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UNSCRIPTED INDIAN GREEN REVOLUTION

Muhammed Ameer
Kerala Agricultural University,
Thrissur - 680656
Corresponding Author mail: muhammedameer221@gmail.com

Keywords : Green revolution, seed conservation, soil health, pesticides, weeds

Abstract
India is a predominantly agricultural nation and agriculture remains the largest sector of our economy. The founding fathers of our nation were well aware of this. They kept agriculture as the main focus of the very first five-year plan formulated after the independence. Mahatma Gandhi, the father of our nation, even warned us that, "to forget how to dig the earth and tend the soil is to forget ourselves". Gandhiji's warning makes us aware of how significant is to engage in agricultural practices. Apart from that, it should also be emphasized that the agricultural sector plays a significant role in social security by providing food, nutrition as well as countless employment opportunities especially for the rural population of India. Having said that, the other side of the picture should also be explored. The increasing number of farmers suicides put an alarming sign on the policies we adopt in the name of the well being of the farmers' community. This paper will try to delve deeper into the question of where we failed our farmers and the ways to redress it by detailing the solutions to the problems I could identify during my studies.

Most of the problems the Indian farmers face today has a direct correlation with the Green Revolution. A huge increase in crop production has been brought in developing countries including India by the use of artificial fertilizers, pesticides, and high-yield crop varieties. The acclaimed Indian geneticist, Dr M S Swaminathan was the main proponent of this movement in India. He urged the Indian farmers to cultivate their lands adopting the newly invented techniques. Even though they could produce substantial quantities of rice and wheat, their unwanted side effects have caused the destruction of our agricultural sector. New studies have been published on this for the last few decades. The ill effects of the Green Revolution were once again brought into discussion with the new action plan Food and Agriculture Organisation of the United Nations (FAO) emphasizing the significance of soil conservation to regain the health of people. The decision opened a new realm of possibilities in eco-friendly agriculture practices worldwide.

It is a proven fact that anything grows beyond the limit, the mother nature tries to suppress it by some methods like a disease. It can be understood by simply observing the growth of plants in the forests. Scientists had not paid attention to this basic fact while trying to boost production. The Indian farmers had a variety of indigenous farming techniques adopted keeping in mind the natural diversity of the various places they lived. They also used to preserve high yielding nutritious seeds of millets and pulses. The Green Revolution forced the farmers to abandon all of these age-old practices. It should also be noted that Punjab, the place chosen to adopt the new practices was very fertile due to the alluvium deposits of its celebrated five rivers. Anything planted there used to grow rapidly and give high returns. The poverty India experienced at that time was not a result of low grain production but a lack of proper marketing strategies.

It was hoped that trend of raising the output of food grains would continue for a long time after importing high yielding dwarf varieties in the 1960s. However, in the following years, large

fluctuations in food grain output were noted, creating insecurity among producers as well as consumers. The productions of millets and oilseeds decreased drastically throughout the years in the country which was known for its richness. Nobody reported this loss while everyone hailing for the success of the green revolution. The Green Revolution promoted exports. The farmers lost their independence through this. The feudal in Punjab, i.e, the big landowners, received their share in profit but the quality of soil deteriorated due to the continuous use of pesticides and artificial fertilizers, which too were imported to prevent the shutdown of chemical factories after World War II. Their profit motives were paid off heavily. In a few years, the unique farming methods adopted by our forefathers were totally abandoned.

Seeds conservation was one of the major areas which lost recognition during the times of the Green Revolution. When we discuss the seed conservation practices followed by the traditional farmers of our nation, it is very interesting that they entrusted women the responsibilities of seed banks. Women were the protectors of two of the most important things in the world, the children and the seeds. Our women cared for both in the same way. But the proponents of the Green Revolution neglected these efforts and ignored local high yielding seeds to protect the corporate interests. They wanted to replace them with hybrid seeds purchasable in the market. When Cyclone Aila caused destructions in the Eastern Region and thousands of fields were submerged in flood, it was the seeds conserved by Dr. Dabel Dev, India's Seed Warrior, came to the rescue. He did not hesitate to help farmers with the large collection of seed banks he preserved. The tribal population also were there in the forefront of seed preservation.

The seeds not suitable for certain soil invite diseases. It happened during the Green Revolution paving way for the pesticide market. Various types of pesticides and fertilizers were distributed in the name of good agricultural practices. People were fooled by the construction of compost tanks using big budgets whereas earthworms were killed due to excessive use of pesticides. When nutrients not needed for plants were used widely, weeds started to grow all over. In reality, it is the art of nature to balance soil by plants and weeds are a big part of it. But the so-called experts urged the farmers to use weedicides. It is true the traditional farmers also had their own practices to curb the unnecessary growth of weeds but it was not on a mass scale like the weedicides. Their methods were also nature friendly.

Conclusion

The agricultural sector in India should become free from the all of problems discussed above. The industrial and service sectors needed to be developed along the scale of agricultural production. The farmers' life needs to be secured like any other profession. They should be given complete freedom over production and distribution. The traditional practice of seed saving is worthy of continuing as it has been a practice in our country for thousands of years until it was discouraged recently. There is a need of educating the farmers regarding the market trends so that they face competition independently in the markets. It will also help in growing new farming entrepreneurship practices. Education, as well as Policy-making, also has a major role to play in this as it is the root of development. I hope if the agricultural education curriculum can incorporate all these things in the syllabus, it will help to drastically change the present system.

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POTENTIALITY FISH HYBRIDS IN AQUAFARMING

N.C.Ujjania, V.K.Ujjania[1] and L.L.Sharma[1]
Department of Aquatic Biology (VNSGU) Surat, Gujarat
[1]College of Fisheries (MPUAT) Udaipur, Rajasthan
Corresponding author : vikasujjania@gmail.com

Introduction

Genetic improvement attributes to the better performance of the new generation over the parental stock. There are several approaches towards this goal contributing hybridization, selective breeding and other population manipulation techniques. Hybridization is a rapid method of genetic improvement and method of animal improvement, in which two or more species of unlike genetically constitution, differencing in one or more characters are crossed together. The crossing of distant genetically variable stocks can produce increased performance termed heterosis or hybrid vigor. Through hybridization uniform products (monosex hybrids) can be produced, by hybridizing two species depending upon the sex-determined mechanism present in two species e.g. *Tilapia mossambica* (male) x *Tilapia nilotica* (female). Hybridization is one of the methods employed for combining desirable qualities of selected fishes, which would interbreed and also raised strains superior to those to which the parents belong. Fish hybrids generally tend to be intermediate in taxonomic characters pertaining to the parents but may show desirable qualities like phenotypic growth, better food conversion, higher survival, resistance against disease and tolerant to unfavorable environmental conditions.

