ISSN (E): 2582-6344

Times of Agriculture

An explode in Agriculture

A monthly e-magazine

October, 2021
Issue-18

FOOD SCENARIO IN INDIA

PRODUCTION AND CONSUMPTION

Times of Agriculture

A Resonance in Agriculture

ISSN : 2582-6344

A Monthly e-Magazine

Times of Agriculture

A Resonance in Agriculture

ISSN : 2582-6344

A Monthly e-Magazine

EDITORIAL BOARD

Management Team

Manager

Organizer | Treasurer

Mr. Nishakant Maurya

Content Editor

Writing | Editing

Mr. Devesh Tiwari
Mr. Vipin Kumar Maurya

Founder

Technical | Design

Mr. Aman Kumar

Times of Agriculture

A Resonance in Agriculture

ISSN : 2582-6344

A Monthly e-Magazine

REVIEWERS

Agronomy

Mr. Ravikesh Kumar Pal, BAU, Sabaur

Mr. Pradeep Rajput, SVPUAT, Meerut

Vegetable Science

Dr. Gaurav Singh, ANDUAT, Ayodhya
Mr. Sharvan Kumar, ANDUAT, Ayodhya
Mr. Mahendra Kr Yadav, CSAUAT, Kanpur

Fruit Science

Dr. Shashibala, U.P. College, Varanasi
Mr. Anshuman Singh, ANDUAT, Ayodhya
Mr. Ravi Pratap Singh, ANDUAT, Ayodhya

Floriculture

Ms. Ragini Maurya, BHU, Varanasi

Ms. Sachi Gupta, ANDUAT, Ayodhya

Soil Science

Dr. Bharat Lal, RLBCAU, Jhansi
Mr. Kumar Anshuman, ANDUAT, Ayodhya
Mr. Sandeep Kr. Diwakar, ANDUAT, Ayodhya

Genetics & Plant Plant Breeding

Mr. Ashish Sheera, SKUAST, Jammu
Mr. Pratik Kumar, JNKV, Jabalpur
Mr. I. Gopinath, IARI, New Delhi

Plant Pathology

Dr. Ravi Prakash Mishra, CGC, Mohali
Mr. S.S. Patel, BHU, Varanasi
Mr. K. Vignesh, Annamalai University, T.N.

Biotechnology

Dr. Ashutosh Singh, RLBCAU, Jhansi

Mr. Vishwajeet Yadav, SVPUAT, Meerut

Extension Education

Dr. Jagatpal, COER, Roorkee
Dr. Alok Sharma, JRU, Ranchi
Mr. Kevin Christopher, BAU, Sabaur
Mr. Anand Kumar Pathak, DeHaat
Ms. Pragati Shukla, RPCAU, Pusa

Entomology

Mr. Ankur Prakash Verma, SVPUAT, Meerut

Mr. Anuj Shakya, CSAUAT, Kanpur

Remote Sensing

Mr. Shivam Pandey, RSAC, Lucknow

Home Science

Ms. Garima Dwived, SHUATS, Prayagraj

CONTENT

Cover Story

Food scenario in India: Production and consumption

Agriculture Updates

Scientists developed a solution to convert keraitin waste in food and fertilizer

Indian scientists have developed a new sustainable and affordable solution for **converting keratin waste** such as human hair, wool, and poultry feathers to fertilizers, pet, and animal feeds.

Professor A. B. Pandit, Vice-Chancellor, Institute of Chemical Technology Mumbai, along with his students, has developed these technology to convert the **keratin waste to food for pets and fertilizers for plants** with the support from the '**Waste Management Technology'** programme of the Department of Science & Technology, Govt. of India. The key technology behind this involves pre-treatment followed by **hydrolysis of keratin** using a technique called **Hydrodynamic Cavitation**, which involves vaporization, bubble generation, and bubble implosion in a flowing liquid.

Manipur, Hathei chilli and Tamenglong mandarin orange got GI tag

Two famous products of **Manipur**, **Hathei chilli**, which is found in Manipur's **Ukrul** district and is known for its unique flavour, and **Tamenglong mandarin orange** have been granted the Geographical Indication (GI) tag.

The Hathei chilli works as a good anti-oxidant and possesses high calcium and Vitamin C levels. It has an extremely high American Spice Trade Association (ASTA) colour value of 164. The extractable colour of chilli is usually expressed using **ASTA values**.
The Tamenglong mandarin orange is bigger in size, weighing **232.76 grams** on average. It is a unique sweet and sour flavour.

Kanyakumari clove got GI tag

The unique clove growing in the hills of **Kanyakumari** district in Tamil Nadu has been awarded a geographical indication (GI) as **'Kanyakumari clove'**. The Kanniyakumari clove that accounts for nearly **65% of the country's** production got the GI tag thanks to the efforts of the **Maramalai Planters** and **Blackrock Hill Planters** Associations since 2019. Law firm M/S Puthran Associates helped the planter bodies in the GI application process.

Brimato: dual grafting of brinjal and tomato

ICAR-Indian Institute of Vegetable Research, Varanasi, Uttar Pradesh develop a double grafted vegetable **Brimato,** after a successful field demonstration of grafted **Pomato (Potato + Tomato),** the dual grafting of **brinjal and tomato (Brimato**) was demonstrated in the field during 2020-21. In brimato brinjal hybrid - **Kashi Sandesh** and improved cultivar of tomato - **Kashi Aman** were successfully grafted onto **brinjal rootstock - IC 111056.**

The grafting operation was carried out when brinjal seedlings were 25 to 30 days old and tomato 22 to 25 days old.

The brinjal rootstock - IC 111056 has a tendency to develop two branches in around 5% seedlings. The grafting was done by **side / splice method,** wherein, 5 to 7 mm slanting cuts **(45° angle)** were made both in the rootstock and scion.

World Egg Day

Since 1996 **World Egg Day** has been celebrated every year on the **second friday in October**. In 2021 on **8 October** countries throughout the world will join together in many different celebrations of the egg. It was founded by the **International Egg Commission (IEC)** at a **conference held in Vienna in 1996**. The idea behind the day was raising awareness across the world, of the important place eggs have in human nutrition.

The IEC was formed in 1964 in order to give a global presence to egg producers and to promote and popularize egg consumption as part of a balanced diet.

IARI developed country's first-ever non-GM rice

the Indian Agricultural Research Institute (IARI) has developed the **country's first-ever non-GM** (genetically modified) **herbicide-tolerant rice varieties** (**Pusa Basmati 1979** and **Pusa Basmati 1985**) that can be directly seeded and significantly save water and labour compared to conventional transplanting.

The varieties Pusa Basmati 1979 and Pusa Basmati 1985 contain a **mutated acetolactate synthase (ALS)** gene making it possible for farmers to spray **Imazethapyr,** a broad-spectrum herbicide, to control weeds.

National Mission on Edible Oils – Oil Palm (NMEO-OP)

The Union Cabinet has given its approval to launch a new to be **Mission on Oil palm** known as the **National Mission on Edible Oils – Oil Palm (NMEO-OP)** as a new Centrally Sponsored Scheme with a special focus on the **North east region** and the **Andaman and Nicobar Islands.** It is proposed to cover an additional area of 6.5 lakh hectare (ha.) for oil palm till the year 2025-26 and thereby reaching the target of 10 lakh hectares ultimately.

The Union Agriculture Minister asserted that the Government's decision for making major intervention in North Eastern states for oil palm promotionwill turnNE states into oil palm hub of the country.

Union Agriculture Minister distribute mustard seed mini kit

Under a special program by the Union Ministry of Agriculture and Farmers Welfare, distributed **8,20,600 seed mini-kits** which will be free of cost in **343 identified districts** of **15 major** producing states of the country.

Union Agriculture Minister, Shri Narendra Singh Tomar launched the programme by distributing **mustard seed mini kit** worth about Rs. 2 crore in **Morena** and **Sheopur districts** of **Madhya Pradesh**. The program has been started under the National Food Security Mission (NFSM) - Oil Seed and Oil Palm Scheme.

Union Agriculture Minister launched ‘Amul Honey’

Union Agriculture Minister launched **'Amul Honey-** a product of Gujarat **Cooperative Milk Marketing Federation Ltd. (GCMMF)’** under active cooperation with **'National Bee Board** (NBB)'.

The Minister said that Prime Minister Shri Narendra Modi had expressed his desire for a sweet revolution on the soil of Gujarat, by launching **Amul Honey**, India has started the journey towards fulfilling the dream of the Prime Minister.

FOOD SCENARIO IN INDIA

PRODUCTION AND CONSUMPTION

India is the world's largest producer of **milk, pulses and jute**, and ranks as the second largest producer of rice, wheat, sugarcane, groundnut, vegetables, fruit and cotton. It is also one of the leading producers of spices, fish, poultry, livestock and plantation crops. India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world. As per the Third Advance Estimates, the estimated production of major crops during 2020-21 is as under:

Foodgrains – 308.65 million tonnes.

Rice – 122.27million tonnes

Wheat – 109.52million tonnes

Coarse Cereals – 51.15million tonnes

Oilseeds - 361.91million tonnes

Pulses – 25.72 million tonnes.

AREA AND PRODUCTION

Area under agriculture in India is **127.59 mha** and contribute 64% of total world food production. Average yield of food grains is **2325kg/ha** and if we talk about production status in states then UP contribute maximum in production of food grains and Punjab stood 2nd in production. Total Horticulture production is estimated to be 329.86 Million Tonne (Highest Ever). Which is an increase of about 9.39 Million Tonne (2.93%) over 2019-20. Increase in production is registered over previous year in all categories *viz.* Fruits, Vegetables, Aromatics & Medicinal Plants, Spices and Plantation Crops except Flowers. Fruits production is estimated to be 102.76 Million Tonne compared to 102.08 Million, Tonne in 2019-20, a marginal increase of 0.68 Million Tonne, contributed mainly by Banana, Jackfruit, and Mango. The production of Vegetables is estimated to be 196.27 Million Tonne in 2020-21 compared to 188.28 Million Tonne in 2019-20, an increase of 4.24% contributed mainly by Potato, Onion, Brinjal and Cabbage. Onion production is estimated to be 26.92 Million Tonne as against 26.09 Million Tonne in 2019-20. Potato production is reported to be 53.69 Million Tonne against production of 48.56 Million Tonne in 2019-20, an increase of 5.13 Million Tonne (10.55% higher).

TOTAL CONSUMPTION OF FOOD GRAINS

If we talk about consumption trends in India:

The per capita consumption of cereals was higher in rural areas as compared to urban areas during the period studied. The per capita cereal consumption showed a declining trend during 1972-94 in both rural and urban areas. The decline was more pronounced in rural area (12.19%) than in the urban area (5.43%) during this period. It was further found that consumption of rice increased by 6.54 per cent in rural area and by 6.66 per cent in urban area in 1993-94 over 1972-73. In case of wheat consumption in rural areas, there was an increase by 13.39 per cent in 1993-94 over 1972-73 level. The food grains production has increased at the rate of 2.68 per cent per annum during 1960-1999 which was mainly because of productivity growth (2.44%).

EXPORT AND IMPORT OF AGRICULTURAL COMMODITIES IN INDIA

India has a diversed economy and is a major contributor to the global food basket, thanks. As per WTO's Trade Statistics, the share of India's agricultural exports and imports in the world agriculture trade in 2017 was 2.27% and 1.90%, respectively. India is among the world's leading producers of many commodities such as dairy, cereals, spices, fruits & vegetables, rice, wheat, cotton, and others. Apart from fulfilling domestic demand, Indian agricultural produce that includes horticultural produce, and processed foods are exported to more than 100 countries in the world including the US, countries in the Middle East, and the EU.

Amidst the COVID-19 pandemic, the smooth functioning of the agriculture sector was ensured by issuing relevant guidelines. There was a considerable improvement in the food grain production and the COVID-19 induced movement restrictions worldwide did not affect India's agri-exports as they did with other commodities and it's contribution in GDP had also increased. With respect to agri-imports, India majorly imports vegetable oils, fresh fruits, pulses, and spices. Data pertaining to agriculture exports and imports for this story has been collated from the monitoring dashboard of the department of commerce. India's agriculture exports increased by 7 times and imports by 8 times, in last 15 years.

