, almost impossible for a veterinary surgeon to rule out on antemortem the possibility of potentially infectious or contagious and zoonotic nature of the disease. It is even not possible most of the times by mere inspection of carcass and viscera after slaughter to declare the safety of the meet for human consumption or rule out presence and thus possibility of spread of certain infectious agent. This means that going for an emergency auction of a sick animal almost always involves definite risk as the probability that the said animal is not suffering from a zoonotic/infectious disease and that its meet is fit in all respects for human consumption is almost never 100 per cent.

To conclude with a suggestion it may be asserted that it may be imperative to do away with the whole rationale of projecting officially lesser mortality percentage by means of emergency auctions and culling of possibly problematic cases.

The results which were concluded from the present study are:

1. Sick, very weak or emaciated animals are, generally speaking, put for emergency auction.
2. Most often there is systemic involvement of the said animal. Fever/ toxemia/ septicemia are often the associated features.

3. Sometimes animals are already recumbent when auction proposal is to be implemented.
4. Often the issue at hand is saving the mortality of government livestock rather than saving the consumer.
5. Generally speaking the precise cause of death in govt. livestock is not known or the nature of disease is undiagnosed, especially when it is a sporadic case of death (certain outbreaks are of course well diagnosed as they become a cause of concern, sporadic cases being not subject to detailed examinations as Research authorities are not involved in these cases. Postmortem reports submitted by VAS's don't and often can't contain the exact and confirmatory diagnosis. It takes weeks and months to correctly diagnose an outbreak with all our best efforts with the help of disease investigation authorities so confirmatory diagnosis of a sporadic case, in present conditions, is often not attempted or even if attempted the results are not forthcoming or delayed. Passing the animal for slaughter by way of emergency auction when even one has not identified the cause of disease, as is the general practice, is simply questionable.
6. There is hardly any such thing as incineration in farms/ field for suspected and sometimes even confirmed cases. Even deep burial is not a general practice. The department has yet to procure incinerators.

Spineless Cactus as Non Conventional Fodder Crop for Arid and Semi-Arid Regions

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Livestock is symbolic to wealth and power across civilizations for centuries. India is blessed with diversified type of livestock. Livestock population is around 529.7 million and is expected to grow at the rate of 0.55% in the coming years. To provide sufficient milk to the ever growing population there is a need to increase the current milk production of 164 million tonnes to 400 million tonnes by 2050. The average yield of milk and meat in our animals is 20-60% lower than the global average. Further, their production potential is not realized fully because of constraints related to feeding management. However, the demand will reach to 1012 million tonnes of green fodder and 631 million tonnes of dry forage by the year 2050. At the current level of growth in forage resources, there will be 18.4 % deficit in green fodder and 13.2% deficit in dry fodder in the year 2050. In order to overcome this problem spineless cactus need to introduce in dry areas for supply of good quality fodder.

SpinelessCactus (*Opuntiaficus-indica*L. Mill.) is a CAM (crassulacean acid metabolism) plant grows arid and semi-arid areas of India.It is originated on the central plateau of Mexico.Since cactus has a higher conversion efficiency of water to dry matter than any other kind of plants, hence is highly useful as fodder for cattle, sheep and goat.The fodder quality of cactus is quite comparable with several other cultivated nutritious fodder crops. In general, cactus cladodes are high in carbohydrates (60 g/100 g DM), dry matter digestibility 70%, moisture content 85-90 %, crude protein 5-12 %, crude fiber 43%, phosphorus 0.08-0.18 %, calcium 4.2 %, potassium 2.3 %, magnesium 1.4 %, energy 2.6 Mcal/kg, carotenoids 29 µg/100 g and ascorbic acid 13 mg/100 g.

FOLLOWING STEPS ARE OPTED IN CACTUS FARMING:

Nursery Management:The nursery propagation was undertaken both in shade net house having 50 % shade to create suitable environment and also under open condition. Following techniques needs to be adopted for undertaking nursery propagation of cactus.

1. **Curing of cladodes**: Keep the fresh cladodes under shade for curing after removing from the mother plantsto bring down the moisture content upto 65-70% before planting in the nursery/field.A curing period of 2 weeks is ideal before planting in the nursery/field.
2. **Nursery media**: Selection of suitable nursery media plays key role in success of the propagation in cactus. Soil, sand and FYM in 40:40:20 proportions are the best media for cactus nursery rising.
3. **Planting in nursery:**Planting the cactus during post rainy season i.e. October onward till March is the ideal time where maximum plant survival will be observed. The cactus cladode of 6 months of age and above should be selected for nursery propagation. The matured cladodes may be cut into 2, 4, 6 and 8 pieces for multiplication. However the survival and growth of single cladode is faster but 1/8th piece of cladode, can be multiplied into a new plant though it takes longer time to become a mature plant. The cladodes/pieces should be treated with fungicide (Mancozeb) @ 2g/liter water before planting. The cladodes should be planted erect keeping 1/3rd portion below media. In case of cladode pieces the uncut portion should be kept above media while planting in the pot/bag.
4. **Water management:**The cactus is very sensitive to moisture therefore optimum watering should be provided during nursery stage. Do not water the plants immediately after the planting. After a week time, water the plant lightly (1 liter/pot or bag) and subsequent watering may be provided at 10 days interval.
5. **Hardening the propagules:**The sprouting and development of new cladodes and roots will take around 60 days. At this stage the propagules should be exposed to sunlight by taking them outside the shade net for hardening. A period of 30 days is sufficient for hardening the propagules. Therefore the propagules will be ready for field planting in 90 days.

Cactus Cultivation and Management: The following package of practices needs to be followed for successful cactus plantation.

Climate:*Opuntia*can cultivate from sea level to desert where temperatures are extremely high and can tolerate high temperatures of up to 60 to 70°C. It grows in area where average annual rainfall ranges from 300-600 mm and free from frost, hail and strong winds. Hot sunny days and cool dry winter where temperatures do not fall below maximum 5^0 C are most suitable for cactus production. A temperature range of 18–30 °C is suggested for germination and soil temperatures of around 22 °C promote the best root growth.

Site selection and land preparation:*Opuntia* thrives best on sandy and sandy loam soils. It can easily be grown in especially gravelly or stony or degraded poor quality land, where other crops cannot be grown.

Planting time: Cactus can be planted throughout the year, but the best time for its planting is September-October and February-March.

Selection of the cactus accessions: The selection of cactus accessions depends upon the purpose of plantation i.e. fruit, fodder or vegetable. The thorn less accessions should

be selected for fodder purpose. The accessions 1270, 1271, 1280 and 1308 are tested for its growth, biomass production and nutritional content in biomass at Indian Grassland and Fodder Research Institute, Jhansi, Central Agro Forestry Research Institute, Jhansi, National Research Centre on Arid Horticulture, Bikaner, Central Arid Zone Research Institute, Jodhpur, Central Soil Salinity Research Institute, Karnalare recommended for fodder purpose planting.

Establishment of cactus plantation: Cactus is propagated by seed and vegetative parts. However, the most common method of propagating cactus is by leaves (cladode) that are at least 10-12 months old. The matured cladode of identified accessions is used for planting material. Curing of freshly harvested cladodes is necessary under shade for 15 days before planting in the field. It is better to plant on ridges to avoid flooding during rainy season. The cladode should be planted erect keeping 1/3rd portion below ground and it should be treated with Mancozeb@ 2g/liter water before planting to prevent disease caused by seed borne fungal pathogens.

Spacing: Spacing depends upon the type of cultivar and the purpose for which the plantation is being raised. In general, cactus is reported to give best production when planted in rows 3or 2 m apart keeping distance between plants 2 or 1 m.

Manure and fertilizer application: A combination of organic and inorganic fertilizers might be the best option when less manure is available. Application of 5 tonnes well decomposed Farm Yard Manure and 60:30:30 kg NPK per hectare is recommended at the time of planting. Application of 20 kg Nitrogen is useful in enhancing the new sprouting after every harvest for biomass.

Intercropping: To provide a nutritional balance, farmers are encouraged to grow leguminous fodder like *lathyrus*as intercropwhich is capable of withstand under drought conditions. Use alley cropping with cereal, legume pasture crops and perennial grass like TSH/guinea grass grown between rows of cactus.

After care and maintenance: Weed control is essential to increase cactus productivity. Keep the field weed free during initial plant growth period by hand weeding or application of herbicide (Glyphosate @ 5 ml/liter water). Provide the optimum moisture for initial plant establishment period of one year. Therefore watering the plants at 15 days interval during post rainy season is very much essential.

Harvesting management: Cactus harvest management must take into consideration harvest intensity, frequency and timing. Interaction between these factors affects cactus regrowth. Cladodes are tender and should not be grazed directly by animals otherwise longevity of crop drastically decreases. The biomass harvesting in cactus should be initiated after one year of the plantation. Keeping the basal cladode, the other cladodes may be harvested by cutting with sharp knife. Cactus can be fed to cattle and small ruminants like sheep and goat by mixing it in total mixed ration (TMR). Many farmers prefer and are encouraged to cut the cactus into smaller pieces and supplement with hay or straw. Goat may consume on an average 3 kg of the cactus daily and can maintain their body weight without any adverse effect on their health. Cactus can be used as a fodder for replacement of 25% dry matter with their regular grazing.

Yield: The average of 15 to 37 cladodes and fresh biomass yield of 15 to 20 kg per plant was recorded at 12 months after planting. The biomass yield increases with increase in age of the plants and 27 to 29 kg biomass per plant was observed at 21 months after planting.

NUTRIENT COMPOSITION

Cactus fodder is rich in vitaminA and water soluble carbohydrates. Forage quality is comparable with several other cultivated fodder crops. The average chemical composition of cactus cladode is given below:

Chemical composition (Dry matter basis)	
Dry matter %	10-11
Crude protein %	11.81
Dry matter digestibility %	70.00
Ether Extract %	1.18
Fiber %	8.12
Ash %	2.55
Ca %	6.05
P %	0.30
Mg %	3.15
K %	1.82
Na %	0.05
Cu %	6.13

NDDB, Anand

SUMMARY

Spineless cactus can be cultivated on the bund of farms by small and marginal farmers of arid and semi arid region with low inputs not only to overcome malnutrition in livestock's but also increases socio-economic condition of rural people.

Modern Trends of Plant Nutrition in Indian Agriculture

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Plants and man have evolved, together in a kind of symbiosis since the dawn of history. Mankind has been repeatedly invaded by hunger and disease. Since then, it became our permanent challenge to feed mankind and fight against diseases caused by malnutrition. Plant nutrition has been of great interest since time immemorial, at first among philosophers, and later among researchers.The problem was found to be lied in lower food production due to poor plant nutrition. Efforts to alleviate hunger became successful only after the discovery of the nutritional needs of plants in the mid-nineteenth century.In order to augment plant nutrients in low fertility soils, the mineral fertilizers were developed in 1880s and adopted on larger scale since 1950 (FAO, 2006). Liebig's work on the role of inorganic fertilizers in crop production came up with a new insight in the field of plant nutrition (Liebig, 1840). Later it was understood that crop nutrient requirements often cannot be met solely through mineral fertilizers. So, a judicious combination of mineral fertilizers with organic and biological sources of nutrients started being promoted. Now, a new dimension of plant nutrition is determined, on one hand, by the need to feed the world population increasing in geometric progression, and on the other hand by growing environmental problems connected with intensification of agricultural production.

THE ANTIQUITY:

In the Odyssey, Homer named manure as a material that improves plant growth. Next to manure, different kinds of organic materials like compost, straw, animal residues, river and pond silt, green manure, ash, bones, lime and gypsum hadbeen recommended to be used for soil fertilization.(Fageria, 2009).In the middle ages, attention was drawn to the relationship between plant yield, growth and development on different soils. At the turn of the 16th and 17th centuries, science of plant nutrition started to develop, from the philosophy of nature to experimental sciences that were based on chemical bases. The 19th century was a breakthrough in explaining the nature of plant nutrition with "*Theory of mineral plant*" by Justus von Liebig.

20th century- The Green Revolution:

One of the greatest achievements in this era was effectuation of the catalytic process of producing ammonia from atmospheric nitrogen at industrial scale. Thus obtained ammonia became the basic fertilizer intermediate product in the growing fertilizer industry (Lindströmand Pettersson, 2003). The marvellous effectiveness of the '*chemicalization*' of agricultural production was utilized in form of*Green Revolution* in 1960s (Ortiz *et al*., 2007). Chemical fertilizers, unquestionably, have been continuing to be an important driver of productivity growth. Asserted Norman ErnestBorlaug, "If high-yielding varieties are the catalysts that have ignited the *Green Revolution*, then chemical fertilizer is the fuel that has powered its forward thrust". But the vigorous use of fertilizers allowed for a great increase in yields from a unit of area. This discovery, gradually began to show its dark sides (Voisin, 1965). Further studies showed that excessive or unbalanced fertilization contributes to deterioration of the biological value and quality of yields.

MODERN TIMES- THE ERA OF INNOVATION:

Of late, the preferential application of nitrogen in imbalanced quantity, inadequate P and K application, and lack of secondary and micronutrient application potentially compromises our desired goal of sustainable food security while maintaining a healthy soil and environment resources for posterity. Age-old blanket fertilizer recommendations over large areas do not hold any more relevance under current perspective. According to International Fertilizer Association, "Without fertilizers, human life is unsustainable" (IFA, 2009). That is why it is justified to introduce a multi-pronged approach, keeping the soil health issues in mind, in the realm of plant nutrition in India.

Mineral nutrients- The feed of plants:

Apart from C, H, O, plants require at least 14 mineral elements for their nutrition. These include the macronutrients nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg) and sulphur (S) and the micronutrients viz. chlorine (Cl), boron (B), iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), nickel (Ni) and molybdenum (Mo) (Mengel and Kirkby, 2001). These are generally obtained from the soil and applied fertilizers. Crop production is often limited by low phyto-availability of essential mineral elements and/or the presence of excessive concentrations of potentially toxic mineral elements, such as Na, Cl, B, Fe, Mn and Al, in the soil solution.

Nano materials- A novel formulation:

Nano fertilizers are synthesized or modified form of traditional fertilizers or extracted from different vegetative or reproductive parts of the plant by different chemical, physical, mechanical or biological methods with the help of nanotechnology for improving soil fertility, productivity, nutrient use efficiency and quality of agricultural produces. Sized below 100 nm nano-particles are used as fertilizer for efficient nutrient management which are more eco-friendlyand reduce environment foot print of agriculture. Nano fertilizers have the potential to enhance NUE owing to higher

nutrients uptake caused by smaller surface area of nanomaterials which increases nutrient-surface interaction. They are very effective for precise nutrient management with matching the crop growth stage for nutrient and prevent plant from different biotic and abiotic stress.

Liquid fertilizers- A potential reality:

Liquid organic fertilizers produced from agricultural residues and industrial wastes are becoming increasingly popular.Of different fertilizers, liquid fertilizers, a special class of fertilizers, hold very strong promise in protected cultivation viz. hydroponics, aeroponics or even open field for perennial fruit crops. The liquid fertilizers, provide an enormous possibility of tailoring nutrient use across critical growth stages, a pre-requisite for better nutrient-use-efficiency. In India, the traditional liquid fertilizer are called *Panchagavya*, a manure made by fermenting cow dung in water. Other Indian liquid manures such as Jeevamrut and Beejamrut are reportedly used not as sources of nutrients but of plant growth hormones (Vasanthkumar, 2006.)Fertigation or foliar application can also be addressed here with following advantages:

- Ease of handling and application (once set up)
- Ease of blending
- Uniformity of application
- Starter and in-season application
- Blend with crop protection products

io fertilizers- Substitution of synthetic fertilizer:

Bio fertilizers are now included in the Fertlizer Control Order, 1985 which specifies revised standards for ten preparations namely: Rhizobium, Azotobacter, Azospirillum, Phosphate solubilising bacteria, Mycorrhizal biofertilizers, Potassium mobilizing bacteria, Zinc solubilizing bacteria, Acetobacter, Carrier based consortia and Liquid Consortia. Application of organic manures is required in very high quantities to meet nutrient demand of crops; chemical fertilizers are becoming increasingly expensive. Bio fertilizers are, thus, attractive as they are applied in small quantities, are cheap and reduce dose of chemical fertilizers, give synergistic benefits on productivity, nutrient use efficiency, crop quality, soil health and disease suppression. The additional advantages of bio fertilizers include longer shelf life causing no adverse effects to ecosystem. (Sahoo *et al*., 2014).