Role of hybridization in aqua farming

The progress from traditional system to modern intensive farming a capital oriented that can be qualified by the use of expensive inputs. Till now, the investigation have been undertaken to evolve proper feed, water quality control and health management to carps for getting high yield with low input cost. Selection in breeding stocks is adopted to upgrade and improve the genetic status of a particular species. The use of several biotechnological tools in aquaculture has resulted into higher fish production. The technique of hybridization in several ways to improve fish productivity in selection programs when strains are selected with the knowledge that their hybrids are good. The use of hybridization technique is wider spread and practical all over the world in terms of culture and management of the fish experimental and commercial levels.

The main aim of hybridization is to improve the existing stock and to develop the hybrids having desired traits over the parents with high production potential and disease resistance. All the Indian major carps are the esteemed for their excellent growth and quality of fish flesh and flavor. For obtaining still higher yield from ponds and to produce disease resistant varieties, the production of hybrids with desirable culture qualities including faster growth rates, higher fish flesh yield *etc*. The selection of carp species to be hybridized depend on the purpose *i.e*. production of fertile or sterile hybrids. In recent years, hybrids produced from crossing female of

common carp and male rohu or mrigal, and vice versa have proved to viable but sterile. They can be used for stocking such water where common carp creat problems because of its prolific breeding habit.

Types of hybrids

The fish hybrids may be categorized into two groups, as follows:

1. Interspecies hybrids

Interspecies hybrids are produced by the crossing the same genera of different species. In crossing of *Labeo rohita* and *Labeo calbasu* over 90 % fertilization was obtained. These hybrids were extremely viable, looked more like the male parents and faster growth rates than that of parents. In the *L. bata* X *L. rohita, L. bata* X *L. calbasu* and *L. calbasu* X *L. gonius* crosses, the percentage of hatching was poor and showed no distinct promise. The first produced by cross of *L. rohita* X *L. calbasu* achieve maturity in two to three years and was induced bred, producing F_2 generation possessing a very rang of characters.

2. Intergeneric hybrids

Crossing the fishes belonging to different genera produces intergeneric hybrids. Hybridization amongst the member of the Indian major carps, Chinese carp and Common carps have been attempted to obtain hybrids having superior qualities the parental species for culture than.

(A) Hybrids among the Indian major carps

There have been many hybridization trials among Indian major carps. Intergenetic hybrids were produced between Catla, Rohu, Mrigal, Calbasu, Fimbriatus and Reba. Catla is fastest growing carp with high body girth and excellent flesh quality but proportionately less among of flesh due to large size of the head. It does not readily accept antifical feed and is easily harvested from ponds. It has been found that hybrids by the crosses between catla with other Indian major carps are viable and mature in 1 – 2 years. The most promising amongst them are Rohu – Catla, Catla – Rohu followed by *Catla – Mrigal*, *Catla – Calbasu*, *Calbasu – Catla* and *Catla – Fimbriatus.* The carp hybrids produced Catla – Rohu and Rohu – Catla are very much important in terms of growth. F_1 hybrids are again either artificially propagate to produce F_2 or back cross with parent to establish new characters. Rohu – Catla, hybrids is very promising in terms of growth, food and feeding habits, variability and good flesh contents. Both hybrids are intermediate in various morphometric characters. In both hybrids head is smaller than catla and flesh more than the parents. Unlike catla, the hybrids readily accept artificial feed. Both hybrids are faster in growth compare to parents and fertile in nature.

Hybridization of female catla with male calbasu was attempted since calbasu has a small head and Spindale shape body. It readily accepts artificial feed. Harvesting of this fish is difficult as it easily escape the net by burrowing into the mud. The hybrids Catla – Calbasu shows faster growth than then that of calbasu. The head size is smaller than the catla. The body girth is higher than that of calbasu and the fish flesh is more than both parents.

The first attempt to produce hybrids of male mrigal and female rohu did in 1958. The fertile hybrid between male rohu and female mrigal has a deeper body girth than either of its parents while head is bigger than mrigal but smaller than rohu. These hybrids are intermediate between their parents in certain morphometric characters.

(B) Hybrids between Indian major carps and Chinese carps

Most of the hybrids produced between Indian major carps and Chinese carps do not show any promising results, as they are generally non-viable. Hybrids between rohu and Chinese carps die

before or on first day, the longest survival (for two week) was seen in grass carp hybrids. Catla – Silver carp (*Catla catla* X *Hypophthelmicthys molitrix*) is more viable and could be reared for more than four months. Growth rate of this hybrid is faster than that of catla and in early stage is at par with silver carp. The hybrid has a body girth comparable to catla and size of head and scale nearer to silver carp.

(C) Hybrids between Indian major carp and common carp

Common carp is highly domesticated species and plays an important role in fish production. The work on hybridization of Indian major carp and common carp was done in 1959. Hybrids produced by female common carp and male rohu have been observed to be most viable. Common carp is an omnivorous feeder and a prolific breeder in ponds. Whereas, rohu is fast growing Indian major carps and esteemed for its quality fish flesh, which is, free from off flavor often encountered in common carp raised in ponds. Thus the hybrids produced between these two species would be of considerable interest if it could combine the pond breeding and omnivorous feeding habit of common carp and at the same time retain the valuable qualities of rohu. Thus the production of Indian major carps and common carp hybrids point out a convenient method of obtaining sterile hybrids with a better fish flesh quality than the common carp and omnivorous feeding habits raised in Indian ponds.

Common carp – Rohu (*Cyprinus carpio* X *Labeo rohita*)

Hybrids of female common carp and male rohu were produced in 1984. Hybrids posses various morphometric characters intermediate of both the parents but have a greater resemblance with common carp. Like common carp it is omnivorous, bottom feeder and its growth rate is also comparable with common carp and it is sterile. It contain more flesh than common carps but less than rohu. Its higher flesh contents, bottom feeding habit, infertility and high growth rate as against common carp suggest the possibility of its use in fish culture as a substitute for common carp.