India has consistently maintained a trade surplus in agricultural commodities over the years. India's agri-exports increased from Rs. 38,078 crores in 2004-05 to Rs. 2.7 lakh crores in 2018-19. However, in 2019-20, there was a decline in export by around 8%. Between April 2020 and February 2021 of 2020-21, India's agri-exports have already crossed the 2019-20 levels, indicating growth in agri-exports for 2020-21 in line with the earlier trends.

Likewise, the import of agricultural products has also increased over the years. In 2004-05, agri-imports were worth Rs.18,924 crores which incresed up to Rs. 1.68 lakh crores in 2016-17, recording a growth of almost 8 times. However, since 2016-17, the value of imports dropped to reach Rs. 1.42 lakh crores in 2018-19. In 2019-20, India's agri-imports were worth Rs.1.51 lakh crores and in 2020-21, up to 28 February 2021, the imports were worth Rs.1.44 lakh crores.

Comparison of exports of agriculture and allied commodities by value during the first 11 months of 2019-20 and 2020-21 shows that the exports during April 2020 and February 2021 were Rs. 2.69 lakh crore as compared to Rs. 2.27 lakh crore during the same period in 2019-20, indicating an increase of 18.4%.

HUNGER REPORT OF OUR COUNTRY

Meanwhile, the imports had also increased by 2.38%, from that Rs. 1.4 lakh crores to almost Rs. 1.44 lakh crores during the same period in 2019-20 and 2020-21 respectively.

And if we seen our self sufficiency in food grains then there will always be problem if Hunger in our country.

India State Hunger Index (ISHI) is a tool which we used to calculate hunger and malnutrition at the regional level in India. It is constructed in the same way as the Global Hunger Index (GHI) 2008 and was first time calculated for 17 states, covering more than 95 percent of the population in our country.

The ISHI was developed by the International Food Policy Research Institute (IFPRI) and presented for the first time 2008 in conjunction with the non-governmental organization Welthungerhilfe and the Department of Economics, University of California.

According to report of ISHI, India has shown improvement in recent years.

In 2008, India's ISHI score was 23.30 and level was alarming at that time.

REASON BEHIND FOOD SCARCITY

The challenges behind food scarcity in India are :

a) Non - uniform rainfall among states
b) Less land holding per capita (1.04ha)
c) Unfavourable climate changes
d) Less access to remote areas
e) poverty (large percentage of marginal farmers)
f) Inadequate distribution of food through public distribution mechanisms (PDS i.e. Public Distribution System).
g) Lack of coherent food and nutrition policies along with the absence of intersectoral coordination between various ministries.
h) A number of programmes with improving nutrition as their main component are planned in the country but these are not properly implemented.

✓ **And many other reasons are responsible for malnutrition and food scarcity in India.**

✓ **Although government had many programs to decrease food scarcity and ensure food security, but solely these are not enough to combat food problems of our country.**

Measures to overcome food scarcity

We should became responsible and perform our duties.

Nutrition Programmes:

ICDS: The Integrated Child Development Services (ICDS), launched in 1975, aims at the holistic development of children up to six years of age with a special focus on children upto two years, besides expectant and nursing mothers. This is done through a package of six services: health check-ups, immunization, referral services, supplementary feeding, non-formal pre-school education, and advice on health and nutrition effective implementation.

Mid-day Meal Scheme: The mid-day meal scheme (MDMS) has been revised and universalized at the primary level from 1 September 2004.The 11th Five Year Plan has given the following action points for improving the performance of MDMS:

1. **MDM to be managed by the local community and PRIs/NGOs, and not contractor-driven: civic quality and safety to be prime considerations.**
2. **Sensitize teachers and others involved in nutrition, hygiene, cleanliness, and safety norms to rectify observed deficiencies.**
3. **Involve nutrition experts in planning low cost nutrition menu and for periodic testing of samples of prepared food.**

NREGA : By now it is well recognized that rural works programmes (RWPs) have become important instruments in the strategies for alleviating poverty and hunger in many developing countries. Enacting the National Employment Guarantee Act is one of the key electoral promises of the ruling coalition at the Centre under the Common Minimum Programme (CMP). The Bill was passed by the Parliament in August 2005 and became the National Rural Employment Guarantee Act, 2005 (NREGA).

National food security mission: NFSM launched in *Rabi*, 2007

To enhance the production of rice, wheat and pulses by 10mt, 8mt and 2mt respectively by the end of 11th plan. It was called Accelerated pulses production programme (A3P).

Others plans like-

- ✓ **Rashtriya krishi Vikas Yojana (RKVY)**
- ✓ **Integrated scheme of oilseeds, pulses , oilpalm and maize (ISOPOM)**
- ✓ **National horticulture mission 2010(NHM)**

About Author

Preeti Sharma
M.Sc. Entomology
C.C.S. Haryana Agricultural University
Hisar, Haryana

RED RICE – ITS HEALTH BENEFITS

Rishita Kapoor
M.Sc. (Ag)

Department of Genetics and Plant Breeding
CSKHPKV Palampur (H.P.)

"Red rice is high in zinc, iron and vitamin B_{12}, which all aid in the development of RBC in human body, which is a crucial factor in skin health. Rice's antioxidants may aid in the battle against free radicals, which help to keep our skin looking young."

Red rice is a type of rice with a high anthocyanin concentration, which gives it a red hue. This rice is frequently consumed partially hulled or unhulled due to the presence of anthocyanin, and it has a red husk rather than the brown husk that is more frequent. It contains the most nutrients of all rices taken with the germ intact when compared to polished rice. The red husk, which is packed with natural goodness, is what makes this rice variety a healthy choice.

Red rice is high in zinc, iron and vitamin B_{12}, which all aid in the development of RBC in human body, which is a crucial factor in skin health. Rice's antioxidants may aid in the battle against free radicals, which help to keep our skin looking young.

When red rice is cooked, the natural red colorization in the rice's bran (or hull) leaches out and turns the remainder of the meal pink. Because of the bran, red rice provides a lot of fiber, and its flavour is much stronger than hulled rice, tasting nutty and rich. As a result, red rice is currently regarded as an extremely nutritious whole grain.

Red rice- A Quick Overview

"Red rice" could also refer to a wild rice type with a low grain production, which has led to it being regarded as a weed by many rice farmers in indigenous Asia. Since, it has ability to cross-breed, resulting in weaker rice plants, this type of red rice has become a real nuisance in rice estates. Attempts to genetically modify this rice variety to make it more advantageous have been made on numerous occasions. Red yeast rice, a specific product made in China and Japan, is also known as **"red rice"**. Rice grains are hulled and polished before being inoculated with a mould that produces a crusty scarlet coating. You can eat this rice in the same way as conventional rice, but it is also used in Traditional Chinese Medicine to cure a number

of diseases. Red rice is grown throughout Europe, Southeast Asia, and the American South, and a few corporations have created their own cultivars by crossing different kinds.

Crimson rice is a type of rice that has a red bran layer. There are thousands of variants of rice around the world. Rice bran comes in a variety of colours, from light to black. The crimson bran layer, which contains Iron, Zinc, Potassium, Sodium, Manganese, and other minerals, contains 95 percent of the minerals and dietary fiber found in whole rice. Carbohydrates and proteins predominate in the inner white part.

Health benefits of Red Rice

Red rice *is widely recommended for heart patients and diabetics due to its higher nutritional content and health benefits. It is also favoured by health experts and fitness enthusiasts due to its high fiber content, which aids in weight loss. We can receive the following nutrition and health benefits by eating red rice.*

Nutritional value of Red Rice:
Serving Size: 100 g

Proximity	Amount
Energy	405 Kcal (1695 KJ)
Protein	7.0 g
Total Fat (Lipid)	4.9 g
Carbohydrate	86.7 g
Total dietary Fiber	2.7 g
Water	1.6 g
Ash	3.4 g

Minerals	Amount
Iron, Fe	5.5 mg.
Zinc, Zn	3.3 mg.
Potassium, K	256 mg.
Sodium, Na	6 mg.

Fiber rich

Red rice is a complete grain that contributes to our daily fiber intake. Red rice has roughly 2 grams of fiber per quarter cup, which accounts for 8% of daily fiber needs. Adults should consume 14 grams of fiber every 1,000 calories of calories consumed.

Fiber is well-known for its ability to prevent and relieve constipation while also improving digestive function. Red rice, on the other hand, is high in fibre and low in carbohydrates. It also gives the body the energy it needs to function normally, slows digestion, and helps with weight loss.

Iron Rich

Iron deficiency or anaemia sufferers will benefit from this. Men require at least 8 mg of iron per day, while women require 18 mg. 2% of the daily iron requirements can be meet with just a 1/4 cup plate of red rice.

Iron is necessary for the body to function properly. The body requires oxygen to move through it; otherwise, we may feel exhausted throughout the day. Iron also aids in the prevention of infection.

Aids in diabetic management

Insulin regulation is aided by red rice. Sugar regulation is aided by the low glycemic index and is beneficial to diabetes individuals. There are a few more natural compounds that aid to maintain a healthy sugar level. Diabetics with

uncontrolled blood glucose levels risk damaging their eyes, kidneys, and coronary heart. A type of red yeast rice– Hon-Qi was given to both diabetic and non-diabetic rats in an animal study conducted at the National Pingtung University of Science and Technology's Department of Food Science. This was an attempt to come up with a novel way to cope with diabetes. The results claim that oral Hon-Qi treatment can lower blood glucose in diabetic rats with insufficient insulin.

Asthma can also be prevented

The finest part about red rice is that it aids in the regulation of lung functions. This rice increases oxygen circulation in the body and helps to avoid asthma because of its high magnesium content.

Increases oxygen consumption

Daily consumption of red rice, which is rich in iron, can aid in oxygen absorption and circulation to all of the tissues and cells of the body. In addition, increased oxygen levels in the body might enhance your mood and make you feel more energized.

Beneficial to the digestive system

Red rice is high in fiber and can aid in a variety of digestive functions. Red rice is high in soluble and insoluble fibers, which help to eliminate toxins from the body and aid bowel movements. It also acts as a natural laxative.

Helps to prevent heart disease

Because red rice contains whole grains, it can help lower harmful cholesterol levels in the body. Red rice bran can aid in cholesterol reduction and heart disease prevention. Additionally, we can include Noni, Flaxseeds, and Anjeer in our daily diet if we wish to include natural nutrients that lower cholesterol levels.

Reduces tiredness

Red rice is a great weight-loss alternative and It is a healthier alternative to other rice varieties due to its high fibre content. Red rice bran keeps us fuller for longer.

Free radicals are counteracted by antioxidants

Zink, iron, and manganese are all abundant in red rice. These nutrients can aid wound healing and keep the body's defence mechanisms in good working order. They're also high in anti-oxidants, which protect the body from free radicals that can harm tissues and cells. The skin benefits greatly from antioxidants. Red rice consumption may assist to prevent the the skin from developing fine lines and wrinkles. Red rice may also aid to make the skin firmer and tighter, as well as reduce the damage caused by UV radiation, which can lead to wrinkles.

Contains Vitamin B_6

One dish of red rice provides 23 percent of the vitamin B_6 needed for the organ's proper functioning. This vitamin is necessary for serotonin equilibrium, red blood cell formation, and DNA cell formation.

High Cholesterol can be reduced

Red rice's effect in lowering total cholesterol levels in the blood was first observed in human research in 1970. Monacolin K is the active substance in red rice. It is similar to the cholesterol-lowering medication Mevacor, which contains lovastatin. According to EMedtv, any red yeast rice supplement containing a significant amount of lovastatin is an unapproved medicine, not a dietary

supplement, because lovastatin is a prescription drug. If you are suffering from a liver illness, are pregnant, or are under the age of 18, avoid red rice. Gas, heartburn, and dizziness are some of the side effects.