Soil Test Crop Response- Understanding the variability:

Soil Test Crop Response studies use the targeted yield approach to develop relationship between crop yields on the one hand, and soil test estimates and fertilizer inputs, on the other. Targeted yield concept, thus, strikes a balance between fertilizing the crop and soil. In this era of ever increasing prices coupled with increasing demand of chemical fertilizer and depleting soil fertility necessitates the integrated use of organic (renewable) and inorganic (non-renewable) sources of nutrient for sustainable crop production and better soil health. Of late, STCR has developed algorithms of leaf colour

chart, SPAD and fieldscout CM 1000 meter values at three critical growth stages with yield in rice-wheat system; also developed fertilizer prescription equation for hitherto untouched secondary nutrient (sulphur). Besides, soil testing protocol for organic farming system including characterization and quantification of microbiologically exploited organic phosphorus-pools in organic farming systems has also been developed.

Crop diversification- Resilience in agriculture:

Crop diversification through legumes has own a strategic position in intensive as well as subsistence agriculture, as they are an excellent source of nutritional feed for livestock and mini-nitrogen factory having profound ameliorative effect on the soil. Availability of short duration varieties coupled with matching agro technologies has resulted in identification of several remunerative, and more productive cropping systems which have either already shown their promise or have tremendous potential for expansion in new niches and diversification in the existing cropping systems.Crop substitution and crop shift are also taking place in the areas having some specific soil related problems.

Diagnosis Recommendation Integrated System- An assessment of plant requirement:

One of the main plant nutrition objectives is increasing net incomes through efficient fertilization management. To reach this goal, it is initially necessary to correctly determine the yield-limiting impact of a given nutrient. The search for an effective method to determine plant nutritional status has been the target of many researches in plant nutrition. Nutrient concentrations far below or above critical values are associated with decreasing vegetative growth, yield and quality. The DRIS method expresses results of plant nutritional diagnosis through indices, which represent, in a continuous numeric scale, the effect of each nutrient in the nutritional balance of the plant. (Beverly, 1991; Walworth & Sumner, 1987). In general, the DRIS has some advantages over other diagnosis methods: presents continuous scale and easy interpretation; allows nutrient classification (from the most deficient up to the most excessive); can detect cases of yield limiting due to nutrient unbalance, even when none of the nutrients is below the critical level; and finally, allows to diagnose the total plant nutritional balance. (Baldock & Schulte, 1996).

Site Specific Nutrient Management- Increasing use efficiency:

Despite clear understanding on efficient management of fertilizers, improving nutrient use efficiency continues to be an enigma. The 4R Nutrient Stewardship Principles of applying the right source of plant nutrients at the right rate, at the right time, and in the right place is at the core of the precision nutrient management approach. Site-specific nutrient management (SSNM) can effectively replace the blanket fertilizer nutrient recommendations for achieving high nutrient-use efficiency, economic profitability with lower environmental footprints. The new decision support tools (Nutrient Expert, GreenSeeker, remote sensing, real time nutrient management etc.), based on the

principles of SSNM, help to quickly develop fertilizer recommendations in presence or absence of soil test data. There are five principles of SSNM:

- Balanced fertilization based on crop requirements
- Plant based estimation of root nutrient supplies
- Need based Nitrogen management
- Sustainable Phosphorus and Potassium Management
- Increasing profitability

Organic Nutrition- Sustaining soil health:

Organic fertilizers comprise a variety of plant-derived materials that range from fresh or dried plant material to animal manures and litters to agricultural by-products. They, undeniably, are a store house of all essential macro and micro nutrients, albeit in limited amounts. Besides, they have distinctive role in building soil biology,physical health and resilience - the contributory factors in sustaining tempo of productivity growth. But, organic manures alone may not be able to meet the nutrient requirement of high yielding crops to produce the required food grains for the burgeoning human population due to their low nutrient contents and slow rates of nutrient release. So comes integrated nutrient management.

INM- An efficient management:

Presently, micronutrients has been receiving increased attention as their deficiency is threatening the agricultural sustainability, nutritional quality as well animal and human health. Balanced nutrition does not mean the application of nitrogen, phosphorus and potassium alone in certain proportion through fertilizer,but it should ensure that the nutrients in available forms are in adequate quantity and in requiredproportion in the soil to meet the requirement of the crops for obtaining the desired levels of yield.Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. Thus, integrated use of the chemical, organic and biological sources of plant nutrients and their different management practices have a tremendous potential not only in sustaining agricultural productivity and soil health but also in meeting a part of chemical fertilizer requirement for different crops and cropping systems in India.

Plant bio fortification- Heralding the future:

Hidden hunger or micronutrient deficiency retards the growth and development of both crops and humans. Soil micronutrient deficiencies limit crop productivity and nutritional quality of foods, which together affect nutrition and human health. Plant biofortification is defined as the procedures whose purpose is to increase the content of some elements, nutrient compounds and vitamins in plant yield in order to improve its biological quality, and, as a result, to improve the health of food consumers (Khush GS, 2012). The drivers are low purchasing power of poor people especially in third world

countries, their less access to markets and health-care systems, and lack of awareness regarding the long-term health benefits of these nutrient supplements. Hence, bio fortification of different crop varieties offers a sustainable and long-term solution in providing micronutrients-rich crops to people.Agronomic bio fortification is achieved through micronutrient fertilizer application to the soil and/or foliar application directly to the leaves of the crop. This applies to iodine, zinc, molybdenum, selenium etc.

CONCLUSION:

The great progress in plant nutrition, which has been observed in recent years, is a result of the achievements in, among other things, sciences such as agriculture, chemical technology, physics, physiology, and in the use of modern analytical techniques with precise research equipment. W. A. Lewis said, "The secret of rapid agricultural progress is to be found much more in fertilizers, in new seeds, in pesticides and in water supplies than in altering the size of the farm, in introducing machinery, or in getting rid of middle men in the marketing process". So, the agricultural professionals, are also holding the key and the way forward to salvage this burdened planet and should agree with the opinion of Arnold Fink, an outstanding German agricultural chemist, that "Scientific theories and hypotheses can be used in agriculture as long as they find confirmation when confronted with the nature".

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Colour Enhancement of Ornamental Fishes through Application of Dietary Carotenoids

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Aquarium keeping in home is considered as the most popular hobbies in the world and it is said to be 2nd largest hobby in the world. Indian waters posses over 250 indigenous varieties of ornamental fishes. Ornamental fishes have very attractive colour and peaceful nature and they are also known as 'living jewel'. Colourations in fishes are highly correlated to their behaviour and habitat. Many fishes are exploited from natural environment or raised in confined environment only because of their colouration. This lead to the development of one of the most important industry called ornamental fisheries.

Ornamental fish trade is a multibillion-dollar industry in which approximately more than 125 countries involved the trade. Singapore has been the ornamental fish capital of the world with an export value is US$42.97 million, contributing to 12.7% of the total exports in 2016. Till today it remains the main trading hub in Asia, with more than 30% of the fish exported having been sourced from other countries. The second position was occupied by the Spain with exports worth US$39.56 million in 2016. Among the top 10 importing countries in 2016, USA was the single largest importer of ornamental fish with an import value of US$56.57 million, contributing to 19.7% of the total imports in 2016. The UK occupies the second position with imports worth US$23.02 million. Export value for the Indian ornamental fish industry in 2016 was US$ 1.06 million and it contributed 0.3% of the total export. Import value for the Indian ornamental fish industry in 2016 was 192,511 US$ and it contributed to 0.1% of the total imports. India holds 66th position in the world among the importing countries.

Each pattern and each colour could provide basic behavioural data about that fish species and give an idea about its mode of communication. The peculiar colour patterns in some fishes will help in performing mimicry and camouflage for their life and survival. The functions may vary like imparting ornamental value, helping for camouflage /mimicry (cryptic), giving warning coloration (aposematic) etc.

SOURCES OF COLOUR:

Colouration of fishes is due to the presence of two types of special cells called the chromatophores and iridocytes. The chromatophores are branched connective tissue cells situated in the dermis either above or below the scales. These cells contains varies kinds of pigment granules which may be carotenoids, melanin, flavines, purines, pterins, porphyrins and bile pigments. Depending upon the colour of the pigments the chromatophores are designated as erythrophores (red or orange), xanthophores (yellow) and melanophore (black). The carotenoids are obtained by the fish through its food, while melanin is the break down product of some amino-acids. Other shades like blue, green and brown seen in fishes are the result of suitable mixing of the above three kinds of chromatophores.

The iridocyes contain a crystalline substance guanine which is opaque, whitish or silvery. It is a waste product and is deposited in the form of granules or rounded, polygonal bodies, or in the form of plates. These are opaque and posses great reflection power, so that the iridocytes may also be called the mirror cells. They give white or silvery appearance to the fish.

Sources of carotenoids:

Natural sources carotenoids can be divided into two- plant sources and animal sources. Plant based carotenoid are mainly derived from micro algal pigments and other aqua feed formulation are Yellow corn, corn gluten, alfa alfa, and marigold. Algae such as *Chlorella vulgaris, Dunaliella salina, Arthospira maxima and Haematococcus pluvialis* are used in aquaculture as carotenoid source. Marigold contain astaxanthin which gives red or orange yellow colour; yeast contain canthaxanthin which gives orange colour; alfa alfa contain lutein, zeaxanthine which gives yellow orange colour; algae contain β - carotene, α- carotene which gives greenish yellow colour. Seaweeds are also considered as a good source of plant based carotenoid which contains beta carotene and fucoxanthin which yield greenish yellow colour. Carotenoids containing foods are often red, yellow or orange, but not always. Carrots, yams, potatoes, papaya, watermelon, cantaloupe, mangos, spinach, tomatoes, bell peppers and oranges are among the fruits and vegetable in which carotenoids can be found. Dose of carotene @ 125 ppm from plant source furnish admirable coloration. In rainbow trout higher doses ranging from 125 to 300 ppm further enriching coloration.

Shell fishes such as shrimp, krill, crabs, lobsters, etc. are used as potential animal based carotenoid sources. They also rich in mineral salts (15-35%), proteins (25-50%) and chitin (25-35%). Among the microorganisms, yeast (*Phaffia rhodozyma) and* fermentation product of *Xanthophyllomyces dendrorhous* are the widely used plant sources of carotenoid are the main astaxanthin source. These are the rich source of carotenoid astaxanthin which are added as an ingradiant in aqua feed formulation to enhance colouration in fish. Animal based natural carotenoids are limited in supply as there is declining trend in catches of crustaceans like shrimp, crabs, crayfishes, etc. Animal sources of carotenoids are very expensive and thus aquaculture feed production becomes costlier.

Animal cannot manufacture carotenoids themselves, they have to get it in their diets. Carotenoids need to be consumed with a fat in order for the body to absorb them.

LOCATION OF CAROTENOIDS:

In nature, more than 600 types of carotenoid have been determined. Carotenoids are localized in subcellular organelles (plastids), i.e. chloroplasts and chromoplasts. In chloroplasts, the carotenoids are chiefly associated with proteins and serve as accessory pigments in photosynthesis, whereas in chromoplasts they are deposited in crystalline form or as oily droplets. Some of the carotenoids such as the xanthophylls are involved in photosynthesis by participating in energy transfer in the presence of chlorophyll in plants.

Carotenes and their isomers:

There are two broad classifications of carotenoids: **carotenes and xanthophylls**. The difference between the two groups is chemical: xanthophylls contain oxygen, while carotenes are hydrocarbons and do not contain oxygen. Also, the two absorb different wavelengths of light during a plant's photosynthesis process, so xanthophylls are more yellow while carotenes are orange.

Though fishes cannot synthesize carotenoids, certain fishes have the capacity to convert one form of carotenoid into another form. Based on this capacity, fishes are classified into three types:

1. **Red carp type**: in this group litein is converted into asthxanthin.
2. **Sea bream type**: in this group of fishes litein and carotene remains in the tissues and cannot be transferred in any other form inside the bodies.
3. **Prawn type**: the beta-carotene molecule can be converted into astaxanthin molecule.

Carotenoid occur in several isomeric forms, such as alpha (α), beta (β), gamma (γ), delta (δ), epsilon (ε), and zeta (ζ). Among the various carotenoids, α- and β-carotene are the two primary forms of carotenes. There are more than 600 types of carotenoids. The most common ones in the Western diet and the most studied, are alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, zeaxanthin and lycopene.

IMPORTANCE OF CAROTENOIDS:

1. **Vitamin A precursors:** It is well-know that carotenoids have an unsubstituted -end group, such as -carotene, and the cryptoxanthin precursor of vitamin A in animals. Furthermore, canthaxanthin was also converted to retinol in some fish. 3-Hydroxy carotenoids: lutein, zeaxanthin and astaxanthin, were also reported to be precursors of 3,4-dehydroretinol (vitamin A_2) in some fish. Astaxanthin, canthaxanthin and isozeaxanthin in addition to carotene were precursors for vitamin A in both guppies and platies. Astaxanthin, canthaxanthin and zeaxanthin were precursors of both A_1 and A_2 in rainbow trout (*Oncorhynchus mykiss*).
2. **Communication:** Many animals accumulate carotenoids in their integuments. Integumentary carotenoids may contribute to photoprotection, camouflage and signaling such as breeding color. Fishes change their appearance in response to

background coloration and also display color responses during excitement and courtship (Fujii, 1969). The color pattern can be viewed as compromises between the need to communicate with other members of the species and the need to avoid being eaten. The internal control of color changes is complex and involves both hormones and nerves where the initiation comes from visual cues.

3. **Reproduction and fertility:** Aquatic animals also accumulate carotenoids in their gonads. Carotenoids are assumed to be essential for reproduction in aquatic animals. Astaxanthin supplementation in cultured salmon and red sea bream increased ovary development, fertilization, hatching and larval growth. In the case of the sea urchin, supplementation with -carotene, which was metabolized to echinenone, also increased reproduction and the survival of larvae.

Marine pelagic cold water fish spawn large numbers of small eggs without visible carotenoid depositions, while demersal fish often have eggs containing high levels of carotenoids. The lack of visible carotenoids in transparent eggs may be an adaptation to minimize predation pressure.

4. **Improvement of color in fish:** Dietary supply of carotenoids can improve the skin color as well as market value of ornamental fish. The pigmentation of gold fish and koi carp is improved by addition of carotenoids and these fishes are found to be capable of metabolizing zeaxanthin to astaxanthin. However, gold fish lack the ability to metabolize lutein and have limited ability to convert β-carotene to astaxanthin. Skin pigmentation in tiger barb has been reported to increase when fed with diet containg carotenoids from shrimp meal, marigold and annatto seed extract. The blue green algae has also been used as a source of pigmentation for koi carp.

36-37 mg/kg astaxanthine in diet for intense colouration in gold fish found to be optimum and the supplementation significantly improved the survival rate. In red velvet swort tail, rainbow fish and topax cichlids the intensity of the coloration significantly improved when fed a diet containg 1.5-2% of a carotenoid rich strain of *Spirulina platensis.*

A variety of carotenoids both synthetic and naturally occurring products are available or are being developed for use in aquaculture. Carotenoids developed from natural sources contain mixture several carotenoids like α-craotenoids, β-carotenoids, zeaxanthin, lutein, cryptoxanthin, etc. whereas synthetic precesses provides only specific carotenoids like β-carotenoids. Synthetic carotenoids are expensive and it has limitation to be used in aqua feed formulation depending upon the species. If used in excess synthetic carotenoids lead to deteriorating effect on the environment.