Mrigal – Common carp (*Cirrhinus mrigala* X *Cyprinus carpio*)

Hybrid between female mrigal and male common carp were produced for first time in India at CIFRI Barrakpore, (WB). The hybrids have greater body girth than mrigal and the head small than the common carps, and did not show any sign of maturity even at the end of 14 months of rearing.

(D) Hybrids amongst Chinese carp

Crosses and reciprocal crosses of silver carp and grass carp with common carp were successfully carried out. Common carp x silver carp and common carp x grass carp hybrids survive for 10 months. Hybrids between female grass carp and male Silver carp were observed to consist a mixture of two different types of individual. Some of them are resembled grass carp while other were intermediate to grass carp and silver carp.

Conclusion

Hybrids contribute towards the management and higher fish production of fish in ponds. The crosses between various species or strains are usually considered as selective breeding. Both sterile and fertile hybrids have been produce and this variation has been taken full advantage in fish culture and general fisheries development. The sterile hybrids are very valuable for certain specific purpose in fish culture where fertile may not be a desirable features as regards population control.

Since both fertility as well as induced sterility in hybrids is of vital importance in fish culture, most stress should be given to the study of genetic causes of sterility and reduced fertility in hybrids. Sterile hybrids between major carps and common carps are considered to be the demand of today. They give rise to the more flesh contents at the cost of gonadal development. Secondly, unlike common carp, they being sterile do not disturb the stocking density and ecological conditions of an aquatic ecosystem through natural breeding especially in tropical areas. On the other hand, fertile hybrids are also important and valuable to obtaining new hybridogenic forms with improved qualities in sorting out combining and selecting various desirable characters through successive generation and back crossing etc. Therefore, hybridization can be considered as a tool for the development of inland aquaculture.

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SOIL-LESS CULTURE FOR HORTICULTURAL CROP

Sukanya Misra[1] and Avijit Ghosh[2]
[1]Department of pomology and PHT,
Uttar Banga Krishi viswavidyalaya
[2]Scientist (soil science), ICAR-IGFRI

Under horticultural crop production, soilless cultivation is defined as all methods that enable plant management in soilless culture using nutritional solution as the source of water and minerals, with or without the use of a growth media (e.g. rockwool, peat, perlite, pumice, coconut fibre, etc.). It is divided into the following sections: 1) systems in which plant roots are supported only by liquid medium and no additional media 2) systems in which the plants are supported by a substrate in a solid medium. The hydroponic system is made up of two types of systems: liquid medium and inert substrate. Furthermore, soil-free substrate cultures are divided into two categories: i) open systems (in which the nutrient solution that drains from the roots is not reused) and ii) closed systems (in which the surplus nutrient solution is collected, rectified, and reintroduced) (Winsor and Schwarz, 1990).

Key words : nutrient solution, growing media, root

Historical background

The word “hydroponics” first said by Gericke in 1929.
Nurtient solution first developed by Sachs and Knap in 1929.
Hydroponics was first started in India in 1947 at Kalimpong, Darjeeling.
In India nutrient Film Technique was developed by Sachs and Knap in 1938

Why soilless culture

Plants require nutrients from the soil to grow. It promotes plant development with anchoring, nutrients, air, and water, among other things. However, compared to mineral soils, Soilless media are lighter in weight, more widely available, and more consistent (Yuan et al., 1996). Fertile arable lands are scarce in urban and industrialised areas. As a result, there is need of soil less cultivation. Another thing that must be done on a regular basis is to fumigate the soil, which might create health issues. Climate change has a negative impact on soil health, which has an impact on plant growth and quality.

Techniques of hydroponics

Solution culture and medium culture are the two primary forms of hydroponics.

A. Solution culture

It is also known as Liquid Hydroponics method. The roots of grown plants in solution culture are suspended in a nutritional solution. It's further divided into two categories: I Circulating techniques (closed system)
a) Nutrient film technology b) Deep flow technique
II) Static solution culture/non-circulating technique (open systems)
a) Method of dipping roots
b) Floating technique c) Capillary action technique

Circulating technique: Here nutritional solution is circulated.

Non circulating technique: The nutritional solution is not circulated, but used only once. When its nutrient concentration decreases or pH or Ec changes, it is replaced.

Technique of root inserting (dipping) : Plants are grown in small pots which are filled with a little amount of growth media, and the pots are kept in such a way that the top of the pot (2-3 cm) are submerged in nutritional solution.This method does not need the purchase of expensive goods such as power, a water pump channel, and so on.

Floating technique : In this operation, shallow containers (10 cm deep) can be used. Plants in tiny pots are suspended in a nutritive solution that has been artificially aerated in the container and linked to a Styrofoam sheet or other light plate.

Capillary action technique : Planting pots of varying shapes and sizes are utilised, each with a hole at the bottom. Fill the containers with an inert medium and the seedling will be planted in it. Capillary action transports the nutrient solution to the inert media.

B. Culture with media

The media culture method employs a solid medium for the roots and is named after the inert medium used, such as sand, gravel, or rock wool. Sub-irrigation and top-irrigation are the two basic variants for each medium. It is, nevertheless, classed as follows:

1. Using a hanging bag
2. Using a grow bag
3. The trenching method

Solid growing media:

Perlite: It is the most often utilised media in soilless culture containerized systems. It is made of a mineral of silicone that occurs in volcanoes and are incredibly light.

Coconut Coir: Cocopeat, and Coco-tek are some of the commercial names for coconut coir. It combines vermiculite's water retention with perlite's air retention. It's an all-natural media comprised of shredded coconut husks. The coconut husk serves two objectives for the seed, one is protection from the sun and salt while floating in the water, and another, it is rich in hormone and fungus-free medium to promote germination and roots.

Vermiculite: Potassium and magnesium are both present in vermiculite. It holds water and help in aeration and drainage of soil, but it's not as long-lasting as other media (sand, perlite).

Peat Moss: Peat moss helps to keep growth media wet.

Hydrogel: Hydrogel is used as a growth medium was said by Schzmt and Graham. Plants grown in hydrogel media can withstand any amount of salt.