Helps in Heart Disease Prevention

Plaque build-up in the walls of the arteries is caused by high levels of low-density lipoprotein (LDL) in the blood. This narrows the arteries and has the potential to obstruct the coronary artery, resulting in a heart attack. LDL cholesterol reduction lowers the risk of heart disease. David Becker and Ram Gordon, cardiologists at Chestnut Hill Hospital, conducted a research in 2009. According to the research, patients who received red yeast rice had lower LDL cholesterol levels than those who received a placebo.

Heart health improves when LDL (bad cholesterol) levels are kept under control. It becomes increasingly unlikely that you may have cardiovascular problems. This is excellent news because heart disease can be devastating.

Obesity risk is reduced

Red rice can help you feel satiated for longer period by reducing the desire to eat. Red rice is fat-free, high in energy, and aids with digestion. Obesity is more likely when you consume a lot of fat. It has been proven that those who consume red rice on a daily basis have a lower risk of becoming obese.

It aids in the treatment of asthma

Eating red rice on a daily basis helps to maintain a normal breathing rhythm because it is high in magnesium. This is one of the finest reasons to consume red rice.

Red rice is beneficial for your bones

Red rice is high in magnesium, which is beneficial to bone health. Magnesium is an essential vitamin for bone health, and a lack of it can lead to osteoporosis and decreased bone density as times goes on. Red rice intake on a daily basis has been demonstrated that it can help prevent and alleviate joint problems.

Conclusion:

The health benefits listed above are only a few of the many that one can expect from red rice consumption. What you consume on a daily basis has a significant impact on the health. As a result, you'll want to make this a good consequence. These benefits of red rice should persuade you that switching is, in fact, the preferable option. Now is the time to start putting red rice on your shopping list and mainstay in the household.

****

NUTRITIONAL VALUE OF FRUITS: A WAY OF HEALTHY LIFE OF HUMAN

Shiv Kumar Ahirwar
Ph.D. Research Scholar,
Department of Horticulture
(Fruit Science)
JNKVV, Jabalpur
Dwarka
Ph.D. Research Scholar
Department of Entomology
JNKVV, Jabalpur
Babali
Ph.D. Research Scholar
Deptt. of Plant Pathology
RVSKVV, Gwalior

Malnutrition is one of most problem of human being which affect the happy life and today we about to talk nutritional value of fruits. Nutraceuticals is that substance is which provide medicinal or health benefits as well as prevention and treatment of disease and these nutraceuticals are present in the form of antioxidant and phytochemical in fruit plant and are act as natural pigments which are abundantly present in the plants and acting as disease preventing and curative agent. Some Phytochemical like Flavanols, Flavonoids, Isoflavones, and antioxidant such as Beta-Carotene, Lycopene, Gluthine etc, are present in different colour group of fruit and these chemical compound functions as fighting against heart disease and cancer, and also act as an anti-inflammatory agent. Fruits are a good source of fiber, minerals, vitamins and antioxidants which maintained the proper health and develop resistance to disease to human. Nutraceutical's role in disease preventing and human nutrition, it has a great demand in future because, human body are less responsive to chemical and pharmaceutical and drugs.

Introduction

Fruits are very nutritive to human diet being rich in vitamins and minerals and nutrients consist of carbohydrates, proteins, fats, vitamins and minerals also they come under the category of "protective foods". The fruits having sufficient water, carbohydrates, fats, proteins, fiber, minerals, organic acids, pigments, vitamins and antioxidants, among others which are more important to human body growth, development and to gaining resistance power against different diseases and disorders. Fruits are contained pectin, cellulose which stimulate intestinal activities and energy giving substances like oil, fats and proteins. They are relatively low in calories and fat (avocado and olives being the exceptions), they have no cholesterol, they are rich in carbohydrates and fiber, they contain vitamin C and carotene, and some are a good source of vitamin B6. Fruits are play an important role in control of human diseases like obesity, cancer, diabetes, heart disease, hypertension, anemia, scurvy, peptic ulcers, diarrhea and many fruits confirm to the saying "An apple a day keeps doctor away".

Daily Requirement of Nutrients:

About 23 nutrients are required for a balanced nutrition, include carbohydrates, proteins, fats, vitamins and minerals. The Indian council of medical research (ICMR) has recommended a balanced diet to contain 120 gm fruits and 300 gm of vegetables. The recommended daily allowances (RDA) nutrients for an Indian man and woman, doing moderate work, as prescribed by (ICMR) New Delhi are given in Table 1.-

Nutrients	Requirement to Man	Requirement to Woman
Energy (kcal)	2875	2225
Proteins (g)	60	50

Fat (g)	20	20
Calcium (mg)	400	400
Iron (mg)	28	30
Vitamin A (IU)	2400	2400
Vitamin B_1 (mg)	1.4	1.1
Vitamin B_2 (mg)	1.6	1.3
Niacin (mg)	18	14
Pyridoxine (mg)	2.0	2.0
Folic acid (ug)	100	100
Vitamin B_{12} (ug)	1.0	1.0
Vitamin C (mg)	40	40

Note- * weighing 60kg, doing moderate work. (Source: Gopalan et. al. 2004)
** weighing 50kg, doing moderate work.

Nutritional values of fruit crops:

1. **Source of vitamin-**

- **Vitamin A (carotene)**- Deficiency cause cessation of growth, night blindness, drying of tear glands, roughness of skin in children, formation of stones in kidney and bladder. It Is Found in Mango, Papaya, Jackfruits, Dates, Banana, etc.
- **Vitamin B_1 (Thiamin)** – This ia essential for the maintenance of good appetite, normal digestion, growth, fertility, lactation and normal functions of nervous tissue. Deficiency causes beriberi disease, loss of appetite, loss in weight fall in body temperature, sore throat, etc. It is found in Cashew Nut, Almond, Banana, Bael, Litchi, Papaya and Pomegranate.
- **Vitamin B_2 (Riboflavin)**- Vitamin B_2 enhancees growth and health of the skin and for respirations of cornea and present in the retinal pigments of the eyes. Deficiency cause pellagra, swollen nose, and baldness, loss of appetite, loss in weight, sore throat, etc. The fruits like Bael, Custard apple, Jackfruits and Wood apple are rich source of vitamin B_2.
- **Vitamin B_3 (Pantothenic acid)** - Important in digestion, skin formation and normal growth and developments of body. Deficiency causes dermatitis, ulcer and general weakness of the body.
- **Vitamin B_6 (Pyridoxin):** Important for the formation of hemoglobin in blood and also helps in the digestion of protein food. Deficiency cause anemia, weakness of nerve and loss of reproductive ability.
- **Niacin (Nicotinic acid)**: Deficiency of it causes roughness of skin, pellagra and abnormality in the tongue and cellular respirations. The fruits like Bael, Custard apple, Wood apple and Jackfruit are rich source of this vitamin.
- **Vitamin C (Ascorbic acid**): It is essential for growth, formation of bones and teeth, resistance to diseases and act as reducing agent making possible absorption of dietary iron. Deficiency causes scurvy disease, delay in wound-healing, enlargement of heart and damage to heart muscles. Present in Aonla, Guava, Citrus, Ber, Strawberry, Pineapple etc. are rich source of this vitamin.

2. **Source of minerals:**

- **Calcium:** It develops the bone and tooth formations. Deficiency causes rickets, osteomalicia, pigeon chest, retarded growth. Present in Date, Ber, Anola, Beal, Tamarind, Karonda, Phalsa and Wood apple etc. are rich source of calcium.
- **Iron:** It is essential part of red blood cells and plays key role in respiration. Deficiency causes anemia in children and pregnant woman. Fruits like Sapota, Anola, Custard Apple, Karonda, Phalsa, and Tamarind are rich source of iron.
- **Phosphorus:** It works as cell multiplication of bones and soft tissues and helps in the liberations of energy on oxidation of carbohydrates. Fruits like Wood Apple, Jackfruits, Ber and Tamarind are rich source of phosphorus.
- **Magnesium (Mg):** Magnesium is important in protein synthesis, release of energy from muscle storage and body temperature regulation and for proper heart function and plays a role in bone formation.
- **Sodium (Na**): Sodium is important in electrolyte balance and essential in Co-regulating ATP with potassium and important role in the regulation of blood pressure.

3. **Source of energy:**

- **Proteins:** These are body building foods essential for growth. Proteins represent less than 1% of the fresh mass of fruit tissues. The protein content of fresh fruits is calculated by multiplying the total nitrogen content by a factor of 6.25. Apples as non-protein nitrogen fractions. Pears and oranges are rich in proline, and black and red currants in alanine. Deficiency of proteins causes retarded growth, physical and

mental fatigue, delayed healing og wounds and complications during pregnancy. Fruits like Wood Apple, Custard Apple, Chironji, Jackfruits and Bael have high protein content.

- **Carbohydrates**: Carbohydrates are broadly classified as soluble and insoluble carbohydrates and provides energy so that a person can carry out his work satisfactorily. Most of the fruits are high in sugars mostly dextrose and levulose and other sugars also Sugars are important calorie yielding foods being easily digested and yield energy quickly, e.g., Mango, Potato, Sweet potato.
- **Fiber:** The main components included as fiber are cellulose, hemicelluloses, pectin, lignin, resistant starch and non-digestible oligosaccharides. The fibrous portions of fruits are found to exert beneficial effects by increasing the intestinal peristalsis and consequent relief from constipation, weight control, prevention of colon and rectal cancers, control of diabetes. The fiber content of most of the fruit's ranges from 0.5 to 3.4%. Fruits like Guava, Sapota and Aonla contain relatively more fiber than others.
- **Fats or Lipids**: Fat or lipids is a concentrated source of energy for plants during germination, forming components of cellular membranes and cuticular waxes, and they are mainly present as triglycerides or phospholipids. Some fats are known as essential fatty acids because of their importance in cell structure and functioning. The fats content of fruits is usually low (0.1-0.5%). Lipids form a natural coating on the fruits and protect them from insects, parasites and adverse environmental conditions. Examples of fat content on a dry mass basis are: 1. Avocado: 35–70%; 2. Olive: 30–70%; 3. Grape: 0.2%; 4. Banana: 0.1%; and 5. Apple: 0.06%.

4. **Moisture** Fruits having higher (70-80%) moisture content and maximum water content varies between individual fruits because of structural differences. Cultivation conditions that influence structural differentiation may also have a marked affect Pulpy fruits contain relatively less moisture and more nutrients than the juicy fruits.
5. **Source of Anti-nutritional compounds:**

- **Phenolic compounds:** Phenolic compounds form complexes with proteins, enzymes and minerals and reduces their bioavailability. The levels of these Phenolic compounds in most of the fruits is less than 1.0 per cent. However, certain varieties of Aonla contain as high as 4.5 % Phenolic compounds (tannies). The peel of Ber contains 3-4 % polyphenols. Fruits like Grape berries (380 mg /100gm fruit) and Jamun (410 mg/100 g of fruit) contain significant number of polyphenols.
- **Organic acids**: For proper digestion of foods organic acid play an important role. They also help for increasing appetite. The most abundant acids in fruits are citric acid, malic acid and oxalic acids. However, large amounts of tartaric acid occur in grapes. Malic acid is the major component in oranges and apples. The acid content of fruits generally decreases during maturation. Benzoic acid occurs in cranberries, quinic acid in bananas. Some fruits such as Aonla (210 mg/100g) Phalsa (200mh/100g) and Jamun (89 mg/100g) contain significant amount of oxalic acid. The rich source citric and malic acids Are Ber, Sapota, Aonla and Jamun, etc.
- **Phytate Phosphorus:** In some fruits such as jackfruit, phalsa and pomegranate about 30-40 per cent of the total phosphorus is present in the form of phytic acid.

6. **Source of phytochemicals:** Phytochemical are naturally occurring, biologically active chemical compound in plant and act as a natural defense system for host plant and provide color, aroma and flavor. Phytochemical are also use as protective and disease preventing particularly for some forms of heart disease. Most important roles of these chemical with respect to human being is somewhat similar in that they function as oxidant that react with free oxygen molecule.