COLOURATION OF ORNAMENTAL FISHES:

The fishes with colourful and diverse pigmentation patterns are called ornamental fishes and they are one of the most sought after pets of the world. However, colours and even its absence can have ornamental value e.g. Albino fish. Albino varieties of ornamental fishes have less melanin pigment or they lack melanin. Albinism in animals is considered as a pigmentation abnormality. The manipulation of colour in ornamental

fishes has always attracted researchers. The methods used for the improvement in colouration are genetic engineering and nutritional supplementation of pigments.

CONCLUSION:

Carotenoids are widespread and important pigment classes in the organisms as well as contributing characteristic quality criterion for marketing and consumer demands of aquaculture products. Appearance of an animal product, especially color plays an important role on the marketing. Color, nutritional value, healthy appearance, freshness and sensory test components are the elements to choose the product.

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Upshot of Climate Change on Herbicide Efficacy

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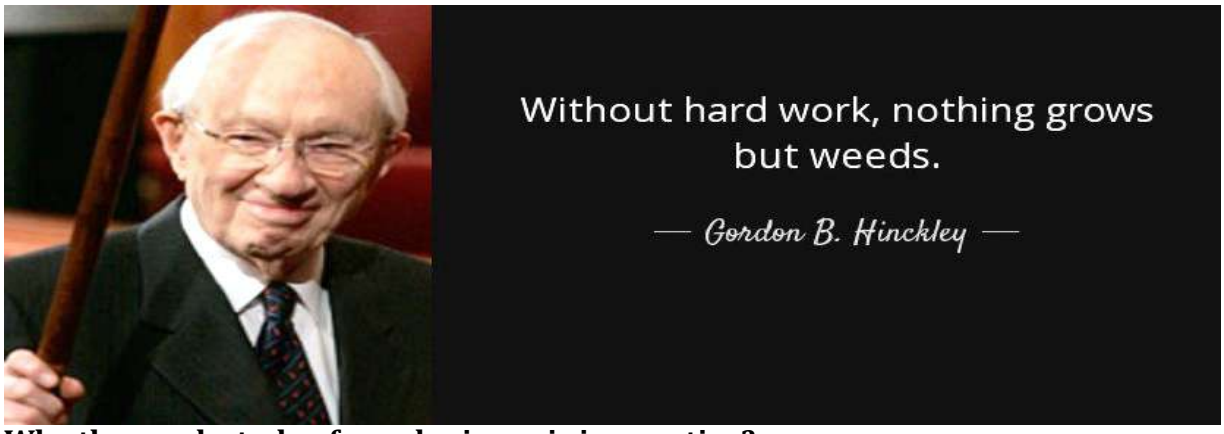
Climate is a major force in Earth's environmental system, and even minor changes in climate can have complex and serious effects on the environment and nature. Climate changes in the past have occurred over hundreds or even thousands of years, but recent changes have received wider attention because of radical shifts occurring in just a few decades. These regional and global climate shifts have started affecting life on our planet in numerous ways, but effects on agriculture and food supply may be one of the greatest threats to sustaining life. Assessment of the effects of global climate change factors [particularly of elevated carbon dioxide(CO_2) concentrations and rising temperature] on agriculture and farming practices is important to anticipate and adapt practices that maximize agricultural production in future climate scenarios. Achieving sustainable crop production in unpredictable environments necessitates a holistic approach that focuses on not only increasing crop productivity but also effective management of agricultural pests such as weeds.

Herbicides have become the major tools for weed management because of their simplicity in use, greater efficacy, and more importantly, due to the reduction in control costs by saving labor and time. The advent of herbicides for selective control of weeds has boosted crop production and producers' ability to provide high-quality produce. Given the importance of herbicide use for effective weed control, it is essential to understand the factors that govern herbicide performance.

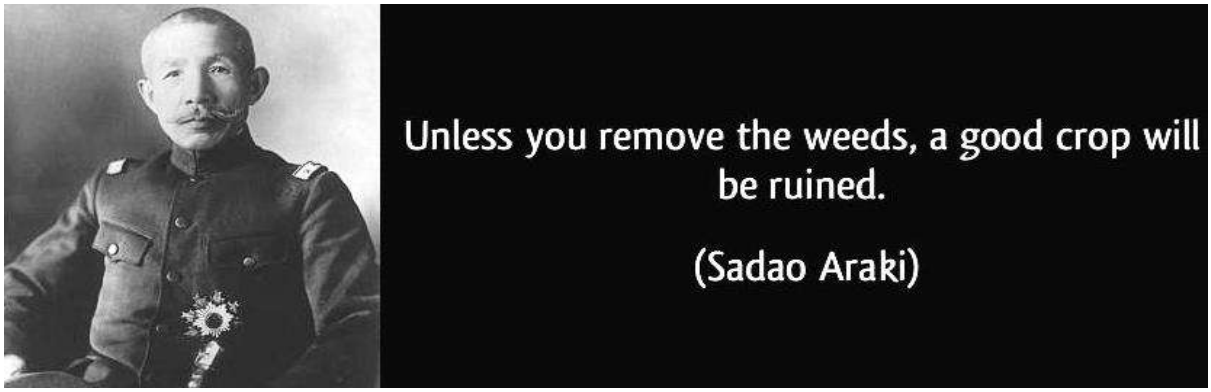

Besides plant morphological and anatomic characteristics, environmental conditions play a pivotal role in determining the efficacy of herbicides at the time of

application. Several environmental factors such as temperature, moisture, relative humidity, and solar radiation influence a plant's physiological status and its susceptibility to herbicides. In addition, changes in the global climate due to a rise in CO_2 concentration and its associated effects on global temperature and precipitation can have significant impacts on herbicide efficacy. Understanding the effects of climate change on weed growth and herbicide activity is imperative to optimize herbicide applications for effective weed control in future.



Why thorough study of weed science is imperative?

Weeds, recognized by humans as undesirable plants interfering with agriculture and natural resources, are the oldest and most common problem in profitable crop production. Unlike outbreaks of pests and diseases, which may be random and irregular, weeds are relatively constant and pose severe problems in crop production. If left uncontrolled, weeds can cause severe crop losses.Weedsdirectly reduce cropyields bycompetingforessential resources such as light, water, nutrients, and space; furthermore, weeds compromise the quality of yields by contaminating the seed and lowering the value of harvested crops. Weeds also interfere with harvest operations, produce harmful chemicals (allelopathy), and serve as hosts for pests and diseases.Hence, weed control is a major component of successful crop production.



FACTORS INFLUENCING CLIMATE CHANGE

Since the beginning of the industrial era(1750's), human activities have largely contributed to global warming by altering the amounts of greenhouse gases and aerosols (small particles). These emissions accumulate in Earth's atmosphere and

increase in concentration over time, creating the so-called greenhouse effect, which can alter the planet's energy balance by absorbing outgoing thermal radiation from the surface. Consequently, continued global warming will be accompanied by an increase in Earth's mean temperature, changes in the frequency and distribution of precipitation, wind patterns, evapotranspiration, and weather extremities such as droughts, floods, severe storms, and hurricanes.

Water vapor is the most abundant and primary greenhouse gas in the atmosphere, but the amount of atmospheric water vapor is largely influenced by naturalprocesses.Other trace gases that contribute to the greenhouse effect include CO_2, methane and nitrous oxide. Although the atmospheric concentrations of these gases are in trace amounts compared with water vapor, their concentrations are largely influenced by human activities and are more responsive to management for limiting global warming effect. Among the trace gases, CO_2 contributes most significantly to the global climate change because of its heatabsorbing properties and longer atmospheric lifetime.At current emission rates, the concentrationof CO_2 is predicted to reach ~1000 ppm by the end of the twenty-first century, resulting in an increase of 2–4°C in the Earth's annual surface temperature.

Since the Industrial Revolution, human activities have contributed to >40% increase in the atmospheric concentration of CO_2. Agriculture and farming practices such as production and operation of farm machinery and on-farm energy use directly account for 14% of total greenhouse gas emissions. Deforestation for land-clearing purposes causes an additional 18% of emissions in the form of CO_2. Other agricultural processes such as wetland rice cultivation and enteric fermentation in domestic ruminants contribute to about 54% of methane emissions, whereas about 70% of nitrous oxide emissions are linked to conventional tillage and fertilizer applications. The negative environmental impacts of agriculture can be mitigated to a large extent through technological advancements such as precision agriculture, which reduces extensive use of fertilizers and pesticides; agricultural intensification on existing land to avoid large-scale deforestation; and greenhouse gas sequestration by capturing these emissions in trees, soils, and plants.

Impact of climate change factors on weed management and herbicide efficacy

Weed management becomes the primary focus for farmers and weed scientists around the world. Several options exist for weed control including cultural, mechanical, chemical, and biological methods; however, chemical weed management through the use of herbicides is the most economical and widely used alternative including the United States. In recent years, herbicide use has increased in other parts of the world, including China, India, and Africa because of their potential to improve crop yields and saves labor and energy, thereby reducing the cost of farming. Although the focus of weed management is shifting toward integrated strategies to reduce the impact of herbicide use on the environment and the development of herbicide-resistant weeds, herbicides remain the mainstay of weed control due to their ease of application and cost-effectiveness. Given the importance of herbicide use in sustainable crop

production, it is essential to understand if climate change influences the efficacy of herbicides to control weeds in future.

Several studies have focused on the impact of climate change on crop productivity, but less attention has been given to the impact on weed management, particularly herbicide efficacy. Changes in herbicide susceptibility due to environmental stress could have serious consequences for crop–weed competition and may contribute to higher production losses in future.

ENVIRONMENTAL FACTORS THAT AFFECT HERBICIDE EFFICACY:

To realize the impact of climate change on herbicide efficacy, it is important to understand how environmental conditions affect herbicide performance. Successful use of herbicides depends on environmental conditions prior to, during, and after herbicide application. The environment influences not only growth and physiology of the plants but also the herbicide and the interaction between the plant and herbicide.

Here, we discuss the effects of environmental factors such as light, CO_2, temperature, soil moisture, relative humidity, rainfall, and wind on herbicide action in plants. These factors can affect herbicide efficacy directly by altering the penetration and translocation of herbicides within the plant or indirectly by changing the growth and physiological characteristics of the plants. While foliar-applied herbicides are influenced by many environmental factors, soilapplied herbicides are influenced mainly by soil moisture and temperature.

1) Light

Light is one of the most important environmental factors that influences plant growth and development. Variation in light intensities changes the anatomy, morphology, and growth of plants, which further affects herbicide performance. Light is the source of energy for photosynthesis, and the rate of photosynthesis determines the rate of phloem translocation of assimilates. Net photosynthetic rate typically increases with light intensity, and higher photosynthesis and subsequent phloem translocation will increase the movement of foliar-applied systemic herbicides.

Stomatal conductance and leaf cuticle development are positively correlated with light intensity. At high light intensity, stomata remain open, thus improving tissue penetration for foliar-applied herbicides. Furthermore, plant branching and leaf thickness increase to reduce the damage caused by excessive light energy and to ensure the proceeding of photosynthesis. Conversely, at low light intensity, plants tend to produce thinner leaves with greater specific leaf area and plant height to capture available light and meet the demand for photosynthesis. These adaptations in plant growth and leaf anatomy influence the amount of herbicide that is absorbed and retained by the plant; for example, higher plant branching increases surface coverage and absorption of post-emergence (POST) herbicides, whereas thicker leaves slow the diffusion of herbicides resulting in reduced herbicide activity.

2) Carbon Dioxide

The importance of CO_2 influence on herbicide efficacy has come to attention in recent years as a result of the steady rise in atmospheric CO_2 since the industrial revolution. High CO_2 concentrations in the atmosphere are likely to have pronounced effects on weed biology, consequentlyaltering herbicide performance on weeds. One of the most prominent effects of elevated CO_2 levels is the reduction in stomatal conductance, which could increase up to 50% in some plants. Reduced stomatal conductance can alter the efficacy of both foliar- and soil-applied herbicides.

Furthermore, at elevated CO_2 levels, leaf thickness increases and the number of open stomata decrease; thus, reducing the amount of foliar-appliedherbicide that is directly absorbed into the plants, thereby protecting the weeds from damage by POST herbicides. Decreased stomatal conductance also results in reduced transpirational flow, which further reduces the uptake of soil-applied herbicides. For instance, common lambsquarters is a C_3 weed that has shown higher tolerance to glyphosate as a result of increased growth and biomass at elevated CO_2. Glyphosate efficacy at elevated CO_2concentrations was also reported to decrease in C_4 invasive weeds such as Rhodes grass (*Chloris gayana*), weeping lovegrass (*Eragostis curvula*), and dallisgrass (*Paspalum dilatatum*) owing to increased biomass and leaf area. Greater CO_2 concentrations may stimulate rhizome or tuber (below-ground) growth relative to aboveground growth in most perennialweeds, which may render herbicide control of such weeds more difficult.

3) Temperature

Temperature has both direct and indirect effects on herbicide efficacy. Temperature has complex effects on plant growth and development. Photosynthesis, phloem translocation and respirationare some temperature-dependent physiological processes. Changes in the rate oftheseprocesseswill indirectlyaffect herbicide penetration and translocation. Germination, seedling growth rate, and leaf anatomy (leaf area, leaf shape, and cuticle development) can be influenced by air and soil temperature, which, in turn, determine the time when plants are most susceptible to herbicides. Temperature can directly affect herbicide performance through its effects ontherate of herbicide diffusion, viscosity of cuticle waxes, and physicochemical properties of spray solutions. Higher temperatures may lower the viscosity of cuticular lipids, thereby increasing the permeability anddiffusion of herbicides through the cuticle; for example, uptake and translocation of glyphosate was found to be higher at22°C than at 16 °C in *Desmodium tortuosum*(Beggar weed). Although high air temperatures tend to speed both absorption and translocation of most foliarapplied herbicides; warmer temperatures also may result in reduced herbicide uptake due to rapid drying of spray droplets to solid deposits. Soil temperature affects the movement and permeability of soil applied herbicides within the plant. High soil temperatures may lower the efficacy of soil-applied herbicides by increasing volatility and microbial breakdown.

4) Relative Humidity

Relative humidity primarily influences the activity of foliar-applied herbicides through its effects on herbicide uptake. Relative humidity could influencetheefficacyoffoliar-appliedherbicidesthroughinteractionsbetweenthe herbicide droplet, leaf cuticle, and availability of water in or around droplets. Both air temperature and relative humidity influence transpirational flow; thus, affecting chemical absorption and movement. At high humidity, however, the effects of high temperature on droplet drying is reduced due to increased leaf retention time, hence increased herbicide absorption. Plants grown at high humidity usually develop softer cuticles than plants grown at low humidity, which tend to have thicker cuticles and thus less herbicide penetration. In general, humidity has a greater effect on herbicide uptake than temperature. Therefore, humidity is considered more important at the time of spraying than during thepostspraying period. Increased herbicideuptake athighrelative humiditymay leadtogreater translocationof herbicides. Wild oat plants grown at high (>95%) relative humidity demonstrated significantly increased glufosinate ammonium efficacy compared with those grown at low (40%) relative humidity; furthermore, in a study, uptake of glufosinate ammonium was higher when wild oat plants were exposed to high relative humidity for 30 min before and after treatment compared with those left at continuously low relative humidity.

5) Precipitation

Precipitation can directly influence herbicide uptake by washing the spray droplets off leaf surfaces or by diluting the herbicide to a less-effective form. This effect is more pronounced if precipitation occurs shortly after herbicide application.Herbicideapplicationsaregenerallynotrecommendedimmediatelyafter rainfall because wet leaf surfaces have a higher tendency to bounce off the spray droplets. The intensity and duration of precipitation determine the rainfastness of the herbicide. Rainfastness is the ability of an herbicide to quickly dryand penetrate into the leaf tissues so it remains effective after rainfall. Herbicides with lipophilic properties usually have better rainfast properties than water-soluble herbicides. Ester formulationsofauxinicherbicidesareabsorbedmorequickly thanamineandsalt formulations,whicharemoresusceptibletowash-off.Lowlevelsofprecipitation or dew may improve leaf retention and herbicide efficacy by rewetting spray droplets on the surface. On the other hand, lower precipitation amounts throughout the season may result in water stress conditions that affect both plant growth and herbicide efficacy.