Nutrient supply to the plants

In hydroponics, because of the system's low nutrient-buffering capacity and ability to make quick adjustments, constant monitoring is required in hydroponics. The optimal time to provide the nutritional solution is between 6 and 8 a.m., however water requirements will change during the day and from one day to the next. To minimise damage and the emergence of illnesses, the solution administered to the roots while avoiding soaking the leaves. Plants should not permit to experience water stress since it will impact their eventual yield. It is normally advised that you water your plants only one time in a week. From 20 to 50% of nutritional solution drained-off for prevention of toxic ion accumulation.(Chapman, 1996 and Jones *et al*., 1991).

Control of contaminant : Wilt, caused by Fusarium and Verticillum, is a common disease in hydroponic solutions. All save the major roots are destroyed by Pythium and Phytophthora species. There are no effective fungicides that may use safely in hydroponics. Metalaxyl has been demonstrated to be extremely effective for Pythium management on vegetable crops, however it is not approved for usage. Heat treatment of nutritional solution has also been shown to be useful

in pathogen removal. Pythium root death in tomatoes was prevented by heating nutrient solution (20-22oC). (Davies, 1980).

Advantages of soilless culture : Growing plants in soil-less culture has several benefits over soil-based culture. Because nutrients are delivered to the roots directly plants develop quicker with fewer roots, plants grown closer together, and soil-less culture requires only 1/5th of the overall space and 1/20th of the total water. There are no soil-borne insect pests, diseases, or weed infestations to worry about. Overall, soil-less culture enables effective nutrient management, higher planting density, and enhanced yield per acre, as well as improved product quality. It is also useful in areas of the world where there is a lack of arable or fertile land for agriculture.

Limitations of soil-less culture

Despite its numerous benefits, soil–free cultivation has certain drawbacks. Commercial application necessitates technical expertise and a significant initial investment, but the return is substantial. Soil-less culturing is only suitable for high-value crops. extreme caution is essential.

CONCLUSION

In a nation like India, where urban concrete conglomerate is expanding by the day, soil-less culture to assist more yield and greater quality of products which secure our country's food security. Government action and research institute interest may help to increase the adoption of this technology.

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SCOPE AND IMPORTANCE OF INDIGENOUS UNDERUTILIZED FRUIT CROPS IN MANIPUR, NORTH EAST INDIA

R.K. Dilip Singh, S. Romen Singh and M. Chanchan

Department of Horticulture, College of Agriculture
Central Agricultural University, Imphal-795 004, Manipur
*Corresponding author: romensenjam@yahoo.com

Abstract

Manipur has diverse underexploited fruit crops which play an important role for the income generation for their livelihood as well as medicine to treat different ailments from time immemorial. However, due to rapid human population and deforestation this important novel fruit crops are losing from its native forests area of Manipur which need conservation and eco-restoration for the future mankind. Further, nutrient profiling of this novel fruit crops need to be explored without further delay so that people will aware about its importance for health care.

Introduction

The state of Manipur commonly known as "Jewel of India" is located at 23.80°-25.68°N latitude and 93.03°-94.78°E longitude of the total geographical area (22,327 km^2) and located in the North-Eastern Hill Region of India. Manipur, North East India is a part of biodiservity hotspot of Himalaya and Indo-Burma in the world which has diverse indigenous fruit crops both in valley and hill regions which remain unexplored till now. It has diverse agro-climatic zones *viz*. sub-tropical hill zone, sub-tropical plain zone, mild tropical hill zone, mild tropical plain zone and sub-temperate hill zone growing different kinds of fruit crops from time immemorial. A lot research on ethnobotony was done since 1980s in Manipur and some findings are available on accounts of its folklore (Moa *et al*., 2009). However, availability of most of these indigenous underexploited fruit crops are now depleting rapidly owing to various factors such as '*Jhum/shifting cultivation*', forest fire, felling of trees for timber and rapid human population. The underutilized fruit crops need to be rescue and improved through research, conservation efforts, technology and marketing network. Underutilized fruit crops conservation is one among the keen interest taken up by the Consultative Group on International Agricultural Research (CGIAR) which is one of leading international organization in this 21st century (Singh *et al*., 2014). Minimum research works has been carried out regarding the potential of indigenous underexploited fruit crops found in Manipur and till now no report on identification of superior germplasm of underutilized fruit crops and promotion of for vast cultivation. Considering in view of this idea the present investigation was initiated to provide the information about the important of indigenous underutilized / underexploited fruit crops which are found in Manipur so that people are aware for it conservation for the features.

Table 1: Fruit crop species adapted in sub-temperate hilly tracts in Manipur

Sl. No.	Scientific name	Plant name	Local name	Family	Economic part	Mature period
1	*Castonopis armata*	Chinkapin	U-thangjing	Fagaceae	Nuts	Dec-Jan
2	*Citrus macroptera*	Hatkora	Heiribob	Rutaceae	Fruit peel	Nov-Dec
3	*Citrus medica*	Citron	Heijang	Rutaceae	Fruit rind	Nov-Dec
4	*Doecynia indica*	Crab apple	Heitup	Rosaceae	Fruit	Nov-Dec
5	*Ficus auriculata*	Elephant ear Fig	Heirit	Moraceae	Fruit	June-July

Sl. No.	Scientific name	Plant name	Local name	Family	Economic part	Mature period
6	*Ficus palmata*	Bedu	Heibam/ Heibala	Moraceae	Fruit and leaves	June-July
7	*Myrica esculenta*	Bayberry	Nonganghei	Myricaceae	Fruit	Aug-Sept
8	*Garcnia penduculata*	Sani	Heibung	Guttiferae	Fruit	March-April
9	*Juglan regia*	Walnut	Heijuga	Juglandicaea	Nut	Aug-Nov
10	*Prunus cerasus*	Sour cherry	Cherry	Rosaceae	Fruit	May-June
11	*Plukenetia volubilis*	Mountain pea nut	-----	Euphorbiaceae	Nut	March-April
12	*Rhus semialata*	Nutgall tree	Heimang	Annacardiaceae	Fruit	Dec-Jan
13	*Pyrus pashia*	Wild pear	Heiyu	Rosaceae	Fruit and use as rootstock	Nov-Dec

Table 2: Fruit crop species adapted to sub-tropical hill and plain zones of Manipur