Conclusion:

There are many benefits to consuming fruits daily and we know from the healthy plate example, that fruits will not supply us with everything our body needs but it does make up a good portion of it. Hopefully this article provided you with plenty of information that will encourage not just to eat more fruits to living a healthy lifestyle and eating a healthy diet that includes all food groups. So we should take at least a fruit in a day to boost the energy to making healthy India.

*****

POTATO (*Solanum tuberosum* L.): COMMERCIAL UTILIZATION OF PROCESSED PRODUCTS

Vikash Singh*
Research Scholar
A.N.D.U.A.T, Ayodhya, U.P.

Ashutosh Upadhyay
Research Scholar
Deptt. of Vegetable Science
CSAUAT, Kanpur U.P.

Pranjal Singh
Research Scholar
Deptt. of Vegetable Science
CSAUAT, Kanpur U.P.

Potato (*Solanum tuberosum* L.), is one of the major food crops grown in a wide variety of soils and climatic conditions. It is the most important dicotyledonous crop which is good source of human food. It ranks as the fourth major food crop of the world, exceeded only by wheat, rice, and maize. Per unit area dry matter production of potatoes exceeds that of wheat, barley, and maize. Because of increasing yield per unit area of land, total potato production is also increasing in both developed and developing countries by good cultural practices and improved varieties. In addition, the rate of production of potato in developing countries has increased significantly more than the developed countries. Per capita availability of potato production is highest in Europe, where a large share of total production is used as fodder to feed livestock. The Western European countries like United States and Japan have the highest potato yields in the world. During the past few decades, the proportion of potato crop that is processed for domestic consumption has increased considerably both in developing as well as developed countries.

Why are potatoes so important?

According to UN projections, the world population is increasing at alarming rate which will reach the 8 billion mark by 2050. The UN expects that more than 95% of this increase will occur more in developing countries, where the pressures on earth, water, and other natural resources are already in intense condition. The potato produces more food on a very less land area and faster than any other major food crop, as a resultant we can say that potato crops are an excellent alternative for farmers who need to feed the fast-growing populations with limited land areas of crop land. Growing one hectare of potatoes could yield a crop with a great food value which is more than four hectares of grain production. Potatoes also yield twice the protein per hectare as compared to wheat. Potatoes are a rich source of protein, calcium, vitamin C and have an especially good amino acid balance in their tubers. A single medium-sized potato tuber contains about half of the daily requirement for vitamin C of an adult; other major staples crop such as rice and wheat have none. Boiled potato tuber has more protein than maize, and nearly twice the amount of calcium. Potatoes are valuable source of human nutrition in many developing countries. It contributes carbohydrates, vitamins and minerals in the diet of millions. The researchers are focusing on increasing the proportion of protein and vitamin content in the developing potato varieties, using biotechnology to boost the micronutrient level in the tubers. The farmers of tropics region harvest potato crops within 50 days of planting - one third of the time it takes in colder regions. In upland areas of southern Asia, the potato is emerging as an off-season crop; planted in rotation with maize, it fetches relatively high prices in the market. Similarly, across other areas of the world importance of potato as a winter cash crop is rising

continuously. The presence of high nutrient content and its ability to adapt to marginal environments, relative ease of cultivation practices, low cost and high productivity are attributes that make potatoes one of the principal and most important sources of food and income for underprivileged citizens of developing countries around the world.

Commercial utilization of potato

During the past few decades, the proportion of potato crop production which is processed for domestic consumption and use, has increased considerably. Processed potatoes were used for the following products: chips (crisps), 42%; frozen French fries, 36%; dehydrated products, 4%; miscellaneous uses, 4%; canned new potatoes 2%.

Potato Chips

The globally increasing young population with disposable incomes and changed lifestyles are promoting consumption of potato chips more and more. These chips are eaten as appetizers, side dish or as snacks. Innovations or new products offering are considered as good opportunity for these markets. The introduction of alternatives which are healthier, like the low-fat and low-sodium chips. There are several factors which influence the yield and quality of chips prepared from potatoes. The major problem associated with the chips industry is the maintenance of the desired color of the product. Chips color is the result of the browning reaction between sugars and other constituents such as amino acids. Potatoes stored at 20°C for 3 weeks yielded darker chips than those held at room temperature due to the conversion of starch to sugars by phosphorylase enzymes.

French fries

French fries are very important products of potato-processing industries worldwide. A huge proportion of french fries are served in restaurants and institutions. French fries are prepared for serving after finishing the fry in deep fat. For potato chips, the extent of reducing sugar should be low to avoid dark fried pieces. French fries are prepared from good-quality potatoes. The process of making french fries includes several operations like washing and peeling, trimming, sorting and cutting, blanching, frying, defatting, cooling, freezing, and packaging.

Potato Granules

Potato granules, one of the important products prepared from dehydrated mashed potatoes, contain 67% moisture. They are reconstituted to a special texture which is either dry and mealy or moist and creamy, according to individual choice. Many reviews outline the procedure for production of granules from potatoes. There are several processes have been developed for the production of potato granules, but the add-back process is the one which is commercially employed in the United States. During this process the cooked potatoes are partially dried by adding back previously dried granules for giving a moist mix, which, after holding could be adequately granulated to a fine powder.

Potato Flour

Potato flour is commonly used by the baking industry, it is prepared by dehydrating the peeled, cooked potatoes on a single drum drier which should be equipped with applicator rolls. The thin, dried sheet

of potato solids is then ground to the desired fineness. The single drum drier is one of the most efficiently used means for dehydrating the potatoes. It is done by spreading the mash into a fine sheet, extremely fast evaporation of water can be achieved. The potato flours are available in two forms: granular and fine flours.

Diced potatoes

The diced potatoes made from whole potatoes by slicing which is followed by blanching and dehydration. One of the most important problems which is associated with the preparation of diced potatoes is graying or darkening. It is so simple to make cubed or diced potatoes, the potatoes are cut into bite sizes then parboiled and tossed in some olive oil and garlic, rosemary or other herbs of choice and oven roasted until they become crispy, golden on the outside and fluffy on the inside. It is vegetarian, vegan and gluten-free.

Conclusion

According to FAO potatoes are consumed by more than one billion people around the world. It is consumed in a variety of ways like aloo parathas, chips, flour, starch, soup or gravy thickeners, granules and pan cakes as a processed food. The Indian vegetable basket is not complete without potato. Potato is high in dry matter, edible energy and edible content; all these characteristics prove it nutritionally superior vegetable as well as staple food. As a resultant we can say that potato is most important commercial crop of India.

******

MEDICINAL IMPORTANCE OF MUSHROOM

Suresh Kumar*
Ph.D. Research Scholar

Deptt. of Plant Pathology, Rajasthan College of Agriculture, MPUAT, Udaipur

Mushrooms have long been considered to have medicinal value. The early herbalists were more interested in the medicinal properties of mushrooms than in their basic value as a source of food. Humankind has constantly searched for new substances that can improve biological functions and thereby make people fitter and healthier. Over half of the world's population, rely on plant-based medicines and dietary supplements for their primary health care. These, products have variously been called vitamins, dietary supplements, phytochemicals, nutraceuticals, and nutriceuticals.

Nutraceuticals, are foods that provide medical or health benefits, including the prevention and treatment of disease. A mushroom nutriceutical is a refined and partially defined extract, from either the mycelium or the fruiting body of a mushroom, which is consumed in the form of capsules or tablets as a dietary supplement (not in the form of a food) and which has potential therapeutic application. The demand for medicinal mushrooms and derived products has increased by between 20 to 40% annually depending on the species. The use of mushroom extracts in nutriceutical products and sports drinks constitutes the main area of expansion.

Medicinal Mushrooms

Of the 14,000 to 15,000 species of mushrooms in the world, around 700 have known for medicinal properties. Many bioactive substances with immune modulating effects have been isolated recently from mushrooms. These include polysaccharides, high-molecular-weight polysaccharides, low-molecular-weight protein-bound polysaccharides, glycoproteins (lectins), triterpenoids, and fungal immune modulatory proteins. The commonly known medicinal mushrooms are *G. lucidum, L. edodes, Coriolus versicolor, Auricularia auricula, Cordyceps sinensis and Tremella fuciformis etc.*

Effects of Medicinal Mushrooms

Hematological effects

Lectins are proteins or glycoproteins with specific binding sites for sugars. They are not antibodies or enzymes but have a specific affinity toward glycosylated materials, and they have become useful reagents of cell structures. Some lectins have been shown to have antitumor and immune modulatory activities.

The interaction between the fungal lectin and the surface glycoproteins of red blood cells is an example of the hematological activities of edible mushrooms. Volvatoxin is a lectin isolated from *Volvariella volvacea* and has been shown to reduce hemolytic activity toward red blood cells. Pleurotolysin is a lectin from *Pleurotus ostreatus* and is a hemolytic agent for mammalian red blood cells.

Antiviral effects

The aqueous extract of the shitake mushroom (*Lentinula edodes*) fruiting body as well as the spores, contained antiviral activity against influenza virus infection. Anti-HIV activity, was reported from an extract of the of *L. edodes* mycelia. Lentinan, a polysaccharide isolated from the fruiting body of this mushroom, has no ability to block HIV infection. PSK from *Coriolus versicolor*, possess antiviral activities against ectromelia virus infections. Anti-

HIV activities were reported in a water-soluble extract of *Ganoderma lucidum.*

Antitumor effects

In water-soluble polysaccharide fraction from a fruiting body, of *L. edodes* could inhibit the growth of Sarcoma 180 in mice. A new antitumor polysaccharide, KS-2, which was excreted from the cultured mycelia of *L. edodes.* The main sources for antitumor polysaccharides are from mushroom cell walls that consist of chitin and cellulose.

Antioxidant activity

The ability of mushroom-derived preparations (MDPs) to prevent oxidative damage to cellular DNA has been reported and MDPs were obtained from fruiting bodies of mushrooms. These showed wide variation in their ability to protect against oxidative DNA damage. The highest protection by an MDP obtained by cold water extraction of *Agaricusbisporus*fruiting bodies (Ab-cold).The next highest protection obtained by hot water (100°C) extract of *Ganoderma lucidum* (GI-hot).

Cardiovascular and renal effects

Lentinula edodes was reported to reduce the serum cholesterol level in human. An antiplatelet substance was isolated from the aqueous extract of *Auricularia polytricha*. This antiplatelet sub-stance could inhibit platelet aggregation. This substance was later identified to be adenosine, and was suggested to be responsible for the low incidence of arteriosclerosis, who consumed *A. polytricha*regularly. An aqueous extract from *Pleurotussajor-caju* was associated with a hypotensive action that could reduce the glomerular filtration rate (GFR) in rats.

The aqueous extract of *V. volvacea* has been reported to produce a hypotensive effect in rats. Feeding powdered maitake (*Grifola frondosa*) mushrooms to spontaneous hypertensive rats resulted in a lowering of the blood pressure. It has also been reported that when the dried powder of two other edible mushrooms, *A. auricula* and *Tremella fuciformis*, was fed to the rats, they effectively lowered the serum cholesterol levels. The mushroom did not affect the concentration of serum high-density lipoprotein (HDL) "good" cholesterol, and the reduction of serum total cholesterol by the mushroom diets is attributable to the fall in the LDL "bad" cholesterol.