6) Soil moisture

Soil temperature and moisture directly influence soil-applied herbicides by affecting herbicide concentration, solubility, and movement in the soil and through the plant via transpiration. Low soil moisture content may result in increased adsorption of herbicides to the soil particles, thus reducing their availability for uptake by plant roots. Adequate soil moisture is particularly necessary for pre-emergence herbicides for movement into the zone of weed seed germination and effective weed control. Soil moisture effects on foliar-applied herbicides are related to herbicide absorption,

translocation, and metabolism. Plants grown under moisture stress develop leaves with an upright orientation to minimize leaf surface area that intercepts light and temperature. This orientation has negative consequences for foliar absorption because upright leaves cannot retain spray droplets for a long time. Prolonged periods of moisture stress reduce photosynthesis due to stomatal closure and causes leaf thickening, tissue dehydration, and greater leaf senescence which, in turn, reduces herbicide diffusion and subsequently lowers herbicide absorption and translocation.

7) Wind

Wind may have a less pronounced influence on herbicide efficacy. Nonetheless, windy conditions can interfere with surface application and cause spray drift, thereby reducing spray application efficiency. High wind velocities reduces herbicide retention by moving sprayoff and away from plantsandparticularlyaffectsdepositionofsmallerdropletsontheleafsurface. Furthermore, spray deposits tend to dry rapidly under windy conditions, with a subsequent reduction in herbicide uptake. Wind can also cause cuticle damage through leaf collisions and abrasions from soil particles and also affects evapotranspiration process, thus, altering herbicide absorption from soil.


CONCLUSION AND SUGGESTIONS FOR FUTURE RESEARCH

Global climate change factors has serious implications for not only crop growth and productivity but also herbicide performance and the effectiveness of chemicalweed management. The steady rise in atmospheric CO_2 concentrations and its potential effects on other climate variables such as temperature, precipitation, relative humidity, and radiation have important consequences for sustainable weed control and crop production.

Various studies suggest that any positive impact of climate change on crop growthmay be nullified by higher responses from weeds. Weeds tend to show better survival mechanisms under changing climate because of their greater interspecific genetic variation and physiological plasticity. Furthermore, herbicide properties are significantly influenced by environmental conditions before, during, and after application.

Current weed management strategies that rely heavily on herbicide usage may have altered effects on these aggressively growing weeds in future climatic conditions.

This warrants immediate action in terms of extensive research on the potentialeffectsofchangingclimatevariablesondifferentherbicidechemistries.In particular, it is necessary to develop experiments with multiple climate variables to study the interactive effects of climate change on weed control. Much research has been focused on single factor experiments that have little predictive value in reality because plant responses to interacting climate factors differ greatly from single factor responses.

Limited research has been carried out to predict the effects of global climate change on weed management under field conditions; therefore, it is essential to design longterm field studies with experimental conditions that simulate the future climate to predict the effects of global climate change more accurately. Information generated through such studies will help identify the potential weed control measures that need to be adopted to cope with challenges emerging from aggressive weed growth and possibly increased herbicide efficacy under changing climate.

Getting Down to Bares Bones of Agriculture: ZBNF

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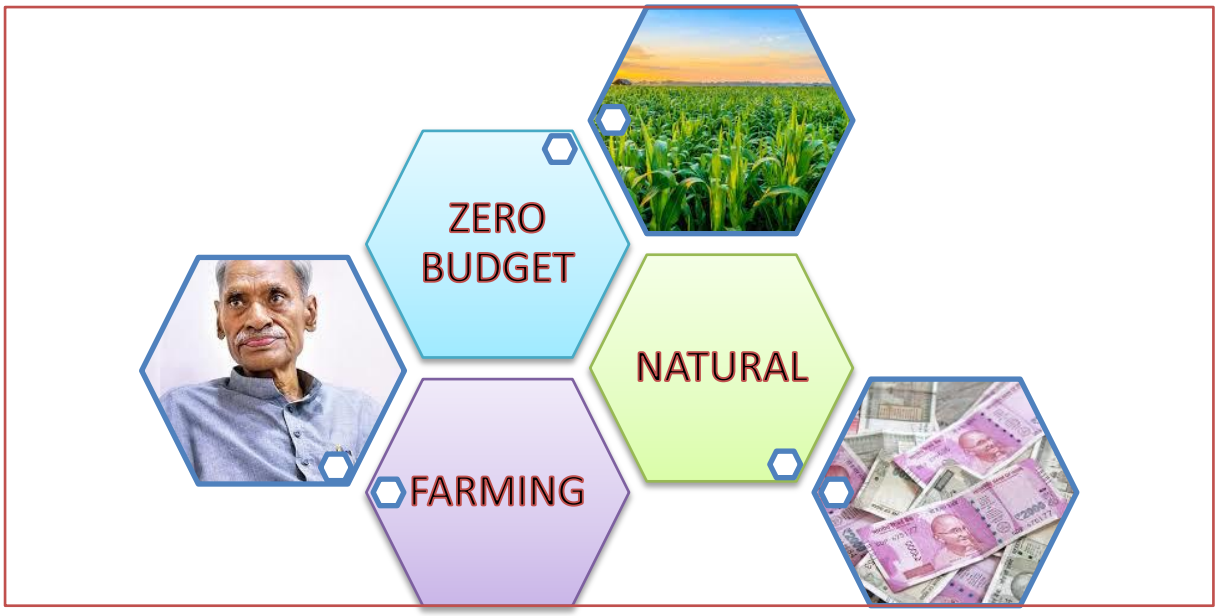
ABSTRACT

Small and marginal farmers that make up the considerableproportion of Indian farming families have been the most effectual and fruitful but simultaneously are the ones to hold up heavy burdens on their heads because of the low levels of net returns. Their income is not sufficient to sustain their lives and drive them into socio-economic hardship. The economy of the nation is suffering from intense agrarian crises due toneolibralization. The farmers are not able to have a sound access to the expensive inputs and markets. The expanding prices of inputs, high rates of interests for loans and unstable market prices push them into the vicious cycle of debts. Debt is, somehow, linked to farmer's suicide and more than a quarter of a million farmers have claimed their lives in the last two decades since the psychological needs of farmers are neglected, debt becomes the primary trigger for their suicide. Consequently,a prompt attention needs to be given to address theproblem of farmer's distress. Under such circumstances,zero budget natural farming promises to cut down farming expenditure and reliance on loans for desperate farmers.

KEY WORDS: Debt, Suicide, Socio-economic hardship, Zero budget natural farming.

INTRODUCTION

India is an agriculture build country,farming here is done with hardcore devotion. Our country is blessed with magical and multifarious soils,fulsome biodiversity, hefty sunbeams, abundant rainfall and friendly air that capacitate cultivation everywhere and anywhere. Agriculture is the cornerstone of our nation which makes up the widest remunerative sector and has a pertinent influence on the socio-economic development. Upto1960sthe agricultural practices predominantly depended upon natural farming. Inherent soil fertility, farmyard manure and scanty irrigation were used for cultivating traditional varieties and farming was done to victual the family members.Due to the population inflation,subsistence farming switched over to commercial farming and



green revolution showed up to offer an epic rhapsody to the farmers and suitably sustained the population growth. It brought along the high yielding varieties and hybrids, fertilizers and intensive irrigation. The output per unit area went up and it became possible to feed the starving population but then aroused the problem of insect and pest attack as the fertilizer responsive varieties were pulpy and attracted many kinds of insects.So, the use of plant protection synthetics was encouragedto procure heavy yields. The inappropriate use of irrigation water rendered the soil problematic leading to salinity, alkalinityand waterlogging. The green revolution helped tremendously to combat with the terrible mess of exploding poverty and hunger but simultaneously engendered some auxiliary disadvantages like erosion of soil fertility, groundwater contamination, environmental pollution and impoverishment of biodiversity. The indiscriminate application of agrochemicals resulted in many environment and health connected issues. Also,the overall cost of production uplifted due to the augmented prices of inputs like fertilizers, pesticides,private seeds of improved varieties etc. Bulk of the farmer families belong to the small and marginal farmers having land upto two hectares.Cultivation of such farmers runs at a slow pace as their innate potential of investment is quite low and to purchase the expensive inputs, borrowing loans become exigent. Farmers need money for next season crop, family expenses, debt recovery etc.Therefore,loans become an easy route to bring home the bacon. Mostly farmers take loans from private lenders with hard rates of interests upto 30-60% the result of which these innocent peasants get sink into the causal nexus of debt. For small landholders, the debt circles are escalators to death that pave their way to suicide leaving many unprepared wives into a turmoil. Under such incidents, need of an alternative is felt that can protect famers from plunging into the domino effect of indebtedness. Zero budget natural farming is an excellent answer to the above issues. It is an alternative to green revolution that protects the deprivation of natural resources and maximize the yields. It aims at intensifying the agricultural sustainability by ensuringlongterm soil prolificacy. It is a way of getting down to bare bones of

agriculture bydoing natural farmingusing nature's principleand starting from a zero base with nil cost of production.All the agrochemicals like syntheticfertilizers, plant growth regulators, chemical pesticides and other additivesare fully abandoned and environmentally sound production of food is possible. It advocates the use of natural inputs to revitalize the soil fertility and enhance rural economy by attenuating credit risks. This method of farming is fancied by many farming communities and should be adopted widely to cure our mother earth by replenishing environmental health.

BASIC CONCEPT BEHIND ZBNF

It is based on the concept that nature has sundry inherited qualities making it the foremost epitome for farming.The term "Zero budget natural farming" is quite self - explanatory where "zero budget" means no monetary expenditure and "natural farming" means farming using the nature's principles and without the use of chemicals. The ZBNF approach starts from a zero base ie.no cost of production and there is complete withdrawal of synthetic chemicals like fertilizers and pesticides.

Figure 1 Crop model suitable for ZBNF

The expenditure of the main crop is compensated by the short duration intercrops to make the overall cost zero. It is a very distinct strategy elicited from the traditional indigenous operations and thoroughly believe in the principles of agro-ecology like nutrient recycling, biomass reprocessing,diversification,increased biological activity, minimized loss of natural resources like water and nutrients,enhanced soil fertility and health. Its background leans upon the sagacious intrinsic farming that is commercially, socially and environmentally apposite.The route of the farming is such that the output becomes the input and saves our natural resources from getting depleted. All the external inputs are derived from natural ingredients like cow dung, cow urine, legume

Figure 2 Making of organic manure

flour, crop residues etc. also termed as 'permitted organic inputs'. Natural concoctions formulated from plants and other natural material are also used to treat the seeds. According to Finance minister Nirmala Sitharaman, zero budget farming is a "back to the basics "approach and should be replicated to double farmers income.

BRAIN BEHIND ZBNF

Maharashtrian agriculturist named Subash Palekar is the pioneer promoter of zero budget natural farming.He evolved it in the mid 1990's as a substitute to green revolution that relied heavily upon chemical fertilizers and pesticides.He opposed green revolution saying that the exploding cost of inputs drive farmer's lives into ferocious circles of debt leading to suicide while the pernicious chemicals used on crops leave disastrous impact on the environmental and soil health. Complete elimination of chemicals and other expensive inputs can end the debt cycle for the small farming communities.

THOUGHT OF ZBNF

During college, Palekar studied about tribal peoples' lifestyle and social structure, and forest ecosystems. He pondered the concept of natural farming when he recognized thatthat there is involvement of human assistance for the existence and growth of forest. As a result, he took up a research on the natural growth of trees. He studied forest vegetation and applied forest principles on his farm from 1989 to 1995 in 154 research projects. This is where he discovered'Zero Budget Natural Farming', hispeculiar approach to farming entailing manures and agroecology without the use of chemicals. He was awarded India's fourth highest civilian award the *Padma Shri* in 2016

Pic.3. Receiving Padma Shri award
(Source:www.thehindu.com)

Pic. 4. Preparation of jeevamrita
(Source:www.indianexpress.com)

Table: 1.Bio of Subhash Palekar

Born	Maharashtra, India
Known for	Philosophy, Natural farming
Notable work	'Holistic Spiritual Farming'
Website	palekarzerobudgetspiritualfarming

(Source: www.wikipedia.com)

FOUR POLES OF ZERO BUDGET NATURAL FARMING

1. JEEVAMRITA (Soil inoculation)

Indian soils are inherently fertile and rich in plant nutrients that need to be activated by adding Jeevamrita.It is a miraculous liquid made of fermented microbial culture that makes the nutrients available to the crops. It acts as a catalytic agent to promote the soil microbial activity and attracts earthworms that bring the nutrients from the lower layers to the top by making the soil porous. During the 48 hours fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine undergo multiplication as they eat organic ingredients like pulse flour. A handful of soil is also used as an additive for an inoculate of native microbial species. Jeevamritaalso protects a plant from fungal and bacterial diseases.According to Palekar addition of Jeevamritais needed for first 3 years after which the soil system becomes self-sustaining. He also suggests that dung and urine should be obtained from indigenous desi cows as it contains more micronutrients than the European breeds.

Table: 2. Composition of Jeevamrita(Source: Babu, R., 2008)

Ingredients	Amount
Water	200 liters
Desi cow dung	10 kg
Desi cow urine	5-10 litters
Pulse flour	2 kg
Jaggery	2 kg
Soil	1 kg

Stir the above contents well to make a fine solution and keep it undisturbed in shade for fermentation for about 48 hours. After it is ready, apply it in the soil.

APPLICATION

Jeevamritais supplied per acre of land, twice a month in the irrigation water or as 10% foliar spray to get effective results.

2. BEEJAMRITA (Seed treatment)

This formulation is used for treatment of seeds, seedlings or any other planting material. It also protects the young roots of a plant from fungal and soil as well as seed borne diseases generally attacking the roots after monsoon season. Ingredients are similar to those of Jeevamritalike cow dung, cow urine soil, lime, natural fungicide and an antimicrobial liquid. Many natural concoctions prepared from leaves and pulp of neem, tobacco and green chilies are used for management of insects and pests. The neem leaves have nitrification inhibitors so it reduces the nitrification losses of nitrogen.

Table: 3.Composition of Beejamrita(Source: Babu, R., 2008)

Ingredients	Amount
Water	20 liters
Cow dung	5Kg
Cow urine	5 liters
Soil	Handful
Lime	50 grams

APPLICATION

Stir the above mixture well and add it to the seeds, mix them by hand to coat the mixture on seeds. Keep it for drying and use for sowing. In case of legume seeds, just dip them quickly and leave for drying.