Sl. No.	Scientific name	Plant name	Local name	Family	Economic part	Mature period
1	*Aegle marmelos*	Bael	Heirikhagok	Rutaceae	Fruit, leaves	Jan-Feb
2	*Artocarpus heterophyllus*	Jackfruit	Theibong	Moraceae	Fruit	May-June
2	*Artocarpus lakoocha*	Monkey Jack	Harikokthong	Moraceae	Fruit	July-Sept
3	*Averrhoea carambola*	Carambola	Heinoujom	Oxalidaceae	Fruit	Sept-Oct
4	*Dillinea indica*	Elephant apple	Heigri	Dilliniaceae	Fruit	Oct-Dec
5	*Elaegnus umbellata*	Silver fruit	Heiyai	Eleaegnaceae	Fruit	March-April
6	*Emblica officinalis*	Aonla	Heikru	Euphorbiaceae	Fruit	Nov-Dec
7	*Rubus ellipticus*	Raspberry	Heijampet	Rosaceae	Fruit	Dec-Jan
8	*Olea ferruginea*	Indian olive	Chorphon	Oleaceae	Fruit	Jan-Mar

Table 3: Fruit crop species adapted to mild-tropical plain and hill zones of Manipur

Sl. No.	Scientific name	Plant name	Local name	Family	Economic part	Mature period
1	*Baccaura sapida*	Burmese grape	Motokhei	Euphorbiaceae	Fruit	Aug-Sept
2	*Antidesma bunius*	Chinese laurel	Heiyen	Phyllanthaceae	Fruit	June-July
3	*Flacourtia jangomas*	Indian plum	Heitroi	Flacourtiaceae	Fruit	Dec-Jan
4	*Tetrastigma bracteolatum*	Indian chestnut vine	Monjamhei	Vitaceae	Fruit	Dec-Jan
5	*Spondias pinnata*	Indian hog plum	Heining	Annacardiaceae	Fruit	Mar-April

Sl. No.	Scientific name	Plant name	Local name	Family	Economic part	Mature period
6	*Meyna laxiflora*	Moyna	Heibi	Rubiaceae	Fruit and leaves	Nov-Dec
7	*Sygygium jumbos*	Roseapple	Shileima	Myrtaceae	Fruit	May-July
8	*Syzygium cumini*	Java plum	Jam/Jamun	Myrtaceae	Fruit and seed	May-July
9	*Phyllanthus acidulus*	Star gooseberry	Kihori	Euphorbiaceae	Fruit	Jan-Feb

Table 4: Mode of propagation and nature of growing of the indigenous fruit crops in Manipur

Sl. No.	Crops name	Mode of propagation	Wild/Cultivated
1	Chinkapin	Seed	Wild
2	Hatkora	Seed	Wild/ Home stead garden
3	Citron	Seed	Wild/Home stead garden
4	Crab apple	Seed	Wild
5	Elephant ear Fig	Seed	Wild
6	Bedu	Seed	Wild
7	Bayberry	Seed	Wild
8	Sani	Seed	Wild/Home stead garden
9	Walnut	Seed	Wild
10	Sour cherry	Seed	Wild
11	Mountain pea nut	Seed	Wild
12	Nutgall tree	Seed	Wild
13	Wild pear	Seed/cutting	Wild
14	Bael	Seed	Wild/Homestead garden
15	Jackfruit	Seed	Wild/Homestead garden
16	Monkey Jack	Seed	Wild
17	Carambola	Seed/air layering	Wild/Homestead garden
18	Elephant apple	Seed	Wild/Homestead garden
19	Silver fruit	Seed	Wild/Homestead garden
20	Aonla	Seed	Wild/Homestead garden
21	Raspberry	Seed/Cutting	Wild
22	Indian olive	Seed	Wild/Homestead garden
23	Burmese grape	Seed	Wild/Homestead garden
24	Chinese laurel	Seed	Wild/Homestead garden
25	Indian plum	Seed	Wild
26	Indian chestnut vine	Seed	Wild/Homestead garden
27	Indian hog plum	Seed	Wild/Homestead garden
28	Moyna	Seed	Wild/Homestead garden
29	Rose apple	Seed	Wild/Homestead garden
30	Java plum	Seed	Wild/Homestead garden
31	Star gooseberry	Seed	Wild/Homestead garden

Endangered plant of indigenous fruit crops in Manipur

Among the indigenous fruit crops of Manipur, citrus species *viz*. *Citrus macroptera* (heiribob) and *Citrus medica* (heiyang) are among the endangered plants which need conservation and eco-restoration as well *in situ* conservation are needed. Besides, all this novel fruit crops need conservation since due to rapid deforestation their native place of its growing sites are decreasing day by day which need coordinated efforts among different agencies such as Government, NGOs and research institutional for strengthening the biodiversity conservation system together for the future.

Constraints for cultivation of indigenous fruit crop cultivation in Manipur

1. Lack of quality planting materials
2. Lack of standardization of vegetative propagation methods
3. There is lacking of scientific way of cultivation and agro-techniques
4. Lack of knowledge about the different process products from it
5. Rapid expansion of human population and deforestation in its growing site
6. Poor shelf life under ambient room temperature
7. Poor network for marketing facilities from remote areas to the main market

Importance of indigenous fruit crops in Manipur

1. Provide income generation since there is good demand in the market
2. Good source of nutrients (antioxidant, vitamin and minerals)
3. Value addition and processed products can be prepared
4. Soil erosion can be control by conserving indigenous underutilized fruit crops since they are abundant in the hilly tract of Manipur
5. They are source of medicinal value for the treatments of diseases in remote places like starfruit / carambola for curing jaundice etc.

Future prospects of indigenous fruit crops in Manipur

1. Scope for the expansion of indigenous underutilized fruit crops due to increase in demand of this medicinally importance fruit crops
2. Underutilized fruits are rich source of vitamins and minerals which will be helpful for minimizing malnutrition among the poor people
3. Conservation of indigenous fruit crops will be helpful for eco-restoration of forest in the hills
4. As population increases there will be increase in the demand of this novel fruit crops in the future

Conclusion

The rural people of Manipur are using these plants as traditional medicine as well as income generation for their livelihood. At present scenario, there is lacking of encouraging timely scientific intervention to ensure the ecological aspect of biodiversity conservation thereby increasing the scope for conservation of gene bank for such medicinally important plants which are threaten to be extinct mainly due to rapid population and deforestation. Thus, if this hidden wealth of novel indigenous underutilized fruit species is explored without further delay for eco-restoration by conserving its local indigenous fruit crops, the state like Manipur which is a part of hot spot of biodiversity for maintaining diverse indigenous underutilized fruit crops having medicinal value and rich in nutritive values.