Medicinal Components of Mushrooms and their properties

Mushroom	Component	Properties
Ganoderma lucidum	Polysaccharides, Triterpenes, LZ-8 Protein, Ganoderic acid, Beta glucan	Immunomodulatory, anticancerous, Anti tumour, anti-HIV, cardioactive. anti-platelet, anti-autoimmune diabetes, Anti-hypersensitivity,
Lentinula edodes	Eritadenine, Lentinan, Guanosine, monophosphate	Reduces cholesterol, Anti-virus, Anti-tumor, reduces blood coagulation
Cordyceps sinensis	Cordycepin	Cure lung infections, hypoglycemic activity, anti-depressant activity
Agaricusbisporus	Lectins	Enhances insulin secretion
Pleurotus sp.	Lovastatin	Reduces cholesterol

VEGETABLE GRAFTING: A NOVEL TECHNIQUE TO ENHANCE YIELD AND QUALITY IN VEGETABLE CROPS

Dr. Pankaj Kumar Ray

Subject Matter Specialist (Horticulture)
Krishi Vigyan Kendra,
Agwanpur, Saharsa, Bihar

India is the second largest producer of vegetables next to China and the production and productivity also surpasses that of fruit crops. The recommended per capita consumption of vegetables is 300 g against the availability of 230 g currently. The rapid increase in population accompanied with shrinkage in agricultural land has caused a tremendous shortage of vegetables. However, the production and quality is also seriously affected by biotic and abiotic stresses along with changing climate. In addition to this a large migration of population to urban areas has always demanded for regular and good quality vegetables. Hence, constant research are undertaken to overcome the drawbacks and produce good quality vegetables in limited land with available resources. Certain novel techniques thus developed helps in attaining this goal. One such technique is Vegetable grafting which is quite a simple technique to develop resistant and superior quality vegetables.

Vegetable grafting is a scientific method of propagation involving the union of scion of desirable quality with the rootstock of desirable tolerance level. The history of vegetable grafting dates back to early 20th century which was initiated and popularised in Japan and Korea. Grafting was initially done in cucurbits to impart resistance to soil borne diseases and eventually was adopted in other crops like tomato, brinjal etc. Japan, Korea and China have emerged as the leading producer of grafted seedlings (FAO 2012) by adopting mechanised systems to rapidly produce the grafted seedlings. This novel technique on witnessing great success became widespread in the Western continents too. In India, grafting work was started in IIHR Bangalore by Dr. R.M. Bhatt and his associates. IIHR Bangalore also organized first ever short course on "vegetable grafting" during year 2013. Now, constant and progressive research and field trials have been conducted by both private and public sectors. An increase in yield upto 80% in Solanaceae and upto 60-90 % in cucurbits has been witnessed with the deployment of vegetable grafting. To attain success in vegetable grafting a potential rootstock that is compatible and appropriate to impart tolerance should be selected which is most often varietal/ species specific.

Need for Vegetable Grafting in Present Scenario

Though the ultimate goal is enhanced yield, it is often accompanied with imparting resistance to pest and diseases (soil borne), to decrease the level of toxicity, to impart resistance to cold, heat, drought etc., improving quality, improve scion vigour, effective use of applied inputs to the soil through deployment of efficient rootstock and to manipulate the harvest period. However, it has emerged as a successful technique to withstand nematode infestation which is otherwise not easily controlled.

How to Produce a Grafted Vegetable?

- Selection of scions and rootstocks with desired quality.
- Preparation of seedling.

- Grafting the scion over rootstock using specific type of grafting for a particular species.
- Placing in healing chamber for the faster union of scion and rootstock through vascular connection between them and to reduce water loss from scion.
- Acclimatization (hardening) to the outdoor environment.
- Eventual transplantation in the field or greenhouse.

Common Methods of Grafting

- **Hole Insertion Grafting**: It is widely adopted in cucurbits, usually when scion and rootstock have hollow hypocotyls. First a hole is made in the rootstock and an appropriate size scion is inserted into the hole and clipped together. A temperature of 21-36 °C and RH 95% should be maintained for obtaining higher success rate.
- **Tongue Approach/ Approach Grafting:** This method gives high rate of success and hence is widely adopted by farmers and nurserymen; uniformity of grafted seedlings makes it highly desirable. Equal size root stock & scion should be selected and scion and rootstock should be prepared by making cut in hypocotyl at 30-40°in relation to the perpendicular axis. The scion and rootstock are clipped together by securing the joint with a grafting clip.
- **Cleft Grafting:** This is a common and easy method practiced in all vegetables. The rootstock is prepared by cutting the cotyledonous leaves from the rootstock and make 10-15 cm deep cut with blade on rootstock while, a wedge cut on scion is made and is inserted into the cut made on rootstock and clipped together.
- **Slant/ Splice Grafting:** This is mostly developed for robotic grafting and practiced in most vegetables. The cotyledonous leaves are removed and a slant cut is given on rootstock and similar cut is made on scion and both are joined and clipped together. The grafted plants are to be maintained at 25 °C and 100% humidity for three days.
- **Pin Grafting:** It is similar to slice grafting. The only difference being that specially designed pins are used instead of clips to fix the grafted position of the scion and rootstock.
- **Tube Grafting:** It is similar to slant grafting except that in this method root stock & scion union are held with an elastic tube instead of clips.

Other highly sophisticated methods like robotic grafting and micro grafting are being developed for efficient and rapid multiplication of grafted seedlings.

Table 1: Benefits of Vegetable grafting

S.No.	Benefit	Crop
1	Disease resistance to soil borne pathogens and foliar pathogens	Tomato, watermelon, Aubergine, Artichoke, Cucumber, Pepper, Melon
2	Nematode resistance	Tomato
3	Salt tolerance	Cucumber, Pepper, watermelon, tomato
4	High and Low temperature tolerance	Tomato, Pepper, Cucumber
5	Drought tolerance	Pepper, Tomato

The Major Drawbacks Associated with Grafting of Vegetables:

In the current scenario labour is the major concern for all the operations like grafting and post graft care, constant management, incompatibility of scion and rootstock, excessive vegetative growth and disorders, expensive seeds of rootstock, infrastructure for rooting and graft union, the quality and attributes of fruits may be affected in the undesirable direction.

Table 2: Grafting methods for different rootstocks

S. No	Scion Plant	Rootstock	Method
1	Eggplant	*S. torvum*	Tongue grafting
		S. sissymbrifolium	Cleft method
		S. khassianum	Both tongue and cleft
2	Tomato	*L. pimpinelifolium*	Cleft method
		S. nigrum	Both tongue and cleft
3	Cucumber	*C. moschata*	Hole insertion and Tongue grafting
		Cucurbita maxima	Tongue grafting
4	Water melon	*Benincasa hispida*	Hole insertion and Cleft method
		C. moschata	Hole insertion and Cleft method
		C. moschata x *C. maxima*	Hole insertion
5	Bitter gourd	*C. moschata*	Hole insertion and Tongue grafting
6	Bottle gourd	*C. moschata, Luffa sps*	Hole insertion and Tongue grafting

Precautions for Successful Grafting

- Specific grafting technique for a particular species should be used to attain maximum success.
- The seedlings should be placed under suitable temperature (25-30°C) and high RH 80-95 %.
- The cut surfaces should not be dried and grafting process should be carried under shade.
- The scion and rootstock should match in size and girth.
- Appropriate stage of rootstock should be considered (first true leaf stage).
- The media and tools should be sterilized.
- The labours should be well acquainted with the process.

Conclusion

Vegetable grafting is a novel technique to combat the site specific issues. It has emerged as a reliable tool to overcome the problems of nematodes too. Identification of appropriate rootstock and scion that are compatible and also the deployment of species specific methods is highly rewarding in attaining greater rate of graft success. However, it is still in the budding stage of research in India hence, breeding of appropriate rootstocks is still a matter of trial and error. Also, the use of specific physiological parameters to select plants in the breeding process will be rewarding for future rootstock breeding. Hence, vegetable grafting is being highly encouraged as a way of reducing the cost of management of various biotic and abiotic stresses and enhancing the quality of the produce.

*****

RECENT CULTURAL MEASURES OF RICE IN TELANGANA 2021

K. Laxmi Prasanna
(M.Sc. Scholar)
N. R. Meena
Assistant Professor
ANDUAT,
Kumarganj,
Ayodhya

In Telangana, rice is cultivated on 44 lakhs acres of land. But, due to various changes in the climate and rainfall, rice production decreased recently. Various determining factors came into light such as insect pest damage, chill winters, and rapid husk production. Considering these, modern technology introduced new production technologies like pest prevention; winter resistant practices not only had impact on the strength of cultivation but also reduced the costs of cultivation. Both the farmers and researches came up together in improving the quality of production.

Seasons: Kharif – June to December, Rabi – Nov. to April.

Varieties: We do not prefer long-term varieties (150 days) in Telangana due to long life span.

	Regions	Varieties
1.	North Telangana	Samba Masoori, Telangana Sona, Jagityala Masoori, Pranahita, Polasa Prabha, Bathukamma, Koonaram Sannalu, M.T.U 1010.
2.	Mid Telangana	Samba Masoori Somnadh, Badrakali Telangana Sona Bathukamma, Koonaram Sannalu Red Jasmine, Sheetal, Ramappa.
3.	South Telangana	Samba Masoori, Krishna, Jagityala Sannalu, Bathukamma, Koonaram Sannalu, Telangana Sona, Nellore Masoori, MTU 1010.

New Varieties: Telangana Sona, Batukamma

Seed rate: For fat seed varieties: 25 kg/acre. For thin seed varieties: 20 kg/acre.

Nursery winter- special care:

As the climate drops in winters, following precautions should be taken.

1. Changing irrigated water morning and night.
2. Covering the soil with dry husks or thin polythene sheets.
3. Along with inorganic nutrients, organic nutrients like poultry litter, cow dung, and sheep waste should be added.
4. Extra phosphorous and potash should be added such that plants get resistant to winters.

Nutrient management: NPK ratio usually recommended is 100:60:60.

Weed management:

I. **Nursery weed management**: After 3-5 days of sowing, spray 1-1.5 litre of Butachlor or Ben Sulphuron Methyl (0.6%) and add 4kg of Petrylochlor (6.0%) granules to the field by mixing them well in the sand. Later, after 15-20 days, spray 8gms of Met-Sulphuron Methyl along with Chlorimyuron Ethyl dissolved in 200 liters of water in the field.

II. **Broadleaf weed prevention**: After 25-30 days of sowing, sprinkle 2,4- D (1.25-1.50 litres in 200 liters of water) in the field.

III. **Narrow leaf and broadleaf weed prevention**: In between 15-20 days of sowing, spray Bis-pyrid of sodium (0.5ml in 1ltre) in the field.

Irrigation management:

A. Before transplanting the plants, field should be moist (very less water), after transplanting the plants, fill the field at about 2-2.5cm above the ground.

B. During the critical stages of rice (tillering to booting stage), the field should be filled at about 5cm above the ground as these stages are very crucial.

Social measures to increase productivity in the regions of Telangana:

✓ **Collective social measures**:

1. Deep ploughing should be done in summers.

2. Resistant varieties should be selected collectively by the farmers in that region.

3. Seed cleaning is compulsory.

4. Along with chemical fertilizers, organic farmyard manure should be used in the nursery.

5. During the flowering stage of rice, legumes should be sown to ensure good nitrogen. As legumes increase nitrogen naturally.

6. Weeds should be removed even on the borders of the field.

7. Previous crops residues should be removed properly.

✓ **Organic rice farming:**

- In recent days, farmers are showing more interest in organic rice production. The objective behind this is to increase the fertility of the soil and bring eco-friendly atmosphere to the future generations.
- Varieties - Mid-term and short-term varieties are more preferred than long-term varieties. Especially, scented varieties like Sugandha Samba and Shobini are most recommended.
- In place of inorganic fertilizers, we use organic farmyard manures like cow dung (200 kg) and vermicompost (200 kg) in nurseries (for 5 cents of land) to protect the fertility of the soil. For organic rice, 20 kg of seeds/acre is enough for production.
- The main field is prepared in the same normal procedure. In addition, to enrich the soil, we add 4 tonnes of farmyard manure or 2 tonnes of dry grass or 00.8 tonnes of vermicompost during puddlings which not only increases the fertility of the soil but also provides 60 kg of nitrogen, 16-20 kg of phosphorous, and 40-48 kg of potassium to the plants. After 10 days of transplantation, we add 1.2 kg of PSB or 10kgs of farmyard manure or blue-green algae (4 kg) or Azolla (400 kg) which provides 12-16 kg of nitrogen to the soil. To slow down the availability of nitrogen (should not exceed 20%) to the soil, we use Sodium nitrate or bulldog soda.
- For pest and disease protection, spray 1500ppm neem powder mixed with 1 litre of water. To provide nutrition between their growths, we add 200kgs of neem powder or vermicompost about 2 times, once at 25 days and the other at 50 days gap which prevents cutworms and fire thrips damage.
- Irrigation is given properly during the critical stages of rice is crucial.
- Finally, we cultivate rice crops alternatively with legumes or vegetable plants which naturally enhance the soil and keep it fertile for subsequent rice crop.