Table: 4. Nutrient composition of Beejamrita, Jeevamrita and their constituents

Sample	pH	N	P	K	Mg (ppm)	Cu (ppm)
Beejamrita	8.02	2.38	0.127	0.485	16	36
Jeevamrita	4.92	1.96	0.173	0.280	46	51
cow urine	8.16	1.67	0.112	2.544	6.3	20.00
cow dung	8.08	0.70	0.285	0.231	9.33	3.60
Pulse flour	6.70	1.47	0.622	0.910	12.6	12.40

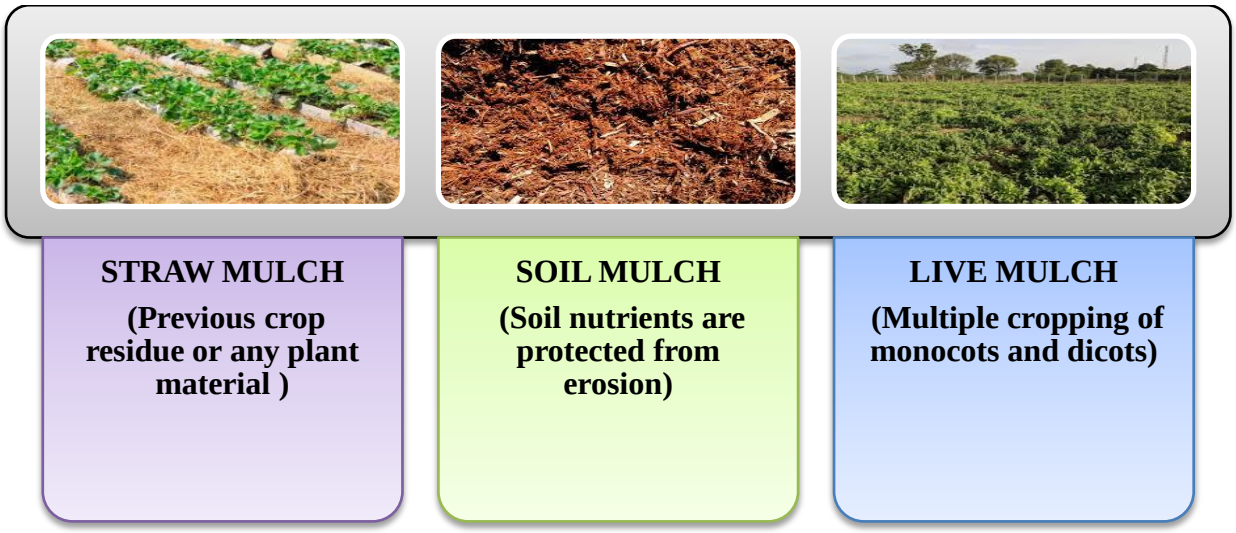
(Source: Devakumar *et al.,* 2014)

3. ACCHADANA (Mulching)

A) Soil mulch – Soil mulch protects the topmost soil layer from erosion and degradation during tillage or cultivation. Always avoid deep ploughing.

B) Straw mulch – Straw refers to the residual waste of previous crop but can also include any dead plant part. When dried organic material is added to soil, it decomposes to form humus through the activity of microbes and provide nutrients to plants.

C) Live mulch – It is a system of multiple cropping in which both monocots and dicotsare grown in the same field. In this way all the essential nutrients are made available to the plants.The legumes (dicot) fix the nitrogen and rice or wheat (monocot) supply other nutrients like potash, phosphate and Sulphur.



4. WHAPASA (Moisture)

It cuts down the heavy dependence of farmers upon intensive irrigation. The exercise of mulching and soilinoculation by jeevamritarefines the soil's physical condition. The soil structure becomes highly porous to increase aeration. Also, the microbial action builds up due to incorporation of organic matter that give rise to humus rich reservoir. Therefore, the dissipation of water via evaporation diminishes due to good soil physical properties.The water management becomes efficient and a balance of air and water is maintained.Both the air and water molecules are present in the soil to supply water in the form of vapors to the plant roots. This technique minimizes the irrigation by irrigating the field only at noon and in alternate furrows. It significantly reduces the irrigational needs and increases water availability, water use efficiency and drought resistance.

PLANT PROETCTION

Homemade fungicides and insecticides are prepared and used under ZBNF.

Table: 5. Composition of different Fungicides(Source:Babu, R., 2008)

Fungicide-1

Water	5 litres
Buttermilk (5days stale)	50 litres

Fungicide-2

Water	200 litres

Desi cow milk	5 litres
Black pepper powder	200 grams

Table: 6. Composition of different Insecticides(Source: Babu, R., 2008)

Insecticide-1

Water	200 litres
Neem leaves or powder	20 kg

Insecticide-2

Water	200 litres
Cow dung	5 kg
Cow urine	10 litres
Neem	10 kg

Insecticide-3

Neem leaves	10 kg
Tobacco powder	3 kg
Garlic paste	3 kg
Green chilies paste	4 kg

Insecticide-3: This mixture is specifically effective against aphids, jassids, mealy bugs and white flies.

APPLICATION

These ingredients must be soaked in cow urinefor 10 days. About 3 litres of the mixture so formed can be mixed with 100 litres of water and sprayed on crops. Fungicides and insecticides could be used either as prophylactic or as curative measure for control of crop pests.

OTHER IMPORTANT PRINCIPLES OF ZBNF

1.Intercropping – It includes agroforestry and developsan association between crops and trees in combination with monocots and dicots. This generate some additional income to thefarmer.

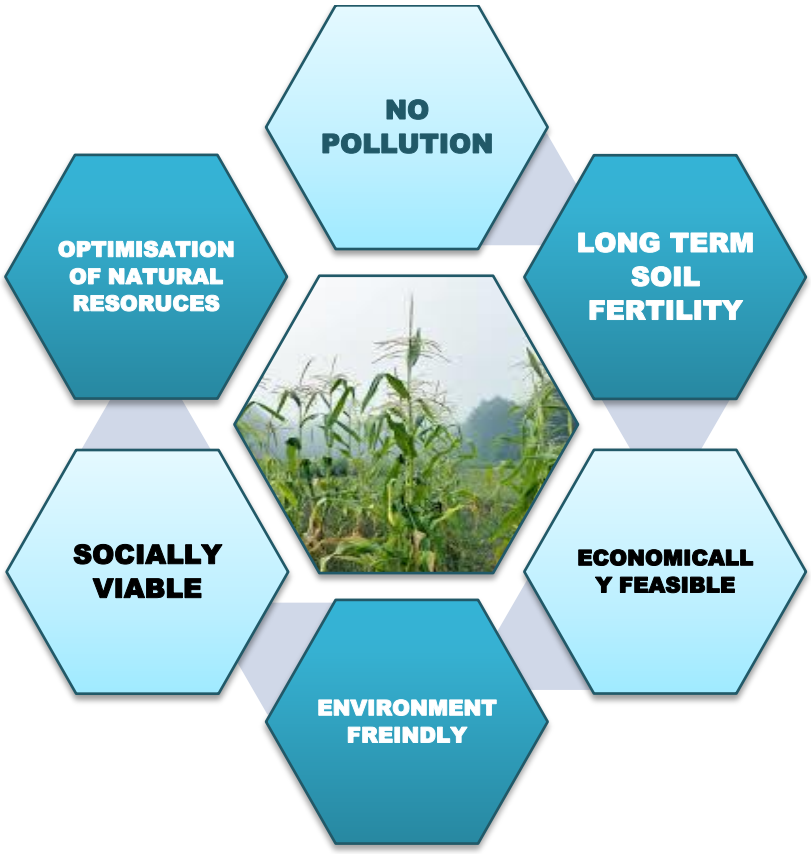
2. Contour and bunds –Constructing contours and bunds will help in preserving rainwater and leads to maximum efficacy for different crop species.

3. Reviving local earthworm species – Vermicomposting is not suggested under ZBNF. Instead the local species of earthworms needs to berevived from the lower layers ofsoil by adding organic matter in it to ensure soil fertility. The use of red worm (*Eiseniafetida)* should be avoided because it accumulates metals like lead and produce phytotoxic substances.

4. Cow dung– The dung of humped cow (*Bos indicus*) has more concentrations of micronutrients and is highly beneficial than the European breeds. Therefore, it is recommended to select indigenous cow breeds for obtaining dung. Also, it is important to take as fresh dung as possible for maximum benefits.

CHARACTERSTICS OF ZBNF

1. Optimization of natural resources.
2.No pollution.
3.Environment friendly.
4.Socially viable.
5.Economically feasible.
6.Long term soil fertility.



ADVANTAGES OF ZBNF

- ZBNF is a cost-effective techniqueas all the inputs are locally available and no money is spent on costly fertilizers and pesticides.The yield per unit area increases and the profit margin expands in general. It ensures self-sufficiency and improves farmer's welfare.
- It is an eco-friendly technique as farming is done in harmony with the nature and without using the harmful chemicals. The environment is not destructed in terms of pollution, ocean acidification, biological magnification, land degradation and erosion etc.
- The food obtained is of superior quality, rich in nutrients and doesnot contain any carcinogenic substance. All the health hazards are eliminated by preventing the pesticide residues from entering the food chain.
- Addition of organic matter enlivens the soil and enriches it with humus and other plant nutrients. The earthworms make the soil porous and enhances the

soil aeration and water holding capacity. Thus, there is an all-embracing positive effect on the fertility and productivity of soil.

- The use of natural concoctions for pest management not only protects the plant from pest attack but also helps to decrease the problem of pesticide residue and gives pure organic produce.
- The mulching helps in conserving soil moisture by slowing down by rate of evaporation. It regulates temperature inside the soil and provides a favorable environment to the biotic fauna.
- Crop rotation,mixed cropping and intercropping rejuvenates the soil and alleviates the loss of soil nutrients and moisture. It also adds to the income of the farmer.
- The natural resources are protected from getting wasted. Optimization of resources results in sustainable agriculture,
- The farmers are protected from indebtedness as the risks of credit are nil. Social reputation of farmers increases.
- The technique of ZBNF suits well in all agro-climatic regions of the country so, it can be practiced anywhere by any farmer.

ISSUES ASSOCIATED WITH ZBNF:

- Lack of scientific validation- Due of lack of proper scientific validation, there are worries regarding farmers' income and food security.
- The yield of the farm may decline for the first 3 years. This isbecause of high C:N ratio of soil that encourages the soil microbes to eat up whole of the nitrogen and a small fraction is left for plant uptake.But after the system becomes self-sufficient, the productivity increases.So, there is a sharp need of patience and perseverance from farmers' side.
- Lack of access to native species of cow -Not all the small and marginal farmers have indigenous cows as they were replaced by exotic breeds. Moreover, due to land fragmentation the patches of natural grazing land are less making animal husbandry a challenging task.
- Labor Intensive – More labor is required under ZBNF for preparation and application of natural inputs that adds to the farmer's cost.
- Production cost ofon-farm inputs - Farmers need to invest in bio-inputs like cow dung, cow urine, crop residuesand labor pushing the production price higher. Therefore, zero budget is not zero in reality as framers spend money on inputs and labor.
- Less support from governmental bodies- The state governments are not actively participating to adopt this technique in their respective states making it invisible for the farmers.

CONCLUSION

The agrarian crisis expounded a period of deflation in agriculture shrinking the farm profits. The green revolution provided immense euphoria to farmers of all sizes.The

package of present scenario agriculture is based on green revolution and contain several antagonistic effects.Therefore,zero budget natural agriculture is one of perfect models under organic farming that incentivizes goals of sustainable agriculture development through upswings in soil health, biodiversity, ecosystem, rural livelihood, human fitness, nutritional standards, abatement of chemicals and climate resilience. As a starter, it rises efficiency, productivity, resilience and productivity of the farm unit. To stop the draining of natural resources and to upsurge the harvest, it is the finest alternative that seeks to improve the overall productivity of the agricultural sector

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Social Network Analysis-A Brief Note

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Social research has consistently focused on the social relationships linking individuals rather than on the individuals themselves. The kind of research that examines the links among the objects of study is called structural. This kind of structural approach is not confined to the study of human social relationships. It is present in almost every field of science. Astrophysicists, for example, study the gravitational attraction of each planet in the solar system on each of the others in order to account for planetary orbits. Molecular chemists examine how various kinds of atoms interact together to form different kinds of molecules. Electrical engineers observe how the interactions of various electronic components like capacitors and resistors influence the flow of current through a circuit and biologists study the ways in which each of the species in an ecosystem interacts with and impinges on each of the others. In social science, the structural approach that is based on the study of interaction among social actors is called social network analysis. The relationships that social network analysts'study is usually those that link individual human beings. But important social relationships may link social individuals that are not human, like ants or bees or deer or giraffes or apes. Orthey may link actors that are not individuals at all. Network analysts often examine links among groups or organizationseven among nation-states or international alliances. A social network consists of a set of nodes and connections between nodes. Nodes may represent people, organizations, departments within organizations, or other social entities. Connections reflect interactions or common activities between nodes but social network analysis is more than just analyzing data generated by social media networks. It exists for a long time, and has its roots in graph theory. It is importance as it maps the flow of goods, services, information between people, teams, organizations, etc. Disciplines such as sociology, business management, and public health have made extensive use of social network analysis for a variety of organizational and network situations.

METHODOLOGY

Steps in conducting social network analysis:

Step 1: Identifying the Network

The first step in an SNA study is to identify the members of the network (Knoke& Yang, 2008). This may be generally difficult if individuals are frequently moving in or out of the network.

Step 2: Collecting Social Interaction Data

Social network analyses can examine several types of interactions among individuals, such as transactions, communication, authority and power, and kindship and descent (Knoke& Yang, 2008).

Step 3: Data Analysis

Sociograms are graphical representations of social interactions that conceptualize individuals or organizations as points, called "nodes," and their relationships as lines between the nodes, which are called "ties." Two individuals with a relationship receive a tie between them in the sociogram, whereas two nodes without a tie indicate that a relationship does not exist. Nodes can be symbolized by color, size, and shape according to individual level characteristics. Similarly, ties can be symbolized by any characteristic of the relationship such as frequency of communication or strength of the relationship.

Factors affecting flow of information through a network:

1.Topology: One actor cannot pass information to another unless they are either directly or indirectly connected.
2.Time: An actor cannot pass information he has not received yet.

Benefits of SNA

1.Worldwide Connectivity
2. Commonality of Interest
3. Real-Time Information Sharing
4. Targeted Advertising
5. Increased News Cycle Speed
6. Trusted Referrals
7. Professional Growth
8. Increase in Human Interaction

Drawbacks of SNA:

1. Backlash
2. Cyberbullying and Crimes Against Children
3. Risks of Fraud or Identity Theft
4. Time Waster
5. Corporate Invasion of Privacy
6. Fake News
7. Decrease in Civil Behavior
8. Depression and Loneliness

Suggestions for effective extension work:

1. The central of key farmers in the identified information network could be effectively used to disseminate the information of new scientific technologies, development programmes, subsidies, etc., needed by the farming community.
2. Extension agency should strengthen peer-to-peer interactions by creating more new links among farmers through mobilizing them into viable groups, organizing frequent group meetings, exposure visits, trainings etc., and thereby ensuring information flow to the isolated actors in the network.
3. Active women farmers may be selected and used as contact farmers for ensuring active involvement of women in the network.
4. The information generated on social networks can be used for the design and development of extension strategies for future innovation adoption process specific to that area.

CONCLUSION

By introducing the idea of SNA, the leadership analysis is enriched. Increasing the successful communication and collaboration of project workers by easily finding experts. It provides insights as to how individual customers behave in context of larger communities.

Chrysanthemum: Queen of East

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Flowers are nature's beloved gift to mankind, and they are inseparable from the social fabric of human life. Flowers being adorable creation of God, benefits all occasions at birth, marriage or death and their importance from aesthetic, environmental, economic and medicinal point of view cannot be under estimated, yet all flowers are not equally admired, preferences vary from period of history, person to person and also depends on place. Flowers symbolize purity, peace, love, beauty and passion and looking to contemporary sense, chrysanthemum ranks second among all flowers.

Chrysanthemum is one of the most beautiful and perhaps the oldest flowering plant, commercially grown in different parts of the world. Chrysanthemum (*Dendranthema grandiflora* Tzvelev) is a popular flower meaning *Chryos* - golden, *anthos* - flower, belongs to family Asteraceae (Composite) native to Northern Hemisphere, chiefly Europe and Asia with a few in other areas. Its distribution is seen almost throughout the world majorly in China, Japan, Europe, USA and India. The basic chromosomal number is n = 9 and a wide range of ploidy levels is found in different cultivars of the species with 2n = 36, 45, 47, 51-75. It is one of the most beautiful flowering plant referred to as "Queen of the East" and "Autumn flower". Mostly the species in the lineage of present day cultivars are from China and the country is credited for having domesticated and hybridized the flowers for improvement. In India, the crop has been naturalized and locally called 'Bijli' in Nagpur, 'Baboona' in Haryana,'Guldhak' in Punjab, 'Market' in Delhi and 'Gendi' in Uttar Pradesh area.

The chrysanthemum has been recognized in India as one among the five important commercially potential flower crops by the All India Coordinated Floriculture Improvement Project (ICAR) and is most important flower grown on commercial scale. Its commercial cultivation is being done in states *viz*., Maharashtra, Rajasthan, Madhya Pradesh, Karnataka, Andhra Pradesh and Bihar and in places *viz.,* Delhi, Kolkatta, Lucknow, Kanpur, Bangalore and Allahabad mainly for the sake of decoration and participating in flower shows, with the help of pot grown plants.