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PEST MANAGEMENT BY AGRONOMIC METHODS

Pratiksha J. Karpe* & Niranjan R. Chavan
MSc. Agri. (Agronomy), College of Agriculture,
Latur Vasantrao Naik Marathwada Krishi Vidyapeeth,
Parbhani
*Corresponding author
Email id: karpepratiksha66@gmail.com

Cultural practices are mostly carried out to provide congenial environment for crop for its growth, development and yield. Now-a-days, the environment is changing and this can alter the population of insect and fungi. Insect, pest and diseases which are soil borne as well as viral diseases can be managed effectively through cultural practices.

Practices adopted for managing the influence of insect and pest population in the cropped field are

1. Changing sowing date in order to create unfavourable environment for the insect and pest.
2. Removal of collateral and alternate host.
3. Increasing population of natural enemy by the introduction of crops otherwise volunteer plants.
4. Exposure of population of pupae to unfavourable conditions of environment.
5. Concentration of pest on alternative host.
6. Creation of harsh conditions by irrigation to insect.
7. Creation of physical barriers by border cropping for the entry of insect pest.

Pest occurrence affected by climate

Survival of pest population, their migration, growth rate, death rate, reproductive rate is affected by climate. Temperature is important weather factor that has severe effort on the activity and occurrence of pest. Population of insect pest is reduced by very less temperature of 0°C in winter and very high temperature of 40°C in summer. As soon as, the weather becomes congenial, the insect pest migrates and their activity is affected by temperature, wind and rainfall. Multiplication of insect pest depends on temperature and availability of food. Emergence of pest is affected mainly by temperature and rainfall.

Tillage

Exposure of different insect's pupae is done by tillage especially preparatory tillage. The exposed pupae are eaten by birds and thus decreasing the population of insect pest. The pupae of insect pest die when they are exposed to sun. The infected bolls incorporated by ploughing reduces the population of pink boll worm. After harvesting of rice, ploughing reduces the yellow stem borer of rice.

Time of sowing

By changing the time of sowing, the crop escapes the incidence of pest. Sowing earlier or late than normal can be done. Early or late sowing affects crop yield but reduces insect pest incidence. Incidence of Red pumpkin beetle of cucurbits can be reduced by early sowing. Fruit borer incidence of chickpea can be reduced by early damage.

Seed treatment

Population of soil borne insect decreases by the treatment of seeds with insecticides. This also helps in proper plant stand. Treating seeds of groundnut with chloropyriphos at the rate 6 ml/kg of seeds helps in reducing white grub population.

Intercropping

Leaf minor in groundnut is controlled by intercropping of groundnut pearl millet which enhances parasitiod population. Intercrops such as coriander, cowpea, black gram, green gram, soybean in cotton helps in decreasing boll worm damage.

Trap crop

Trap crops helps to attract otherwise trap insect and pests. Example of trap crops are marigold in cotton, sunflower in groundnut, castor in groundnut. Marigold in tomato helps to decreases damage of fruit borer.

Border crop

Growing of 2-4 rows of another crop along the border of the main crop is the border crop. It acts as a barrier for incidence of pests. Growing of pearl millet, sorghum or maize as border crop reduces population of thrips on groundnut.

Water management

Early morning irrigations buries larval population of caterpillar of tobacco. Alternating the height of water in rice field damages the egg of Brown plant hopper. High humidity created by frequent irritation reduces the population of thrips.

Nutrient management

Manures and fertilizers applied to the field affects the nutrient content of soil and plants and enhance growth of crop which in turn has influence on the palatability to insect and pest. Application of phosphorus and potassium decreases the incidence of white fly. Application of lime and sulphur decreases incidence of root borer of sugarcane.

Removal of alternate hosts

Insect pest survive on alternate host. Removal of alternate decreases build up of pest.

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FISHERIES BY-CATCH: PROBLEMS AND SOLUTIONS

Mudassir Azhar[1], Hafsa Maqbool [2] and Adnan Amin[3]

[1]Department of Fisheries Science,
Doon P G College of Agriculture and Allied Sciences
Uttarakhand-248007, India

[2]Senior Research Fellow, Division of Aquatic Animal Health Management
Faculty of Fisheries, SKUAST-K, Rangil Ganderbal-190006.
[3]Division of Aquatic Environmental Management,
Faculty of Fisheries, SKUAST-K, Rangil Ganderbal-190006.

Abstract

Bycatch from fishing is a major hazard to marine megafauna species all over the world. Bycatch of long-lived marine megafauna has both direct and indirect biological consequences, lowering megafauna populations and altering ocean trophic dynamics. Simultaneously, significant progress has been made in the improvement of mitigating methods. These accomplishments are noteworthy, yet there are still some critical information gaps and the requirement for innovation.

Introduction

Unintentional capture of non-targeted species, known as bycatch, is widely recognised as a significant hazard to marine life. Air-breathing megafauna, such as marine mammals, turtles, and seabirds, are particularly vulnerable to bycatch, and have been documented as bycatch in more than 90 nations. The bulk of these bycatch incidents have been an outcome of static entangling nets and longline fishing**.**

Many fishing gear are non-selective, snagging animals that aren't supposed to be caught. Bycatch is the term for this non-target excess catch. Some of the species caught as a result of bycatch have commercial worth, and fishermen bring them back to shore to sell them. However, a considerable percentage is rejected and thrown back over the side of the boat. Bycatch kills hundreds of thousands of sea turtles, seabirds, and marine mammals like whales, dolphins, and porpoises.Thousands of oceanic birds were killed when they became entangled in nets or hooked on longlines while diving for bait.

Bycatch –problems

Non-target animals like dolphins, marine turtles, and seabirds are captured during the fishing operation and are known as bycatch. Thousands of kilometres of nets and lines are spread every day over the oceans. Modern fishing gear is highly effective at catching the desired fish species—as well as anything else in its path. It is often invisible to the naked eye and extremely strong. Turtles, dolphins, and juvenile fish are among the marine species hauled up with the catch and then thrown overboard.