✓ **Fair average quality of rice grains :**

S. No.	Restrictions	Avg. permission (%)
1.	Other granules (mud granules, small stones, grass, etc)	1
2.	Defected, damaged, the color changed or infected seeds	5*
3.	Immature or empty grains	3
4.	Other low variety grains	6
5.	Moisture level	17

**Therefore, these guidelines are given by govt of Telangana. *Should not exceed 4%. ●

WONDER PLANT OF INSULIN:

(*Chamaecostus cuspidatus*)

Harshit Mishra
M.Sc. Student
Deptt. of Agril. Economics
ANDUAT, Kumarganj, Ayodhya

In India, *Costus igneus* Nak, (syn. *Chamaecostus cuspidatus, Costus mexicanus* Liebm ex Petersen and *Costus pictus* D. Don) is commonly known as the fiery costus, step ladder or insulin plant. In many regions of the world, the plant is called by different names. Some refer to it as tabubungiaw, while others refer to it as spiral flag. The plant was given this name because studies have found that the leaves of this plant contain a chemical that can stimulate insulin to be released from pancreatic cells in the human body.

It is a perennial, erect, spreading plant with spirally arranged leaves and beautiful blooms that belongs to the Costaceae family and is a recently imported species from South and Central America to India as an herbal cure for diabetes.

Costaceae was initially categorized by Nakai as the family because the fragrant essential oils free from spirally structured leaves and rhizomes. *Engler and Prantl* classified Costoideal as a subfamily within Zingiberaceae before its elevation to the family. Several anatomical and morphological characteristics, such as a well-developed aerial shoot with distinct, stiff, and frequently branching stems, corroborate this isolated positioning. In a low spiral with divergences, the leaves are inserted. There are four genera more than 200 species in the Costaceae family. Costus is the biggest genus in the family, with around 150 species that are mostly found in tropical regions.

It is often grown as a decorative plant in southern part of India, and the leaves are used as a nutritional supplement in the treatment of diabetes mellitus. The leaves are wide and spirally arranged on a sturdy brown stalk. The plant is recognized by fleshy leaves of dark green colour and rich in corsolic acid (it stimulates insulin synthesis and hence regulates blood hyperglycemia level).

Diabetes is a disease in which the body's blood sugar (glucose) levels become abnormally high. Insulin is a hormone that enables glucose enters your cells to provide energy and therefore aids in the management of the illness. Insulin Plant has become one of the medicinal plants that assist in the treatment of diabetes.

So, if you or someone you know has diabetes, you should read this article to understand how this Wonder Plant – Insulin assists in the treatment of diabetes.

C. igneus leaves were among the plants found to be used efficiently by the tribal people in Namakkal district, Tamil Nadu, in treating diabetes. The aerial portion of *C. pictus* D. Don is used as a

solution in Mexican traditional medicine for the treatment of renal disease.

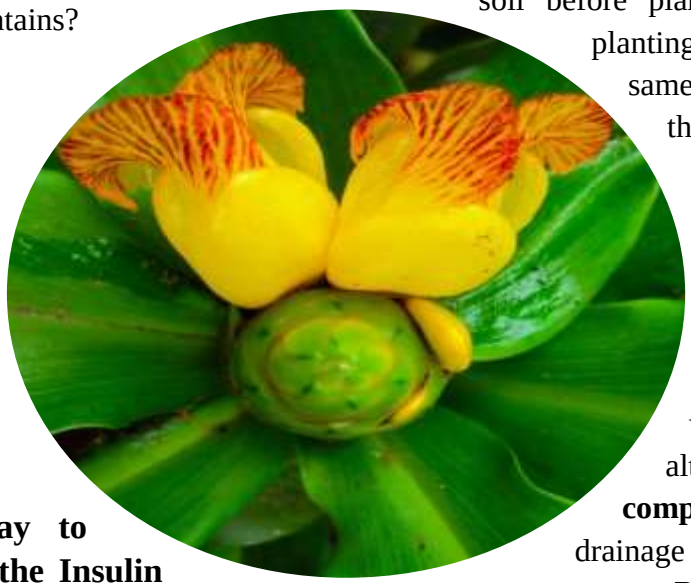
A number of recent researches have been done to examine this plant's anti-diabetic potential. Moreover, it has been shown to have a variety of pharmacological actions such as hypolipidemic, diuretic, antioxidant, anti-microbial, and anti-cancerous properties. Various phytochemical studies also indicate the existence of carbohydrates, triterpenoids, proteins, alkaloids, tannins, saponins, flavonoids, steroid, and trace minerals. This effort is an attempt to obtain and investigate the many pharmacological and phytochemical investigations that have been published to far.

Wonder Plant of 'Insulin'- How Does it Work?

The beautiful green foliage of *Costus igneus* is well-known. The plant's leaves contain corsolic acid that reduces the risks of diabetes. It helps to lower blood sugar levels, making it a viable therapeutic plant. That's not all there is to know about the insulin leaf. The meaty, dark green leaves are a nutrient-rich treasure trove. Do you want to know what nutrients the plant contains?

Here's the quick overview:

- ✓ Protein
- ✓ B Carotene
- ✓ Flavonoids
- ✓ Iron
- ✓ Antioxidants
- ✓ Terpenoids
- ✓ Ascorbic Acid
- ✓ Corosolic Acid and others.



What is the best way to consume the leaves of the Insulin Plant?

To achieve effective changes in sugar levels, doctors advised chewing a leaf of this plant every day for one month. If you don't like the taste of insulin plant leaves, don't eat them. Make a decoction by boiling one plant leaf in a glass of water. You may also benefit from the plant by drying the leaves. This plant's leaves can be harvested and dried in the shade. After that, grind the dried leaves. The resulting powder must be taken on a regular basis. One tablespoon of this powder can be consumed once a day.

Caution: Do not chew more than the recommended amount, since this might cause additional health problems.

Does the Insulin Plant have any side effects?

You might be wondering if this insulin plant has any adverse effects after all the excitement, and the answer is No! The Insulin Plant is completely safe and beneficial for your health. It has been used in Ayurvedic medicine since earlier times. Pregnant and lactating women should seek medical advice before experimenting with the Insulin Plant.

Care instructions for the Insulin Plant -

- ➢ **Propagation of the insulin plant -** Root and stem cuttings can be used to propagate the insulin plant. Before removing the plant from the mother plant, make sure the rhizome has at least **3-4 leaves**. Choose a location with partial sun or partial shade, and then dig **2-3 inches** into the soil before planting the rhizome. When planting with stem cuttings, the same criteria applies; make sure the stem cuttings are around **3-4 inches** long.
- ➢ **Soil -** Soil needs to be **well-aerated (light soil**) and **well-drained** for the growth of insulin plant. It does not grow well in saline or sandy soil, although it grows well in **compost**. You may improve soil drainage by adding organic compost or peat moss. Because the plant is **salt-intolerant**, make sure the soil pH is neutral to **slightly acidic**.
- ➢ **Temperature** - The plant prefers **warm condition** and the temperatures between **35 and 45 degrees** are ideal for the plant to bloom.
- ➢ **Water** - The insulin plant prefers **moist soil** and **frequent watering**. Always keep the soil moist

and water the plants more frequently. Make certain the soil isn't flooded.

- **Sunlight** - Direct sunlight should be avoided by your insulin plant. To grow healthy leaves, the insulin plant requires moderate sunshine. Also, keep your insulin plant out of direct sunlight. If you're going to plant it indoors, make sure it receives adequate light.
- **Mulching** - Organic mulching can be very beneficial to this plant. After the Mulch is removed, the plant should be fertilized and watered.
- The plant is sensitive to caterpillars and mites. To protect your plant from insect damage, use insecticidal soap.
- The plant must be re-potted every year.

Where can we purchase Insulin plant?

These plants are commonly found in nurseries. There are several local plant dealers that not only offer plants but also give seeds for this plant. Insulin plants may be found at many herbal shops. If you are unable to locate such dealers in your local area, you may easily order them from online plant selling websites.

Some of these websites have been listed below:

- mybageecha.com
- indiamart.com
- nurserylive.com
- flipkart.com
- plantsguru.com
- medicinallive.com
- amazon.in

****

COMMERCIAL PRODUCTION TECHNOLOGY OF GLADIOLUS

Swapnil Raghatate
Ph. D. Scholar,
Deptt. of Floriculture and Landscape Architecture,
Dr. PDKV, Akola (M. S.)

Gladiolus is very important and popular bulbous flower crop and having prominent place as a cut flower in the domestic and international market both. The word gladiolus is derived from the latin word gladius meaning a sword, on account of the sword like shape of leaves. Hence it is also called as "Sword lily". Among the different bulbous flower plants gladiolus is leading flower and has a prominent place in its beauty, attractive shape and varieties of colour, good vase life that's why it is called as "Queen of Bulbous Flower". Flowers are very popular in the consumers and used as a cut flowers for the preparation of floral decorations, bouquets, floral arrangement, indoor decorations and also used in the garden as a bedding plant and exhibition. Gladiolus has a long fascinating spikes bears a large number of florets which are different in sizes and smooth or deeply crinkled tepals. There are about 260 species of gladiolus. The species *Gladiolus grandiflorus* L. is cultivated commercially for the production of cut flowers. Gladiolus is grown in all parts of the world. In India gladiolus is grown commercially in West Bengal, Maharashtra, Uttar Pradesh, Punjab, Haryana, Karnataka, Gujarat, Delhi, Rajasthan, Madhya Pradesh, Tamil Nadu and Himachal Pradesh etc.

- **Botanical name** – *Gladiolus grandiflorus* L.
- **Family** – Iridaceae
- **Origin** – South Africa and Mediterranean region
- **Chromosome no.** – n=15, 2n=30

Climate

Gladiolus requires mild climate for better growth, development and initiation of spikes. Very hot and too cold atmospheric condition is not suitable for the cultivation of gladiolus. Better growth of gladiolus occurs at the temperature range between 10-25^0 C. Temperature below 10^0 C hampers the plant growth and development. If relative temperature is high and moisture level of the soil is optimum then gladiolus can tolerate over 25^0 C. In Indian condition gladiolus is cultivated during winter in plains and summer in hills. Gladiolus crop require full sunlight otherwise blasting may occur or the plants may remain blind.

Soil

Gladiolus is cultivated in wide range and all types of soil but sandy to clay loam soil with good drainage, good structure, friable and organic matter rich soil is best suitable for gladiolus cultivation. Soil pH should be between 6.0-7.0.

Propagation

Gladiolus is commercially propagated by vegetative means. It is generally propagated by corms and cormels. For the purpose of cut flower production it is propagated by corms and for the multiplication of planting materials it is propagated

by cormels. The size of the gladiolus corms should be 4-5 cm diameter. Conical shape corms gives better cut flower production than flat shape corms. Seed propagation is also used for developing new varieties of gladiolus. Seeds normally take 3-4 years to produce flower grade corms. Corms should be stored at 4-5^0 C for three to four months or soaking corms in BA 25-30 ppm solution for 30 min. or in GA_3 50 ppm solution for 30 min. for breaking the dormancy of corms.

Seed rate: 1,50,000 – 1,60,000 corms ha^{-1}

Land Preparation

Land should be ploughed at a depth of 20-30 cm. Well rotten Farm Yard Manure or compost @ 5kg m^{-2} should be mix well in the soil. Two to three harrowing's should be given to loose soil and remove weeds from the field.

Types and Classification

Modern types of gladiolus classified in to seven groups on the basis of height of plant, size of flower and arrangements of florets on the spikes.