USES OF CHRYSANTHEMUM

It has a wide range of flower shape, size and colour which is highly suitable for bedding and pot culture. Flowers of loose/spray varieties are used for garland making,

bracelets, veni and devotional purposes in India. Flowers of standard varieties are produced on long, sturdy stems and have good keeping quality were used for table decorations.

Culinary uses:

Dried chrysanthemum flowers Yellow or white chrysanthemum flowers are boiled to make a sweet drink in some parts of Asia. The resulting beverage is known simply as "chrysanthemum tea". Chrysanthemum tea has many medicinal uses, including an aid in recovery from influenza. In Korea, a rice wine flavored with chrysanthemum flowers is called *gukhwaju.* Chrysanthemum leaves are steamed or boiled and used as greens, especially in Chinese cuisine.

Insecticidal uses:

Pyrethrum (*Chrysanthemum cinerariaefolium*) is economically important as a natural source of insecticide. Pyrethrins attack the nervous systems of all insects, and inhibit female mosquitoes from biting. They are considered to be amongst the safest insecticides for use around food. (Pyrethroids are synthetic insecticides based on natural pyrethrum, e.g., permethrin.

Medicinal uses:

Extracts of Chrysanthemum plants (stem and flower) have been shown to have a wide variety of potential medicinal properties, including anti-HIV-1,antibacterial,and antimycotic.

Classification:

Chrysanthemum cultivars can be classified in at least two ways:
Based on flower form: The bloom which appears as a single flower is actually hundreds of flowers called florets. Two kinds of florets are present in a single bloom, disk florets and ray florets. For ease of identification the National Chrysanthemum Society divides bloom forms into 13 classes.

- **Class 1 Irregular Incurve:** These are the giant blooms of the chrysanthemum genus. The florets (petals) loosely incurve and make fully closed centers. The lower florets present an irregular appearance. Flower Size: 6-8 inches.
- **Class 2 Reflex:** The florets in this class curve downward and overlap, similar to bird plumage. The tops of these blooms are full, but somewhat flattened. Flower Size: 4-6 inches.
- **Class 3 Regular Incurve:** A true globular bloom equal in breadth and depth. The florets smoothly incurve and form a ball. Flower Size: 4-6 inches.
- **Class 4 Decorative:** A flattened bloom with short petals. The upper florets tend to incurve, but the lower petals generally reflex. Flower Size: 5 inches or greater.
- **Class 5 Intermediate Incurve:** This bloom class is smaller than the irregular incurve, with shorter florets. Flower Size: 6 inches or greater.

- **Class 6 Pompon:** A small globular bloom, somewhat flat when young but fully round when mature. Size ranges from small button types to large disbudded blooms almost 4 inches in diameter. Flower Size: 1-4 inches.
- **Class 7 Single and Semi-Double:** A daisy-like flower with a center disk and one or more rows of ray florets.
- **Class 8 Anemone:** These blooms are similar to the semi-doubles, but have a raised cushion-like center. Flower Size: Greater than 4 inches.
- **Class 9 Spoon:** Essentially the same as the semi-double, except the ray florets are like spoons at the tips.
- **Class 10 Quill:** The florets in this Class are straight and tubular with open tips. The bloom is fully double with no open center. Flower Size: 6 inches or greater.
- **Class 11 Spider:** Spiders have long tubular ray florets which may coil or hook at the ends. The florets may be very fine to coarse. Flower Size: Six inches or greater.
- **Class 12 Brush or Thistle:** Fine tubular florets which grow parallel to the stem and resemble an artist's paint brushes or in the thistle form the florets are flattened, twisted and dropping. 2inches
- **Class 13 Unclassified or Exotic:** Those blooms which fit in none of the other classes. Flower Size: 6 inches or greater.

Based on cultural type: This classification is based on how the cultivars are handled in production.

- **Standards:** These types are usually grown single stem with all the lateral flower buds removed to develop one large, terminal flower head. This is usually used for cut flower production.
- **Sprays:** These types are usually grown multi-stem with only the terminal flower bud removed to allow all lateral flower buds to flower. This is usually use for pot crop production.
- **Disbuds:** These types are usually grown multi-stem (plants are pinched as rooted cuttings) with the lateral flower buds removed to develop one large, terminal flower head on each lateral. This is usually use for pot crop production.

Chrysanthemum cultivation is set to go hi-tech by polyhouse/protected cultivation:

Cultivation of chrysanthemum throughout the year is not feasible, as chrysanthemum is a short day plant. Off season production is possible only in polyhouse or green house conditions. Under polyhouse conditions temperature, humidity, light, carbon dioxide are controlled to provide ideal conditions for growth and flowering.

Temperature: Temperature and light are two important environmental factors that influence flowering quality. A critical temperature is needed for flower bud initiation and development, below which only vegetative growth occurs. Temperature of 16-25c for vegetative growth and 16-18c for flower induction are required for the production of flowers with higher standards. For balanced root and shoot growth the optimum air and soil temperature were found to be 16c and 18-21c.

Light: Photoperiod and intensity have major effects. Response of chrysanthemum to light differs at different stages of plant growth. It requires long days for vegetative growth and short days for flower bud initiation. Certain amount of vegetative growth is necessary before the plant becomes responsive to photoperiod.

Artificial lighting (Long Days): Artificial lighting is provided to the chrysanthemums after planting, in order to initiate the vegetative growth. Fluorescent or incandescent or high-pressure mercury lamps are used for providing artificial light in the greenhouses. The intensity of artificial light required is about 150Lux. This light was provided by suspending overhead bulbs (100 Watt) per square metre area for a period of three hours per day from 5.00 PM to 8.00 PM to enhance day length from 10 hours to 13 hours to encourage luxurious vegetative growth.

Artificial Shading (Short Days): Short days are provided to induce flowering in plants after attaining the sufficient vegetative growth. Short day treatment consisted of complete shading of potted plants or beds for 14h continuous hours i.e. from 5 p.m. to 7 a.m. every day, this treatment is continued till the floral buds of the forced plant started showing colour. Shading was done by facilitating the black alkathene sheet with 150 gauge thickness. 5 short days are required for lateral buds to change into flowering. 10 short days required for axils buds half way down to form flower buds. 15 short days required for bud initiation on almost all axils up to the base.

Humidity: Relative humidity should not be less than 55-70%. The optimum relative humidity is raised by spraying water through over head foggers and lowered by providing ventilation and heating. Never operate the foggers when the plants are in flowering stage as this leads flower bud damage.

Plate showing from left to right: Humidity control with foggers, lighting and shading under protected conditions.

Some outstanding varieties of chrysanthemum with a range of characters:

S.No	Name of the variety	Flower type	Plant height (cm)	Flower diameter (cm)	Stalk length (cm)	Duration of flowering (days)
Standard Types						
1	Snow Ball	Irregular incurve large	115.79	14.08	96.72	41.25
2	Golden Yellow	Irregular	93.87	10.61	54.06	50.25

		incurve large				
3	Angel Pink	Spider large	100.28	10.41	45.62	24.00
4	Star White	Regular incurve large	96.81	12.33	67.06	44.25
5	Chandrama	Intermediate incurve large	102.20	11.18	82.68	37.25
Spray Type						
1	Terry	Anemone	88.20	3.73	82.26	21.75
2	White Dolly	Anemone	83.12	5.38	84.72	19.75
3	Yellow Spoon	Spoon	92.59	4.56	94.63	36.50
4	Red Stone	Decorative	92.44	6.42	81.55	32.75
5	Star Pink	Decorative	104.29	6.77	86.14	23.25
6	Bronze Spoon	Spoon	74.79	5.17	79.71	31.00
7	Paper White	Decorative	69.86	5.55	57.56	20.25
8	Kelvin Victory	Pompon	78.75	3.57	73.97	25.50
9	Indiana	Pompon	73.72	3.32	60.83	45.75

*The research work was done under polyhouse conditions with three replications at HC&RI, Anantharajupeta, 2016-17.

Snowball

Golden Yellow

Angel Pink

Terry

Indiana

Kelvin Victory

FUTURE LINE OF WORK

- As all the standard and spray types cultivars performed well under naturally ventilated polyhouse conditions, specialized package and practices have to be standardized for increased production of cut chrysanthemum.
- Specialized treatments are to be standardized for regulation of year round production of cut chrysanthemum.

Conservation of Natural Water Resources

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The water conservation consists of all the policies, techniques and things to do to sustainably manage the herbal useful resource of clean water, to shield the hydrosphere, and to meet the current and future human requirement. Population, domestic size, growth and affluence all affect how plenty water is used. The climate alternate has been extended pressures on natural water assets in particular in manufacturing and agricultural irrigation. A lot of international locations have already applied quite a number insurance policies aimed at water conservation. The efforts wished to achieve goals of water conservation include:

I. Ensuring availability of water for future generations where the withdrawal of freshwater from an ecosystem does now not exceed its natural substitute rate.
II. Energy conservation as water pumping, transport and wastewater treatment services consume a big quantity of energy. In some areas of the world over 15% of complete electricity consumption is committed to water management.
III. Habitat conservation the place minimizing human water use helps to keep freshwater habitats for local wildlife and migrating waterfowl, but additionally water quality.

The key things to do to conserve water are as follows:

I. Any really helpful discount in water loss, use and waste of resources.
II. Avoiding any harm to water quality.
III. Improving water administration practices that minimize the use or decorate the advisable use of water. One approach in water conservation is rain water harvesting. Digging ponds, lakes, canals, expanding the water reservoir, and installing rain water catching ducts and filtration structures on homes are special strategies of harvesting rain water. Many people in many countries hold clean containers so they can boil it and drink it, which is beneficial to supply water to the needy. Harvested and filtered rain water can be used for toilets, home gardening, garden

irrigation, and small scale agriculture. Another method in water conservation is protecting groundwater resources.

WHEN PRECIPITATION OCCURS, SOME INFILTRATES THE SOIL AND GOES UNDERGROUND:

Water in this saturation sector is known as groundwater. Contamination of groundwater motives the groundwater water provide to now not be capable to be used as a aid of clean ingesting water and the herbal regeneration of contaminated groundwater can take years to replenish. Some examples of doable sources of groundwater illness consist of storage tanks, septic systems, uncontrolled hazardous waste, landfills, atmospheric contaminants, chemicals, and street salts. Contamination of groundwater decreases the replenishment of on hand freshwater so taking preventative measures by using defending groundwater assets from illness is an essential aspect of water conservation. An extra method to water conservation is training sustainable strategies of using groundwater resources.

GROUNDWATER FLOWS DUE TO GRAVITY AND EVENTUALLY DISCHARGES INTO STREAMS:

Excess pumping of groundwater leads to a reduce in groundwater tiers and if endured it can exhaust the resource. Ground and surface waters are related and overuse of groundwater can decrease and, in extreme examples, reduce the water supply of lakes, rivers, and streams. In coastal vicinity over pumping groundwater can extend saltwater intrusion which outcomes in the infection of groundwater water supply. Sustainable use of groundwater is imperative in water conservation. A necessary factor to water conservation method is communication and training outreach of specific water programs. Developing conversation that educates science to land managers, policy makers, farmers, and the prevalent public is some other necessary approach utilized in water conservation. Communication of the science of how water systems work is a necessary element when creating a administration layout to conserve that machine and is often used for making sure the proper administration plan to be put into action. Drip irrigation gadget Water conservation applications involved in social options are commonly initiated at the local level, by way of both municipal water utilities and regional governments. Common strategies encompass public outreach campaigns, tiered water fees (charging step by step greater prices as water use increases), or restrictions on out of doors water use such as lawn watering and auto washing. Cities in dry climates often require or encourage the set up of xeriscaping or herbal landscaping in new properties to reduce outdoor water usage. Most urban outdoor water use in California is residential, illustrating a purpose for outreach to households as properly as businesses. One critical conservation intention is conventional metering.

THE PREVALENCE OF RESIDENTIAL WATER METERING VARIES SIGNIFICANTLY WORLDWIDE:

Recent research has estimated that water components are metered in much less than 30% of UK households, and about 61% of urban Canadian properties. Although person water meters have often been regarded impractical in houses with private wells or in multifamily buildings, the U.S. Environmental Protection Agency estimates that metering by myself can limit consumption by way of 20 to forty percent. In addition to raising client recognition of their water use, metering is also an essential way to pick out and localize water leakage. Water metering would benefit society, in the lengthy run, it is tested that water metering increases the effectivity of the whole water system, as well as assist useless charges for humans for years to come. One would be unable to waste water except they are inclined to pay the greater charges, this way the water department would be capable to display water utilization by using the public, domestic and manufacturing services.

Some researchers have advised that water conservation efforts be notably directed at farmers, in light of the reality that crop irrigation bills for 70% of the world's fresh water use. The agricultural zone of most international locations is important each economically and politically, and water subsidies are common. Conservation advocates have urged removal of all subsidies to pressure farmers to grow extra water-efficient vegetation and adopt less wasteful irrigation techniques.

New technology poses a few new choices for consumers; features such as full flush and half flush when using a rest room are making an attempt to make a distinction in water consumption and waste. It is also possible to use/"pollute" the water in stages (keeping use in flush toilets for last), hereby permitting greater use of the water for a variety of tasks inside a same cycle (before it needs to be purified again, which can additionally be accomplished in-situ). Earthships frequently use such a setup. Also accessible are current shower heads that assist limit losing water: Old bathe heads are said to use 5-10 gallons per minute, while new fixtures reachable use 2.5 gallons per minute and offer equal water coverage. Another technique is to recycle the water of the shower directly, by using means a semi-closed machine which features a pump and filter. Such a setup (called a "water recycling shower") has additionally been employed at the VIRTUe LINQ house. Besides recycling water, it also reuses the heat of the water (which would in any other case be lost). Water is a very important phase in irrigation. Plants constantly take a lot of ground water for that reason ground water have to be replenished. For crop irrigation, most fulfilling water effectivity potential minimizing losses due to evaporation, runoff or subsurface drainage whilst maximizing production. An evaporation pan in mixture with particular crop correction factors can be used to decide how awful lot water is needed to satisfy plant requirements. Flood irrigation, the oldest and most frequent type, is regularly very uneven in distribution, as components of a field might also acquire extra water in order to deliver sufficient quantities to different parts. Overhead irrigation, the usage of center-pivot or lateral-moving sprinklers, has the workable for a good deal extra equal and managed distribution pattern. Drip irrigation is the most expensive and least-used

type, but provides the capacity to supply water to plant roots with minimal losses. However, drip irrigation is increasingly affordable, specially for the domestic gardener and in light of rising water rates. Using drip irrigation strategies can store up to 30,000 gallons of water per yr when changing irrigation systems that spray in all directions. There are also cheap high quality strategies comparable to drip irrigation such as the use of soaking hoses that can even be submerged in the developing medium to eliminate evaporation. As changing irrigation systems can be a high priced undertaking, conservation efforts regularly listen on maximizing the effectivity of the existing system. This may additionally include chiselling compacted soils, growing furrow dikes to prevent runoff, and the use of soil moisture and rainfall sensors to optimize irrigation schedules. Usually large gains in effectivity are feasible thru measurement and extra high-quality management of the present irrigation system.

The 2011 UNEP Green Economy Report notes that "improved soil natural depend from the use of inexperienced manures, mulching, and recycling of crop residues and animal manure will increase the water protecting capability of soils and their potential to absorb water at some stage in torrential rains" which is a way to optimize the use of rainfall and irrigation during dry durations in the season. Water Reuse Water shortage has become an more and more tough hassle to manage. More than 40% of the world's population lives in a place where the demand for water exceeds its supply. The imbalance between supply and demand, along with persisting issues such as local weather trade and populace growth, has made water reuse a fundamental method for conserving water. There are a variety of strategies used in the cure of waste water to make certain that it is secure to use for irrigation of meals plants and/or ingesting water. Seawater desalination requires greater strength than the desalination of sparkling water.