Approximately 20% of species of sharks are on the verge of extinction, owing largely to unintentional capture in longlines. According to the FAO, 7.3 (mt) million tonnes of fish are thrown away each year. Each year, fishing kills approximately 250000 loggerhead and leatherback marine turtles, as well as 1 billion sharks, three lakhs of small whales, and dolphins. The fishing industry's leaders are becoming increasingly aware of the need to reverse this trend. There are tried and true solutions, such as modifying fishing nets to catch fewer non-target species or letting them to flee. These adjustments are frequently simple and affordable, and they are frequently made by fishermen themselves.

Bycatch is still a major concern, despite contemporary technologies and industry awareness of the issue. Not only can it result in preventable fatalities and injuries, but the fishing methods used can also be damaging to the marine habitats. By collaborating with fisheries and helping to develop and promote innovative technologies and gear for more effective operations, WWF hopes to decrease bycatch.

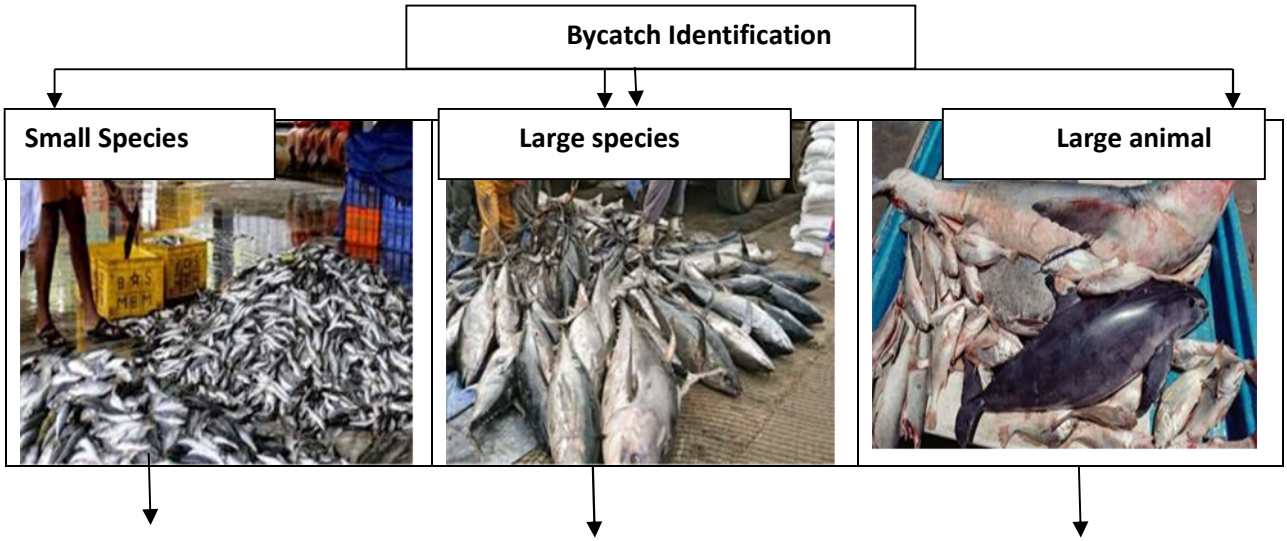
- Bycatch occurs as a result of modern fishing being highly efficient, frequently covering enormous areas of water, and often being highly unselective, catching not only the target species but also a wide range of other marine organisms.
- In certain nations, poor fisheries management exacerbates the problem.
- Ignores net mesh size restrictions, quotas, and legal fishing zones.
- Most fishing gear is non-selective, which means it can capture any species, including some that aren't meant to be caught.
- Longlines, trawling, and the use of gillnets are the most common fishing methods that result in bycatch.
- Longlining is a commercial fishing technique used to catch swordfish, tuna, and halibut that involves suspending hundreds or thousands of baited hooks along a single fishing line.
- The hooks (commonly called “J hooks”) cause problems for marine turtles when swallowed, usually resulting in death.
- Sharks, non-target billfish, and immature tunas are also frequently caught..
- Trawling involves vessels dragging giant nets through the seabed, collecting practically anything in their path, including coral reefs and marine turtles at shallow depths. Bycatch happens when nets capture anything larger than the mesh, such as young fish, sharks, seabirds, marine turtles, and cetaceans (whales, dolphins, porpoises).

Bycatch control and Solutions

- Species-selective gear: use and development
- Control and monitoring of fishing nets
- Increasing gear selectivity through technical conservation techniques..
- Closed or protected areas are utilized to protect juvenile and spawning fish.
- Management and marketing techniques for the fishing industry
- State’s laws for prohibiting discards & over grading.
- Devices should be used to reduce bycatch.
- Using mesh sizes that are large enough to allow some small animals to escape
- Use of TEDs and BRDs.

Bycatch reduction strategies that have been proven to work exist, and new ones are being developed. The World Wide Fund for Nature (WWF) and its partners are trying to develop, test, and adopt alternative fishing gear, as well as to incorporate conservation knowledge into successful fisheries management. In addition, the WWF and its allies are striving to enhance bycatch legislation and raise consumer awareness of sustainably caught fish.
"Circle" hooks are being introduced by WWF in collaboration with partners. When swallowed by turtles, these hooks are significantly less likely to cause suffocation or internal bleeding than J-shaped hooks. Working with the Inter-American Tropical Tuna Commission (IATTC) and other partners, WWF implemented the hook in eastern Pacific longline fisheries. As a result, the number of marine turtles killed could decrease by up to 90% while swordfish and tuna catches remain unaffected.

The first step in decreasing bycatch is to determine which types of bycatch should be avoided.



Square Mesh codend	Fish eye	Turtle Excluder device (TED)
Square Mesh Window	Fish Box	
Juvenile and Trash Excluder Device	Radial Escape Section (RES)	

Bycatch Reduction Devices: Usually refers to technologies that are expressly designed to reduce fish bycatch and other small animals and detritus capture.

Square - Mesh cod end: A shrimp trawl with a square-mesh codend is meant to keep small fish out. Traditional diamond-mesh codend mesh holes collapse as it fills with capture, preventing little fish from escaping. The mesh apertures of square mesh codend, on the other hand, keep their shape as the mesh fills with catch and are available for fish to escape.