1. Grandiflorus or Large flowered hybrids

These are large in size and exhibition type of gladioli. Plants of this types are vigorous, florets are large (10-20 cm wide), closely and symmetrically arranged on 90-150 cm long spikes.

2. Primulinus hybrids

Plants are less vigorous. Stems grow up to a height of 75-105 cm. Flowers are 5-9 cm in diameter and spaced well on 40-45 cm long spike. The uppermost inner petal forms hood over the anthers and stigmas.

3. Butterfly hybrids

Plants grow up to the height of 75-120 cm. Spikes length is less than 45 cm. Diameter of the florets are 7.5 to 10 cm. Florets are arranged symmetrically and closely on the spikes.

4. Miniature hybrids

Hybrids of this gladioli are of relatively recent origin. Height of plants varies from 75-105 cm. Florets are 2.5-5 cm in diameter across on spikes of 40 cm. Some of these hybrids have raffled sepals, produce very small corms and multiply slowly.

5. Face up

Face up gladioli are quaint, dwarf stem of 60-90 cm length. Florets are 5-6 cm in diameter and face upward.

6. Colvillei hybrids

Plants are hardly grow more than 60 cm. Flowers are star shaped with floret diameter 5-6 cm. Hybrids of these galdioli are early flowering and more suitable for growing in greenhouses.

7. Ochideola

This is a new group of gladiolus developed in Israel. Weight of spikes are light, producing smaller florets and shorter stem.

Varieties

Some important varieties are Eurovision, Snow princess, Rose Supreme, Jacksonville Gold, Suchitra, Mayur, White Prosperity, Pink Friendship, Peter pears, Jester, Subhangini etc.

Time of Planting and Spacing

Planting time

Gladiolus is planted during the month of September to October in plains and March to April in temperate region. In mild climate places, planting is done throughout the year, though the best time is June and October-November. Corms are treated with fungicide i.e. Carbendazim (0.2%) or Bavistin (0.3%) before planting in the field. Corms size of 3-5 cm diameter are suitable for production of cut flowers. The depth of the corms should be 5-10 cm depend upon the size of corms and season of planting.

Planting method

Generally gladiolus corms are planted on the ridges and furrow and on raised beds. Corms should not planted too deep and too shallow.

Spacing

For production of cut flowers generally spacing should be between row to row is 30-45 cm and between plant to plant or corm to corm should be 15-20 cm. Generally the spacing 30x30 cm, 45x30 cm, 45x20 cm and 30x20 cm are followed in the gladiolus cultivation.

Manures and Fertilizers

Gladiolus requires optimum nutrients and fertilization for their proper growth, development and quality cut spikes. Well decomposed FYM @ 5kg m^{-2} or 20-25 t ha^{-1} should be incorporated in to

the soil at the time of preparation of land. Generally the recommended dose of fertilizer for proper plant growth, development and better flowering is NPK (120:150:150). Half dose of nitrogen and full dose of phosphorus and potassium are applied as a basal dose at the time of planting and half dose of nitrogen in two splits, one after 30 days and second after 60 days after planting or NPK @ 1:2:2 should be applied 56 g m^{-2}. Recommended dose of fertilizer may vary according to soil type, area, region and states.

Irrigation

Generally the frequency of irrigation is depend upon the type of soil and condition of weather. Normally the irrigation at 8-10 days interval is given for maintaining moisture in the soil. In warm climatic condition frequent irrigation is required. Waterlogging condition is not suitable, so overwatering should be avoided.

Intercultural operations

Weeding

Weeds are the major problem in gladiolus cultivation. It reduces the quality of flower and also reduces the production. Weeds compete with the crop for nutrients, space, water and create environment suitable for pest and diseases. Three to four manual weedings are required to keep the field weed free.

Mulching

Mulching is helpful for reducing the weed population and conserve moisture in the soil. Both organic and inorganic mulches are used in gladiolus cultivation. Organic mulches like straw, coconut fibre, hay, chopped straw, saw dust, peat, husk etc. are used as a mulches. Polythene sheet of silver or black colour are also used as a mulches.

Staking

Some varieties of gladiolus grow tall and are susceptible to lodging hence that varieties needs support to grow erect. The stem of the plant tied to the stake. At 5-6 leaf stage staking is given to the plant with the help of bamboo sticks. During staking the plant care should be taken to avoid damage to spike and underground corms and cormels.

Earthing up

Gladiolus is a shallow rooted crop and it needed earthing up to prevent lodging of the plant due to heavy wind, rain and spike weight. When plants reach the height of about 30 cm these should be earthed up. This process repeated two to three times. Earthing up gives support to the plant to sustain its own weight and prevent lodging.

Diseases and their control measures

1. Fusarium wilt

After digging, the corms should be treated with potassium permanganate (1%) before storing. Also the corms after harvest are treated with carbendazim or mancozeb (0.1%) before storage or preplanting. The occurrence of this disease can be reduced by planting the resistant varieties like Sylvia, Dhiraj, Apricot Glow, White Friendship, White Prosperity, Suchitra and IARI Selection-1 etc.

2. Storage rot

The infection of this disease occurs due to injuries to corms during digging. For avoiding occurrence of this disease damp storage and high temperature should be avoided. Corms should be treated with carbendazim (1 g/l water) before storage.

3. Botrytis blight and flower rot

This disease can be control by using spray of maneb, benlate or mancozeb 0.2%.

4. Leaf spot

Leaf spot of gladiolus can be controlled by spraying of maneb 0.2%.

Insects/Pests and their control measures

1. Aphids: Aphids attack on the plants leaves, stems and flowers and suck the cell sap from plant parts. The population of aphids are controlled by spraying sevin, metasytox or malathion (0.2%).

2. Thrips: Thrips can be controlled by spraying malathion or diazinon (0.1%).

3. Loopers and semiloopers: These insects can be controlled by Methyl dimeton 25 EC or Nuvan (0.1-0.2%).

Nematodes

Nematodes can be controlled by application of thimet 10 G @ 30 kg granules per hectare. Treatment of corms with hot water at 53^0 C are effective in reducing the nematode infection.

Physiological disorders

1. Physiological bud rot or topple

This physiological disease caused due to deficiency of calcium. Spray of $CaCO_3$ 0.2-0.3% is essential to reduce the incidence of this disorder.

2. Tip burn

Due to high levels of aerial fluorides in the atmosphere this disorder occurs. A spray of blitox 50 WP (0.3%) should be given.

3. Geotropic bending

This disorder occurs when the spikes are kept in horizontal position for longer periods. The tips of the gladiolus spikes show tendency to bend against gravity. To prevent the incidence of bending of tips, the spikes should be kept vertically in storage and during transportation.

Harvesting of flower spikes

After 60-90 days of planting spikes are ready to harvest. Spikes are harvested at tight bud stage or when the basal one to two florets show colour for distant market whereas, for local market it is harvested when basal floret is fully opened. The spikes are generally cut with sharp knife above the top leaf sheath. Immediately after cutting the spikes are kept in bucket containing cold and clean water. For the local market it is transported through the bucket containing water itself and for distant market it is packed in a cardboard boxes wrapping with loose papers.

Yield of flower spikes

Yield of spikes is generally depend on the cultivars, density of planting and corm size. On an average yield of spikes are 2,00,000 to 3,00,000 lakhs ha^{-1}.

Harvesting of corms and cormels

Corms take 6-8 weeks after harvesting of spikes to become mature and ready for digging from the soil. Plants stop the growth at this stage. Generally irrigation is withhold 2-3 weeks before the harvesting of corms. Before harvesting of corms light irrigation is given, it loosens the soil and lifting of corms are easy. With the help of hoe or khurpa the corms are uplift and the leaves are detached from the corms with the help of secauter. Then, the corms are dried in a shade, clean and graded and separated according to the size. Then the corms are treated with bavistin powder and packed in a gunny bags and stored at a temperature of 4-5^0 C.

Yield of corms and cormels

Corms: 2-2.5 lakhs corms ha^{-1} (1-2 corms $plant^{-1}$)

Cormels: 5-20 lakhs cormels ha^{-1} (10-20 cormels $plant^{-1}$).

******

FORAGING EFFORT OF HONEY BEE (*Apis mellifera*) IN INDIA

Sundar Pal *
Teaching cum Research Associate
Department of Entomology
R. L. B. Central Agricultural University, Jhansi

Insects are lineman to help in pollination of various cultivated crops around the world. About 73% of the world's cultivated crops are pollinated by bees, 19% by flies, 6% by bats, 5% by beetles, 4% by butterflies and moths and 4% by remaining. Forager bees (*Apis mellifera*) gather nectar, pollen or resin outside the colony once there are 21 days old. Several factors, such as colony characteristics, foraging genes, and variations in the abundance of mRNA in worker bees' brains, affect the division of labor and nurse bees' abilities to forage. JH levels increase before foraging but are unaffected by foraging experiences. Nurses have lower octopamine levels than foragers, irrespective of age. Juvenile hormone modulates changes in octopamine as well. With increasing age, both foraging skills and forager workers become more advanced. Further, the forager bees have a higher n-alkane content than the nurse bees, which may help the forager bees to tolerate the ambient conditions. During the favourable environment and assigned foraging tasks outside the colony, the worker cast begins a new chapter of her life.

Foraging activities and timing

There are two types of forager bees in the beehive: runner bees hunting for food and hesitant bees gathering information about food resources from runner bees returning. Nearby 40 to 90% of all forager groups are shy. In honey bee food runners, catecholamine signaling and glutamate signaling are notably different from those in other foragers. A species' behavior shift from foraging activity to sleep (napping) may occur under some ecological conditions. Deficiency of night sleep may negatively impact honey bee navigation memory. Forager bees need to sleep at night to survive. To classify bee foraging activity, resource foragers collect nectar, pollen or resin. A second important factor is the sucrose response thresholds. In other words, honey bee workers with low sucrose tolerance start foraging for pollen and water more than nectar-foraging workers with high sucrose tolerance. Pollen foragers also assess pollen needs based on their experience with trophallactic contacts and the colony conditions. The proportion of honeybees foraging pollen falls in response to a pollen shortage or poor pollen quality. Insulin receptor substrate (IRS) influences pollen (protein) and nectar (carbohydrate) foraging rewards. Honey bees begin foraging in the morning and continue until dusk. Foragers left the colonies at 8 a.m. more often than at 10 a.m. in desert conditions. Early morning pollen collection is high, whereas afternoon pollen collection is low. Honeybees usually spend different amounts of time on various flower species depending on the plants they are feeding. They spent about 5-6 seconds on each flower.

Range of foraging and favorite flora

In my view, the energy and optical flow-based theories can be considered integrated explanations since they are both necessary factors to calculate and estimate distances and rations. Honey bee foraging ranges from 45 m to 5983 m. They can fly more than 2 km to collect water under desert conditions. Several factors, including race, colony strength, food resource, month, and time of the day

etc., can influence the distances traveled by colonies within a single region. Forager bees more prefer some resources than others, such as water, nectar, pollen, or resin. There was a tendency for water consumers to prefer continuous sources over stable sources and large containers over smaller ones. Foragers of nectar can choose some food sources and flower positions over others. The forages visit for nectar to various crops like niger, sunflower, sesame, eucalyptus, brassica, marigold, schefflora, lagerstroemia, coffee, rubber, jamun, and terminalia, gul mohor, tulsi, basil, banana, peach, citrus, guava, apple, sunflower, berries, safflower, pear, mango, plum, papaya, and neem plants etc.

Constituents influencing foraging liveliness

Factors associated with in-housing and out-side can affect foraging activity. A queen (virgin or mated) is one of these factors. Virgin queens collect little pollen and foraged more actively than colonies led by mated queens. A queen less colony is likely to forage less and collect low quantity of pollen than a mated or virgin colony. Bee foraging activity is influenced by many factors, including hive type, colony strength, pests and diseases, genetic makeup, etc. Concerning out-housing factors, the availability of suitable plant resources significantly affects foraging activity, and forager bees prefer some resources over others. According to findings regarding environmental factors that affect foraging activity, *A mellifera* bees start foraging activities at 8-16 °C on average. At ambient temperatures of about 20 °C, the highest activity was observed, while at 43 °C, it kept the lowest below 10 °C. Foraging distance, moving beehives, host plant location (in greenhouse or field conditions), and communication with other bees, genetically modified crops, and seasonal climate changes may also influence foraging behavior.