Despite this, many seawater desalination plants have been built in response to water shortages around the world.

This makes it fundamental to evaluate the influences of seawater desalination and to locate approaches to improve desalination technology. Current research entails the use of experiments to decide the most fine and least power intensive strategies of desalination. Sand filtration is any other technique used to treat water. Recent research show that sand filtration needs further improvements; however it is approaching optimization with its effectiveness at putting off pathogens from water. Sand filtration is very high-quality at casting off protozoa and bacteria, however struggles with putting off viruses. Large-scale sand filtration amenities additionally require giant surface areas to accommodate them. The elimination of pathogens from recycled water is of high precedence because wastewater constantly includes pathogens succesful of infecting humans. The stages of pathogenic viruses have to be reduced to a positive stage in order for recycled water to now not pose a risk to human populations. Further research is vital to

decide more accurate strategies of assessing the degree of pathogenic viruses in treated wastewater.

Strictly speaking, water that is discharged into the sewer, or immediately to the surroundings is no longer wasted or lost. It remains inside the hydrologic cycle and returns to the land floor and surface water bodies as precipitation. However, in many cases, the source of the water is at a big distance from the return factor and may be in an exceptional catchment. The separation between extraction point and return factor can symbolize enormous environmental degradation in the watercourse and riparian strip. What is "wasted" is the community's provide of water that used to be captured, stored, transported and dealt with to drinking exceptional standards. Efficient use of water saves the cost of water provide provision and leaves extra clean water in lakes, rivers and aquifers for different users and also for supporting ecosystems. A concept that is closely associated to water wasting is "water-use efficiency." Water use is considered inefficient if the same reason of its use can be done with less water. Technical effectivity derives from engineering practice the place it is generally used to describe the ratio of output to input and is beneficial in comparing a number of products and processes. For example, one showerhead would be regarded extra efficient than another if it could accomplish the same purpose (i.e., of showering) by means of the usage of much less water or other inputs (e.g., decrease water pressure). Urinals are extra environment friendly than bathroom stalls in public restrooms for men or boys in situations where the consumer only desires to pee, even though they offer drastically much less privacy. The technical efficiency notion is no longer beneficial in making decisions of investing cash (or resources) in water conservation measures until the inputs and outputs are measured in fee terms. This expression of effectivity is referred to as financial efficiency and is integrated into the thought of water conservation.

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Impact of Soil Health Card Scheme: Lessons from selected success stories in southern India

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ABSTRACT

The present study attempted a synthesis of recently reported research results on the effectiveness Soil Health Card Scheme of Government of India. This scheme is a vital to achieving the goal of "Doubling Farmers Income". The ideal ratio of the three most common fertilizers that is, Nitrogen (N),Phosphorous (P) and Potassium (K) should be 4:2:1 whereas it had reached a threatening level of 8.2:3.2:1 in 2012-13 as per a report by Fertilizer Association of India. Excess application of fertilizers leads to wide range of nutrient deficiency symptoms in soils. Soil is fundamental to life on earth[i]. Fertilizers are the main factors responsible for providing adequate food for the world's current population of over 7 billion people, fertilizers will be even more important in sustaining the over 9 billion people projected for 2050. Soil health cards helps in increasing the farmer's income by reducing the cost of cultivation, application of over dosage of fertilizers and suggesting the farmers to go for balanced applications thus soil health and quality is being protected. The return per rupee investment was also increased from 1.40 to 1.90 after soil testing by the farmers. While the primary impact of mineral fertilizers is on crop yields, they also have an indirect effect on the soil interms of its health and quality. So, the emerging challenge in present day agriculture is to protect and maintain the soil health which is being deteriorated every year by many of the factors either man made or natural and putforward towards the sustainable agriculture.

Keywords: Soil health cards, Soil health, Soil quality, Sustainable agriculture.

1) INTRODUCTION:

Soil health can be defined as capacity of the soil to function as one of the vital living systems, by recognizing that it contains biological elements that are key to the functioning of the ecosystems within certain land-boundaries (Karlen*et al.,* 2001). The

term "soil quality" is also often used synonymously with soil health, but the basic difference between these two terms are that soil quality is related to soil function (Karlen*et al*., 2003; Letey*et al*, 2003), whereas soil health presents the soil as a finite non-renewable and dynamic living resource (Doran and Zeiss, 2000).

"*SwasthDharaa. KhetHaraa.*" - Healthy Earth. Green Farm.

Soil Health Card (SHC) is a Government of India's scheme promoted by the Department of Agriculture & Co-operation under the Ministry of Agriculture and Farmers' Welfare. Soil Health Card scheme was launched by the Prime Minister of India. Shri Narendra Modi on 19 February 2015at Suratgarh in Rajasthan. It is being implemented through the Department of Agriculture of all the State and Union Territory Governments.

Soil Health Card Scheme is a very beneficial scheme for farmers. There are many farmers in India and they do not know which types of crops they should grow to get maximum yield. Basically, they do not know the quality and the type of their soil. They might know by experience what crops grow and what crops fail. But they don't know what they can do to improve the condition of the soil. National Soil Health Card scheme, which has completed its fifth year, has ushered in a new awareness about the importance of a green economy, says Dr P Balasubramanian, Head of the Department of Soil Sciences, Tamil Nadu Agricultural University, Trichy (Source: News services Division) ALL INDIA RADIO. He said that the wide-spread use of these cards has helped in popularizing the optimal use of fertilizers. Talking to AIR, Dr. Balasubramanian said that the health card was an excellent way of protecting the health of Mother Earth by accurately measuring the quality of soil and ensuring the use of proper fertilizers. He said that there is no doubt at all that the card system ensures accurate measuring of the character and constituents of the soil, and increases awareness about eco-friendly agriculture.SHC is a printed report that a farmer will be handed over for each of his holdings. It will contain the status of his soil with respect to 12 parameters, namely N,P,K (Macro-nutrients) ; S (Secondary-nutrient) ; Zn, Fe, Cu, Mn, Bo (Micro - nutrients) ; and pH, EC, OC (Physical parameters). Based on this, the SHC will also indicate fertilizer recommendations and soil amendment required for the farm. Sustainable agriculture is a way of farming that can be carried out for generations to come. This long-term approach to agriculture combines efficient production with thewise stewardship of the earth's resources. It is hoped that, over time, Sustainable Agriculture will do the following:

- ✓ meet human needs for food and fibre
- ✓ protect the natural resource base and prevent the degradation of soil andwater quality
- ✓ use nonrenewable resources efficiently
- ✓ use natural biological cycles and controls
- ✓ assure the economic survival of farming and the well-being of farmers and theirfamilies.

Considering the importance of this scheme in ensuring optimum soil health for sustainable agriculture, we have attempted to present and analyze few select cases of farmers on how use of SHC has benefitted them.

3) Some success stories of SHC Scheme:

3.1) Case from Tamil Nadu:

1	Name of the farmer:	Mr.V.Ramesh; S/o.Veerasamy
2	Village, District	Vengalam(Village), Veppanthattai (Tk),Perambalur(Dt)
3	Mobile No:	
4	Aadhar Card No.:	
5	Crop cultivated:	Cotton
6	Dosage before SHC was received:	120:60:60 (NPK)
7	Dosages after receipt of soil information through SHC:	69:35:66 (NPK)
8	Cost of cultivation:	Rs.62000/Ha
9	Increase in Production:	500 Kg /Ha
10	Use of SHC:	

Through Mission on Soil Health Card, I came to know the benefits of Soil testing, soil test based fertilizer recommendation to crops. Soil health card is very much useful to me to know the status of the soil, required quantity of fertilizer to be applied and to avoid excess use of fertilizer. Though that the input cost ,labour cost is saved and cost of cultivation has been reduced. I also came to know the usage of Bio fertilizers. It is also learnt that the soil test based fertilizer recommendation to crops will maintain the soil fertility and also it avoid the pest outbreak. I also learnt the importance of Micro nutrients application for the Cotton crop is essential for better yield.
Source:Department of Agricultural Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

3.2) Case from Telangana:

1	Name of the Farmer:	Paapireddy
2	Village and District:	Gudur, Rangareddy District.
3	Soil Health Card received in month of :	DECEMBER Year:-2015
4	Crop Cultivated:	Maize
5	Dosage Before SHC was received :	Urea-200 kgs, DAP-50 kgs, MOP-50 kgs.
6	Dosage After receipt of SHC:	FYM-6 Tonnes,Urea-150 kgs,DAP-37.5 kgs, MOP-50 kg.
7	Cost of Cultivation:	15000/-per Acre.
8	Increase in Production:	Inspite of reduced fertilizer, productivity remains same

9	Use of SHC:	1) Reduced cost of Fertilizer about 1500/- peracre. 2) Earth worms are showing up in field implying improved soil Health. 3) Seeing this result he approached us for vermin bed and we supplied it.

Source:Department of Agricultural Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

3.3) Case from Karnataka:

1	Name of the farmer:	Keshawa reddy halkundi
2	Village, District:	Halkundi
3	Mobile No:	
4	Aadhar Card No.:	
5	Crop cultivated:	Bajra
6	Dosages before SHC was received	50 Kg DAP/Acre
7	Dosages after receipt of soil information through SHC:	25 Kg DAP/Acre.
8	Cost of cultivation:	Rs. 5000/- Per Acre.
9	Increase in Production:	Crop not harvested. Expected increase is 15%
10	Use of SHC:	Balanced application of fertlizers

Source:Department of Agricultural Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

3.4) Case from Kerala:

1	Name of the Farmer/ Father:	Ramachandran nair
2	Village, Block, District:	Karakulam, nedumangad, thiruvananthapuram
3	Mobile Number	
4	Aadhaar Number	
5	Crop cultivated	Banana, Variety: Nendran
6	Dosages (per acre) before SHC Was received	N -120 kg P-120 kg K-240 kg Micronutrients-0.00 kg
7	Dosages (per acre) after receipt of soil information through SHC	N-63.02 kg P-6.05 kg K-199.80Kg Micronutrients-0.00 kg
8	Increase in fertilizer usage	0.00 kg

	(kg/acre)Micronutrients	
9	fertilizer saved (kg/acre)	**N-**56.98 Kg P-113.95Kg K-40.2 kg
10	N.P.K before SHC received	1:1:2
11	N.P.K after SHC received	1:0.1:3
12	Quantity of bio fertilizers (pseudomonas) used before SHC (kg/acre)	
13	Quantity of bio fertilizers (pseudomonas) used after SHC (kg/acre)	
14	Difference in bio fertilizer use (kg/acre) (pseudomonas)	
15	Quantity of compost/FYM/vermicompost /City Compost used before SHC received (kg/acre)	10,000Kg
16	Quantity of compost/FYM/ vermicompost/City Compost used after SHC received(kg/acre)	3,000Kg
17	Difference in compost/FYM/ vermi compost/ city compost use(kg/acre)	7,000Kg
18	Cost of Fertilizers (Rs/acre)	Rs.14,270/
19	Increase in production (kg/acre)	1500 kg
20	Increase in farmers income (Rs/acre)	Rs.61,500/-
21	Benefit of Use of SHC (in term of improve N:P:K, Increase in production and farmer in come and improvement in soil health (increase OC, lowering salt content (EC), improvement in soil pH (in case acid and salt affected soils), increase in earth worms etc.	There was 12% increase in yield compared to the control plot which can be attributed to a higher number of bunches and increased bunch weight. Moreover the plants showed increased vigour and health. Considerable increase in income was also noticed with a better benefit cost ratio and net profit.
22	Photograph to be enclosed (Mandatory)	

Source:Department of Agricultural Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

Banana demonstration plot

Farmer with harvested produce

3.5) In Andhra pradesh:

1	Name of the Farmer :	Dasari Hanumanthu Rao
2	Village, District :	Jalipudi, West Godavari district
3	Mobile Number :	
4	Aadhar Card Number :	
5	Crops cultivated :	Paddy
6	Dosages before SHC was received :	Urea-75 Kg, DAP-50 Kg, MOP-25 Kg, 14:35:14-50 Kg per Acre
7	Dosages after receipt of soil information through SHC:	Urea-50 Kg, DAP-25 Kg, MOP-50 Kg, SSP-150 Kg per Acre
8	Cost of cultivation :	Rs.21600/-per Acre
9	Increase in production :	3.0 qts per Acre
10	Use of SHC :	1) Reduction of fertilizer use by need based applied of Recommended dosages. 2) Problematic soils can be rectified.

Source:Department of Agricultural Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India.

CONCLUSION:

With the use of soil health cards, the farmers are able to increase the crop yields by reducing the cost of cultivation, following the recommended dosage of fertilizers bringing the site specific nutrient management. The SHC are to be supplied for every three years. The net income of the farmers increased between 30 and 40% after SHC scheme. It is indirectly helping in maintaining the soil health and fertility and bringing sustainable agriculture. However,there are some lacunae in soil health cards but they are highly useful to the farmers. Soil health can be managed by Soil cover conserves moisture, reduces temperature, intercepts raindrops (to reduce their destructive

impact), suppresses weed growth, and provides habitat for members of the soil food web that spend at least some of their time above ground. Biodiversity is ultimately the key to the success of any agricultural system. Lack of biodiversity severely limits the potential of any cropping system and increases disease and pest problems. soil works for you if you work for the soil by using management practices that improve soil health and increase productivity and profitability immediately and into the future.

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Source: (News services Division) ALL INDIA RADIO.

A Brief Overview of Goat Rearing in Jammu and Kashmir

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ABSTRACT

Jammu and Kashmir has varied agro-climatic and geo-physical conditions (high mountains, low hills and vast meadows), rich alpine pastures, host of other natural endowments and unique socio-cultural setup suitable for livestock production. The farm animal biodiversity in the J&K follows closely the geographical diversity. Goat rearing is practiced in region from times immemorial and is the core activity of rural masses in particular Gujjars, Bakerwals, Chopans, Gaddies and Changpas. The goat genetic resources of Jammu and Kashmir possess unique traits of adaptability and disease resistance and some efforts at ground for making them sustainable are highly recommended.

INTRODUCTION

Jammu and Kashmir (J and K) has hilly demography with total area of 2,22,236 Sq. Km that spreads over the western Himalaya and Karakorum mountains between 32.17 N and 36.58 North latitude and 73.26 E and 83.30 East longitude with geographically, there are three distinct regions i.e. Jammu, Kashmir and Ladakh. The agro-climatic conditions of J and K are temperate in Kashmir, Chenab valley and Poonch district, subtropical in Jammu and cold arid in Ladakh division. As the region possess varied agro-climatic and geo-physical conditions (high mountains, low hills and vast meadows), rich alpine pastures, host of other natural endowments and unique socio-cultural setup suitable for livestock production (Anonymous, 2004, 2017 and Rather et al., 2019). The pastoral areas of state are found both in sub-tropical zone of Jammu and temperate zone of Kashmir. The farm animal biodiversity in the J&K follows closely the geographical diversity (Rather et al., 2020). Sheep and goat rearing is the core activity of rural masses in region and plays a vital role in socio-economic upliftment of weaker sections of the society *viz;* Gujjars, Bakerwals, Chopans, Gaddies and Changpas. The Gujjars and Bakerwals have adopted the sheep and goat rearing as their primary

occupation from times immemorial and prefer to migrate in search of pastures to feed their livestock (Anonymous, 2004). Among all farm animals, goats are considered as most reliable livelihood resource of poor farmers. Goats are easy to manage and maintain owing to their small size and they can sustain wide range of agro-climatic conditions. More often goats are reared for production of meat, but they also serve as ready source for milk to meet the family requirement. Goats produce meat called chevon, milk and good quality fibre called Pashmina. Goats significantly contribute to the agrarian economy and play a very vital role in the livelihood security of the small and marginal farmers and landless laborers. Their small size compared to cattle and buffaloes permit them to be maintained in a limited area. Goats consume a wide variety of grasses, weeds, herbs, bushes, shrubs, tree leaves and crop residues that would otherwise go waste and cause pollution. Goat is an efficient converter of the sparse vegetation available in wastelands, community grazing lands and tree leaves into milk, meat, skin manure, and fibre. Goats are considered as moving refrigerators as they can be milked any time of the day. The article is written with aim to high light goat rearing in J and K.