Square- Mesh Window: A square-mesh window is a netting panel with square mesh netting that is located in the top panel of the codend or trawl body. Fish swim through the square escape apertures as they pass through the trawl, orienting themselves in a direction towards the device.

Juvenile and Trash Excluder Device : This device is used to keep small fish out of the trawl, mainly juveniles or garbage fish, so that large fish can be caught.

Fish eye: A fisheye is an oval steel or aluminium frame attached to the codend through which fish can swim to safety. Fisheyes are typically placed near the top or sides of the codend to allow strong swimming fish to escape while shrimp enter the codend passively.

Fish Box: The purpose of a fish box is to change the flow of water in the codend. It's a box-like device attached to the top or bottom of the codend with an aperture for fish to swim through and escape.

TED: Any trawl alteration that reduces turtle capture is known as a turtle excluder device. Because they can prevent the capture of other large species including as sharks, stingrays, jellyfish, and some large fish, these devices are frequently referred to as trawl efficiency devices.

Conclusion

To reduce bycatch and discarding, the bulk of research suggested combining mitigation strategies such as gear modifications and fleet communications. Furthermore, collaborative programmes that bring together the knowledge of fishermen, scientists, and management have been shown to be more effective in reducing bycatch.

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MAJOR INSECTS' PEST OF GUAVA AND THEIR MANAGEMENT

Akkabathula Nithish

Assistant professor (Department of entomology)
SKLTSHU, Telangana state
Correspondence authors mail- nitishakkabattula@gmail.com

1. Fruit fly

The fruit flies are the maximum damaging insects in the production of guava mainly in rainy periods. Adult flies puncture the fully ripen fruits for oviposition and insert their eggs inside them. Emerging maggots feed the pulp from inside and are responsible for bad smell. The fruits colour at the punctured site changes oozing semi liquid mass.

Management

- Pupation of the flies takes place inside the soil, so deep regular summer ploughing helps in exposing the hibernating pupae to the sun and other natural enemies.
- Destroy the infested fallen fruits with maggots.
- Place methyl eugenol traps to monitor and kill adult flies for effective control. Methyl eugenol and malathion insecticide are mixed at 1:1 ratio and randomly keep all over the orchard at 25 traps or hanging 10 traps at a height of 5-6 feet taking per hectare 10 ml mixture per trap earlier to the fruit ripening.
- Spray thiamethoxam at 1 ml per liter of water in severe infestation.

2. Bark eating caterpillar

Old trees are more likely attacked by caterpillars. They bore into the trunk or at the junction between the branches. They remain in the tunnel during day time comes out during time and feeds the bark. The presence of irregular channels and spots covered with silken web containing excreta and chewed up wood from tree parts are the key symptoms of the pest.

Management:

- Age old orchards should be kept neat and healthy by periodic examine for dried young branches to prevent the pest infestation and also remove severely affected shoots from the tree.
- Cultivation of Mango, zizyphus, litchi, orange, pomegranate, bauhinia, loquat, mulberry, moringa, rose and eugenia should be discouraged close to guava orchards as they acts as the most preferred hosts of this pest.
- Kill the caterpillars mechanically by removing loose bark and inserting the iron spike in shelter holes made by the larvae.
- Apply coal tar and kerosene at 1:2 ratios at the lower portion of the tree trunk to a height of 3 feet.
- Place carbofuran 3G granules at 4 gm per hole and plug the bored hole with the mud.
- Insert cotton swab soaked in 0.05% chlorpyriphos or monocrotophos and plug the holes with mud or apply copper oxychloride solution on the tree trunk in severe infestation.

3. Fruit borer

Larvae bore into fresh matured fruits before ripening and feed the pulp internally which eventually make the fruit hollow. The infested fruits are commonly malformed at the point of entry of larvae. Affected fruits drop off in rotten condition. Such fruits are attacked by bacteria and fungi also, which eventually give an offensive odor.

Management:

- Avoid cultivation of pomegranate orchards close to guava orchards.
- Infested fruits are collect and then destroy to halt the spread of pest.
- Install light traps @ 2 per hectare and the activity of adults can be monitored.
- Spray chlorpyrifos + cypermethrin @ 1 ml/l of water for two times depending on severity of attack.

4. Spiraling whitefly

Both adults and nymphs pierce and suck the sap from the leaves. Such leaves become yellow and drop off. Sooty moulds (fungi) developed on the honeydew secreted by whiteflies. The mould weakens the plant growth by hindering sunlight for photosynthesis. Infestation is less during cool and rainy days and increases in warm and dry days.

Management

- Remove weeds like *Abutilon, Acalypha, Euphorbia,* etc., in the nearby vicinity of the guava orchards and destroy them, as these plants acts as alternate hosts.
- Install sticky yellow traps at 15 per hectare which attracts and kill the adults.
- Release predators like *Chrysoperla carnea, Encarsia, Chilocorus nigrita,* and *Chilomenus sexmaculatus* at 10,000 per hectare.
- Controlling the pest with insecticides with spraying the insecticides once is very difficult as nymphs remain under the waxy covering. Spray imidacloprid 2 ml/l or acephate 1.5 g/l and repeat the spray at 10 days interval based on the incidence.

5. Mealy bug

Both adults and nymphs pierce and suck the sap usually from twigs, leaves and flowers of young plants resulting crinkling with yellow leaves, wilting of terminal shoots, blighted appearance of buds and prematurely dropping of fruits. Affected fruits may have irregular shapes, low quality, and are prone to secondary attack by pathogens.

Management

- Tree trunks should be tied with alkathene banding.
- Avoid the cultivation of guava orchards in the vicinity of mango orchards.
- Overlapping branches should be pruned and swab with methyl parathion @ 1 ml /l to minimize the pest population.
- Release *Cryptolaemous montrouzieri* beetles @ 10 per tree or 2500 – 3750 per hectare.
- In the early incidence of pest spray the orchards with neem oil at 5 ml/1 or profenophos 2ml/l or buprofezin 2ml/l if the pest is still persist.

Official Address :
Peshok Tea Estate
P.O.- Peshok, Dist.- Darjeeling
West Bengal, India
PIN-734312

Contact No : +91 7501389678
email : agriindiatoday@gmail.com