BRIEF HISTORY OF GOAT REARING IN KASHMIR:

Goat rearing is not new to Jammu and Kashmir but was practiced from times immemorial. The statement is supported by recovery of tool made from bones of domestic sheep and goat during excavation at Gufkral, Pulwama located 35.54 L and 75.60E 41 km from Srinagar (Anonymous, 1984). Therefore, domestication of sheep and goat in Kashmir was practiced even before second millennium B.C. Lawrance has mentioned in his book that goat skin fetched one rupee in the mountains and tax on goats for the summer grazing in Kashmir was only Rs 5 per hundred goats (Lawrence. 1895). During recent times many goat breeds were imported for up-gradation of local non-descript goat population to bridge the gap between the demand and supply of meat and milk. The breeds which were imported are as follows.

Table 1. Breeds used for improvement genetic worth of non-descript goats

Breed	purpose	Imported from	Used in area
Toggenburg	Mutton and milk	-	Jammu division
Boer Goat	Milk and adaptability	South Africa	Kashmir
Beetal	-	Gurdaspur (Punjab)	Uri and Karnah
Alpine	-	-	Kashmir

Source (Anonymous, 2017, 2012 and 2019)

Population dynamics of goat sector of J and K from 1951 to 2019: The population dynamics of goat sector of J and K is presented in Table 2 and Fig 1.

Population dynamics of goats in J and K (Lakhs) from 1951 to 2019.

Year	**Population**	**Year**	**Population**	**Year**	**Population**	**Year**	**Population**
1951	4.87	1972	5.69	1992	17.66	2012	23.04

1956	8.15	1977	6.91	1997	18.095	2019	1730
1961	5.77	1982	10.04	2003	20.55		
1966	6.05	1987	3.41	2007	22.60		

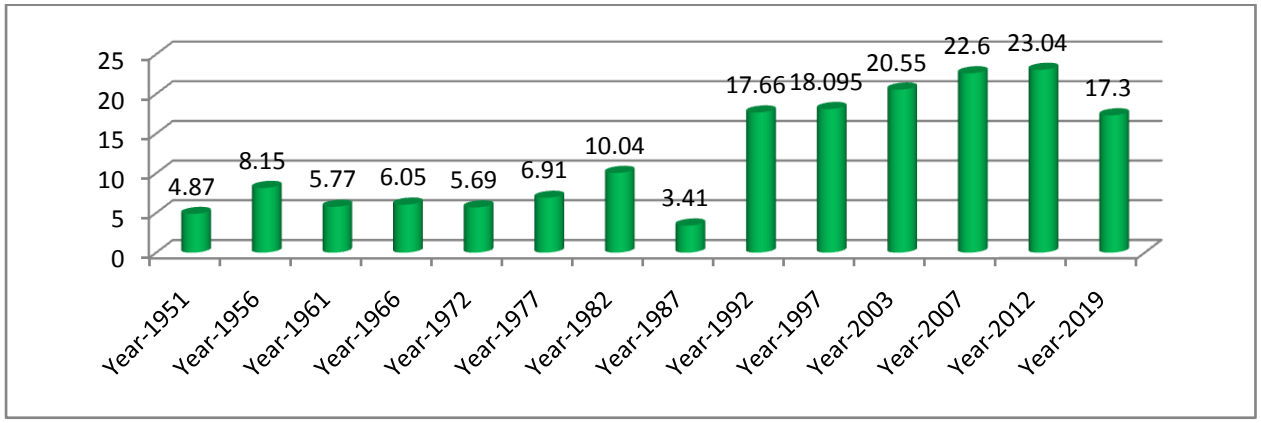

Fig 1. Population dynamics of goat sector of J and K from 1951 to 2019

GOAT GENETIC RESOURCES OF J&K:

Changthangi, Malra and Bakerwal are important breeds of J and K. Nomadic tribes Gujjars and Bakerwals maintain the Bhakerwal. Disease resistance, ability to thrive in harsh condition and excellent mutton confirmation are important traits of the local goats (Ganai. *et al.* 2016). Bakerwal goat is heavy goat breed of J and K possing traits like good feed conversion and reproductive efficiency. Malra and changthangi are non-pashmina and pashmina goat, respectively of Ladakh. Non-descript goat is medium sized goat distributed in hilly tracts of Shopian, Kulgam, Tral, Budgam and Kupwara having adult body weight of 30-40 kg (Anonymous, 2004).

Unique traits of Goats of J and K: Native goat genetic resources posses following unique traits:

I. The native goats possess excellent disease resistance.
II. Adoptability to varying climatic condition like heat and cold tolerance and a
III. Good feed conversion efficiency and can utilize local weeds efficiently.
IV. Has tremendous potential to be projected as the 'Future Animal' and can be managed on low inputs and can withstand changing environment.
V. Can be significantly be improved through cross breeding and selective breeding.
VI. Has excellent survivability therefore, will provide higher returns to farmers.
VII. They provide genetic material for research crossbreeding and for the development of new and improved breeds.

VIII. The goats of J&K are easy to manage on low input, in terms of feed fodder, housing, and health care and possess good efficiency to convert low quality feeds/ fodder in into meat, milk, and fibre.

IX. Goat milk is prescribed for children, old and sick people as it is easily digestible owing small sized fat globules and has possible medicinal value.

X. Goat meat (chevon) lean meat.

XI. Grazing goats can improve soil and vegetation cover and plant and animal biodiversity, for example by removing biomass, which otherwise might provide the fuel for bush fires, by controlling shrub growth and by dispersing seeds through their hoofs and manure, which can improve plant species composition.

XII. Droppings (Manure) of goats improve soil fertility.

CONSTRAINTS OF GOAT REARING IN KASHMIR:

Constraints to goat rearing include the scarcity of good breeding stock, inadequate veterinary and extension services, shrinkage due to encroachment of pastures and grazing lands and slaughter of elite breeding stock. The goat farmers are exploited by the middlemen in marketing of surplus animals for meat markets. There is not even single modern abattoir for hygienic slaughter of goats. The goat products are among the foods available with human health promoting characteristics. Lack of awareness to adopt improved technologies due to poverty, illiteracy and little or no say in decision making process is the weakness of the goat owners.

FUTURE PROSPECTS

There is great scope for rearing goats for meat and milk production under semi-intensive and intensive systems of management. However, there is no effective goat development programme operational at the moment although introduction of Beetal and Boer breeds of goat, and conservation of Kagani goat have been started particularly in respect of Boer goat at Bandipora Kashmir. A complete management programme with respect to breeding, nutrition, management, health care and economics is required to improve goat production in J and K. Characterization and documentation of nondescript goats is highly recommended.

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Wild Life Habitat Management

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ABSTRACT

Habitat is the place where the normal daily activities of animals takes place. Management or maintenance of habitat is the vital point of wild management. The main principle of wildlife management are project formulation and it should be in according to need of wildlife and the practices that benefited one species should not harm the another one. For the purpose of proper habitat management it is crucial to consider salient points such as food improvement, water improvement, shelter improvement and fire management. For the success of all this managemental planning it is essential that the project should be practical and economical and timed evaluation is required to determine whether objectives are being fulfilled or not.

INTRODUCTION

For the existence of an organism basically three factors viz. food, water and shelter are required. Hence, for wild animals also these basic requirements play important roles in their growth and propagation. Since, all these basic components are exclusively related with their habitats, the management or maintenance or manipulation of the habitat is a major component of the wildlife management .This is the prime responsibility of the wildlife manager. It cannot be ignored as wildlife habitats are presently undergoing tremendous changes primarily by the man for his needs, encroachment of forest land for grazing and agricultural purposes due to mushroom growth in human-population, constructing roads and cities etc. Therefore, man's manipulation of environment for his needs or greedy needs is the most prevalent for affecting wildlife habitat and as a consequent the wildlife population. .

PRINCIPLES OF HABITAT-MANAGEMENT

(a) The project should be framed after thorough studies and justification in accordance with the needs of wildlife.
(b) The practices must be evaluated for their effect on other natural resources, land-uses etc.
(c) The improvement practices must simulate natural conditions/ ecosystem perpetuating native flora and fauna.
(e) If tree plantation is needed, the topography of the area must he cared for.
(f)Manipulation should be designed following topographical characteristics of the area.

FOOD IMPROVEMENT

Food is the most important basic need of the animal. Hence, "improvement of food production" is the most frequently used technique to manipulate the habitat of wildlife. This may be accomplished by:-

(1)Production of edible fruits and seeds: The fruits and seeds of many plant species are eaten as preferred food by so many herbivorous wild animals including birds. Therefore, conservation and propagation of such plants are very essential. Their plantation is also important measure for the production of such edible parts. Such fruit species should be saved by providing protection to them and propagated by removing unwanted competitive vegetations found around them.

(2) Production of grazing and browsing food: We know that choice of food is different for different kinds of wild animals as well as there are some particular foods which are not preferred by them. Particularly, herbivorous animals graze and browse on so many plant species but among them all are not so energetic and of good quality. Therefore, such plants species which have good quality as food for wildlife in the habitat should be accessed and judged very carefully.

(3) Production/creation of pasture land: The areas inside the forest or neighbouring the forest which are suitable for pasture lands should be created for the purpose as well as the pasture lands which have become damaged due to over-grazing should also be improved. In such areas, seeding of suitable grass species should be done as per the need of wildlife. As per the requirement in such areas, control-grazing should be adopted and even grazing may be banned for certain required period for the proper growth of the vegetation.

(4) Control Grazing: The practices of control-grazing must be preferred area-wise, phase-wise and period-wise. Such periodical grazing will be helpful in proper growth of the vegetation and germination of the seeds and production of the sufficient food quality.

(5) Control Burning: Mostly herbivorous wild animals prefer new delicate succulent parts of the vegetation. It is more nutritive to the animals and also liked too much. Old and hard plants including bushes become unpalatable and, hence, lessens the carrying-capacity of the habitat. In such condition, control-burning is essential to regain new delicate plants. But in such practices, care should be taken to avoid burning of wild animals and other valuable plants species.

(6)Artificial Feeding: Though the artificial—feeding to the wild animals should not be preferred because the animals lose their wilderness characters in getting such food and become like pets; but some time in pinch-period or in adverse natural condition, artificial-feeding becomes essential to save them, specially the target species.

WATER IMPROVEMENT

The requirement of water is one of the basic needs of wild animals, though its consumption varies in accordance with the species concerned. Therefore, the availability of water source (waterholes) in the habitat is very essential throughout the year. Generally, it has been seen that even after the availability of sufficient food and shelter; there is insufficient number of the species or occurrence of death in the habitat showing the reason of lacking of sufficient waterholes.

Maintenance of Natural Waterholes -Natural waterholes can be maintained and improved as follows:

Natural Waterholes: Natural waterholes are often found in nallas and rocky areas where run-off water is accumulated in depressions. At times, such holes can be improved by deepening the catchments or by trenching run-off water directly to the basin. The arrangement should be done to make it available to the wildlife.

Seeping: Somewhere in natural condition, it is seen that water is coming out drop by drop through a particular space. Such water cannot be utilized by the wildlife. Such water can be collected in a artificially made ditch/tank by applying devices like through hollow bamboo or pipe catching those seeping water. Such collected water will be beneficial and utilizable to the wildlife serving their purpose.

DEVELOPMENT OF ARTIFICIAL WATERHOLES

Artificial waterholes are developed by adopting following measures:-

(1) Reservoirs and Ponds:.

(2) Water Catchments

(3) Other Water Developments: The habitat manager may construct water-development devices such as tanks, wells, tube-wells, hand-pumps etc. with the connection of water reservoirs according to the requirement and suitability of the habitat.

SHELTER IMPROVEMENT

Shelter or cover is also a basic fundamental need like food and water for wildlife and acts as a limiting-factor for them as described earlier. Shelter varies differently for different kinds of species and, hence, it is species-specific in case of wild animals.

Development of Natural Shelter: We know that in nature, there is cycle of plant succession. The phenomenon Is continuous and contiguous process in its own way unless and until it is manipulated by the human-beings. The management should be like that particular stage and can be retarded or retained for longer desired period so that it may be helpful for the target species for its proper growth and propagation, In this way, the desired shelter/cover may be obtained for wildlife. In real sense; the process is tagged with the food-improvement.

Development of Artificial Shelter: Before going towards artificial cover, it is necessary to ascertain the actual necessity of the target-or species in respect of the shelter means what type and how much cover is needed for that particular species. The following artificial management measures are being applied in general for cover improvement purposes:-

Plantation of Trees (Afforestation/Reforestation): Generally; Plantation of trees for shelter purposes is not needed in the jungle, but if it is required then the evergreen shade and fruit trees should be preferred for plantation so that they may meet the demands of food and shelter for wildlife even in the pinch-period.The choice of tree species should be selected as per the suitability of the climate, topography, soil etc. of the habitat and mixed-plantation of the indigenous species must he preferred as far as possible because wild animals of the habitat are genetically habituated for such species.

Development of Brush-piles: Some small animals and birds require their shelter in bushes. They use them as their roosting and nesting covers. Therefore, such covers should be accessed in the habitat and, if needed, must be developed artificially.

Development of Travel-route Cover: During migration, wild animal need shelter in the route. Therefore, such travel-route cover should be protected and developed wherever needed specially near the waterholes. Covers near the waterholes are mostly required to rest by the animals; otherwise, it has been seen that the waterholes which are devoid of covers are not used by the animals. Hence, protection and the development of travel-route covers play an important role in wildlife propagation.

Artificial Nesting: Wherever required, the artificial nests in the form of baskets of variable shapes made-up of wood should be hanged. Such nests are generally required for the game birds in the area which is devoid of vegetation. In the forests; such devices are oftenly not needed, however, may be arranged wherever and whenever required.

Modification in Silvicultural Operations: Generally the silvicultural operations are recommended and practiced in view of getting more and more timbers. In such operations, the ideas of wild animals and their protection as well as propagation are ignored. Hence, there is need of modification in the rules and regulations of silvicultural operations/practices. These modifications should be on the basis of the priorities of the land- use and other factors of the habitat.

FIRE MANAGEMENT

Fire management is an important component of habitat-management. It is the most disastrous in the forest as it results in much harm to the wild flora and fauna. It causes damage to the habitat of the wild animals destroying its food and shelter, forest crop, regeneration, productivity of forest and soil. Hence, wildlife is caused excessive loss by the fire by burning their eggs, young ones and the habitat. As a result, the equilibrium of the nature becomes upset.

But fire is not always harmful, if it is done in controlled condition for the purpose of removing tall and old grasses to bring fresh grass growth for the herbivorous animals. Fires can both kill as well as stimulate new growth and thus checks natural-succession which depends upon the frequency and intensity of burning. Somewhere;

specially in moist areas, it gives favourable result for the herbivorous animals while in other places, particularly in dry regions, does not.

Preventive Measures:

- Goodwill of the local people in preventing fire.
- Early burning before summer- season to prevent uncontrolled fire in summer.
- Education of the masses to prevent fire.
- Ban on the activities causing fire.
- Legislative measures to stop intentional fire.
- Forecasting of burning days.

Remedial Measures:

Quick communication - Wireless-sets/mobile-sets etc. should be provided to all the blocks, range and headquarters so that outbreak of tire may be communicated without delay.

Quick action — Proper and quick action is required if outbreak of fire occurs.

Availability of labourers

Arrangement of water

Arrangement of tools- For the purpose, hand tools are needed for cutting grasses and bushes, digging earth, making ditches etc.

Proper fire policies should be made after thorough investigation of the particular habitat.Hence, fire-management is one of the most important management techniques to achieve the goal habitat-improvement. Protection of the habitat from fire or quick and efficient action taken at the time of fire-outbreak gives excellent successful result in wildlife propagation.

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