Superintendence of search activity

Foraging activity is measured by employing variables such as the beginning, ending, number of bees entering and leaving hives, peak foraging over time, speed, distance, and estimation of foraging distance by hearing the waggle dance etc. Among the other parameters associated with foraging activity and the visiting of plants are the number of foragers per flower, the number of visited flowers per forager, time spent per flower, nectar and pollen collection method from the blooms, the position of the forager bees on or at the side of the flower, the position of visited branches and flowers, the proportion of pollen or nectar foragers relative to total foragers, foraging type, the load of pollen and pollen type, concentration of crop nectar sucrose and competition with other pollinators etc.

Conclusion

Honey bees, (*Apis mellifera*) have typical foraging habits. A honey bee colony's behavior is a reflection of the ambient atmosphere. Many in- and out-colony factors influence this behavior, which has been studied extensively. In addition to assisting in plant pollination, foraging behavior has other benefits for the colony. In practice, maximizing colony products and increasing other agricultural benefits depends greatly on controlling this behavior. All involved are regulating foraging behaviors, determining factors inflicting this behavior, separating subspecies variations, monitoring methods, and handling this behavior. The results indicate further research is necessary to understand foraging behavior fully.

*****

INSECTS AS SOURCE OF FOOD

Lipsa Dash

Assistant Professor and Head,
Department of Entomology,
Centurion University of Technology and Management,

Consumption of insect is more than 7000 years old practice. Around 2300 species belonging to 18 orders have been detected to be edible in nature. Though mostly they are originated in nature still some are farmed in large scale. Insects belonging to order Lepidoptera, Coleoptera, Isoptera and Hymenoptera are being eaten worldwide. However, tropical and subtropical climate is most suitable for harvesting insects in large number due to warm and humid climatic condition. Tropical insects are large in size than their temperate counterparts with stable life cycle which facilitate their mass harvesting. Out of all the stages in the insect life cycle, immature forms are mostly preferred as food source as they are rich in fat and amino acid which is responsible for giving it a better flavour. Production of animal protein is now under great demand due to sharp rise in population. Hence entomophagy is seen as a better alternative to it. Hence great attention is being paid towards use of edible insects as a source of food.

Modern entomophagy

There are six common commercial edible insect species at present, including cricket (*Acheta domesticus*), honeybee (*Apis mellifera*), domesticated silkworm (*Bombyx mori*), mopane caterpillar (*Imbrasia belina*), African palm weevil (*Rhynchoporus phoenicis*) and yellow meal worm (*Tenebrio molitor*). Out of all these, in some cases (*R. phoenicis, T. molitor and I. belina*) only the immature stage is edible as they give a good flavour due to high content of fat in them. In case of cricket only adults are edible.

Silkworm rearing is popular since ancient times as it established a trade between china and Mediterranean region. However, silk is not the only remarkable product made from silkworms, whose pupae are traditionally consumed as food. They are popular in china, Thailand, Vietnam and Japan.

Honeybees are raised as pollinators mostly. Bee brood extract is one luxury nourishment source. Honey of course, has been a popular condiment all over the world. But it is not the only entomic sugar that is popular now. Actually, a newly developed product called lerp, which is the secretion produced by larvae of psyllids, is becoming particularly vogue. Besides monosaccharides and water-insoluble carbohydrates, it is abundant with minerals, especially potassium and phosphorous.

Many countries are still under economic pressure and are malnourished. Practically it is better to provide them their traditional food source rather than to supply them foreign diet. A project called Win Food in China, targeting at alleviating childhood malnutrition, has thus been launched and eating insects is its key. Consuming insects in a healthy and wise manner can be a solution to eradicate poverty. Edible insects are playing a big role in various food systems. Infact they are evolving as a vital source of nutrients in many countries.

Proteins, Vitamins and minerals are lacking in the diets of developing countries even though it is essential for the infants and children. Farm products like vegetables and domestic livestock are often illegitimate or unaffordable for them. Insects, however, are usually cheap but with the nutrients that are deficient in traditional diets. SOR-Mite (protein-enriched sorghum porridge) project provides another insight in improving diets. In many African countries, the grains local people daily

consume are lack of proteins and fats. However, these grains can balance well nutritionally with flying termites, which can be easily gathered. The porridge made of their mixtures is both nutritional and economical.

Edible insects also serve as a feeding source for livestock and aquaculture. Using insects as fodders is particularly popular in areas where vegetable feeds is expensive. The cost is increasingly challenging for industries to feed farmed animals on traditional meals that are made of soy. Insect meal, however, can provide enough nutrition with cost that is distinctly low. Biomass could be recycled during the production of insects, which makes the protein sustainable. Moreover, pupae of Chironomidae and Muscidae are used as fishing baits and feeds.

Food additives can be extracted from insects, too. Carmine, a common natural colorant being used for hundreds of years, is obtained from *Dactylopius coccus*. It provides a bright red dye for clothes, cosmetics and of course, food. Similarly, the lac insect (*Kerria lacca*) is a fabulous source of a water soluble polyhydroxy-anthraquinones called lac dye. Lac resin secreted by the lac insect is commonly used in coating candies and fruits.

Beyond being eaten to allay the hunger or just for pleasure, insect extracts can be used as a source of medicine, healthcare and industrial products. Industrial enzymes for biodiesel production have been successfully extracted from black soldier flies (*Hermetica illucens*). The exoskeleton of adults is a rich source of chitin, which has been proven to enhance the immune system of different organisms.

Economic and Environmental benefits

Primarily, insects are taken as foods because of the low cost. For wild resource-rich species, harvesting is almost free. For farming species, they usually feed on a wide range of cheap fodders with efficient energy transmission. Notably, the efficiency of conversion of ingested food (ECI) of *T. molitor* is 53 to 73% whereas it is at most 40% in other animals. Eating insects would reduce the consumption of pesticides, especially the chemicals. Many edible insects are important pests of economical plants, which are used to be managed by insecticides. However, they would be largely caught artificially with extra profits bringing in. Consequently, the amount of next generation would be controlled by the limited amount of mating adults. As the use of pesticides decreases, the resistance insects generate to drugs will be staved off.

Conclusion

Entomophagy is the key to solving the growing needs of nutrients globally because edible insects can provide high amounts of proteins, fats, vitamins and mineral elements with great economic and environmental advantages. Insects can serve in various areas in addition to being eaten as cuisines and snacks. Various modern products have been developed due to the intensive studies of insects. The consumption of edible insects is increasingly popular. People are consuming insects not only for nutrition, but also for fun. However, it is still concerned that the utilization of edible insects might bring health and safety issues.

******

Morchella :
THE MOST EXPENSIVE MUSHROOMS

Devi Shanthini V.*
Brindhadevi S.

Ph.D. Research Scholar
Deptt. of Plant Pathology
TNAU, Madurai

India showcases a diversity of indigenous ingredients and not many of them may pinch your pocket. Morel Mushrooms or *Morchella Esculenta* locally called '*guchchi'* in the expensive ascomycetes fungus and exclusive ingredient that grows wild on the foothills of Himalayas and Jammu and Kashmir. Guchhi mushroom is a species of fungus in the family Morchellaceae of the Ascomycota. They are pale yellow in colour with large pits and ridges on the surface of the cap, raised on a large white stem. A kilogram of guchchi mushroom can cost Rs.10, 000 to Rs.30,000 per kg scientifically, these mushrooms command a huge demand despite their high price tag.

Scientific Classification:
Kingdom: Fungi
Division: Ascomycota
Subdivision: Pezizomycotina
Class: Pezizomycetes
Order: Pezizales
Family: Morchellaceae
Genus: *Morchella*
Species: *esculenta*

Growth habit

This mushroom is very expensive, so it is also known as "growing gold of mountains". *Morchella esculenta* is commonly found in thick coniferous forest, loamy soil rich in humus of Uttaranchal, Himachal Pradesh and Jammu and Kashmir after snowfall period. It naturally grows in hilly altitude with cold environment. It is found in forest habitat at a height of about 2500-3500 m .It is commonly found as a mycorrhizal or saprobic relationship with hardwood and coniferous trees usually grow in clusters on logs of decaying wood or decaying leaves and even in humus soil. Fructification of morels may be found under forest trees, in fruit orchards, open grassland, under the shrubs, and rarely in old cemented structures. The best time for the morels collection is spring and summer.

Growth characterisation

Morchella esculenta consist of cylindrical structure. The upper part is called as pileus possesses 70-80% of total plant weight. Pileus is about 3-9 cm long, 2-5 cm wide, round or irregular pits are present. It shows yellow, brown, pale or black colour. Lower part is called as Stalk or stipe which

possesses 20-30% of total plant weight. It is about 1 to 4 cm long, 0.5 to 3 cm thick and hollow. It is whitish to pale grey but at maturity becomes greyish brown. Stipes is slightly enlarged at the base and supports the upper part. In fresh form its size varies from 2 cm to 25 cm while on drying the size reduces to 0.1 to 10 cm.

Medicinal properties

The fruiting body of *Morchella esculenta* shows antioxidant and anti-inflammatory and antitumor activities. Extracts of this mushroom show antibacterial activity against *Staphylococcus aureus*, *Salmonella typhimurium* etc. Fruiting body of Morchella esculenta contains a broad range of active constituents which include carotenoids, tocopherols, phenolic compounds and organic acids. Carotenoids contain βcarotene and Lycopene.Powder of M. esculenta can be used an antiseptic, to heal the wounds and used for the treatment of stomach-ache.

High price

Luxury price for this mushrooms is because of their spongy, honeycomb texture and unique flavour and also for their labourious process which can be grown wild, not cultivated commercially. The villagers start the laborious process of collecting these elusive mushrooms sometime around March which continues till May-end. They may or not grow in the same spot the next season. These mushrooms are very fragile and a lot of effort is required to retain their pleated honeycomb texture. It can take months before enough is collected, dried and available for sale in the market. Due to these reasons, the Gucchi mushrooms are highly expensive.

GI tag

Recently, Jammu and Kashmir has granted with GI tag for Gucchi mushrooms. Doda Valley is famous for the cultivation of crops like Rajma beans, Gucchi mushrooms, and lavender plants. The climate of the valley is very much suitable for the growth of these crops. The mushrooms are collected every year in the month of March after the snow melts. These mushrooms are grown Doda District of Jammu and Kashmir. These mushrooms are called Gucchi, or Morel by the local people. These mushrooms are priced at over Rs.20,000 per kg, so now we know how expensive they. This variant is a forest produce being collected by local farmers and tribals.

First time in India

The Indian Council of Agriculture Research-run Directorate of Mushroom Research (DMR), Solan, has for the first time successfully cultivated the world's costliest Morchella mushroom, commonly known as gucchi. This is for the first time that the ICAR-DMR, Solan, has succeeded in producing fruit bodies of gucchi mushroom. As a result, India has entered the list of select countries such as the USA, China, France etc. that have successfully attempted to cultivate Gucchi mushroom under artificial conditions.

Conclusion

Morchella mushroom is one of the most important and beneficial fungus, occur naturally and have lot of properties. It is very important to Pharmacology. Various types of illness can be cured with the extract which mushroom contain and mostly it a boon in curing cancer. So mushroom is one of the best plants to study and to gain knowledge about. Extract of mushroom have anti-microbial, anti-inflammatory and various other properties make us more curious to study it.

******

PLANT TISSUE CULTURE FOR PRODUCTION OF DISEASE FREE BANANA PLANTING MATERIAL

Swati Jagawat
Aquaculture Research and Seed Unit, MPUAT, Udaipur, Rajasthan

Prateek Sharma
Department of Molecular Biology and Biotechnology MPUAT, Udaipur, Rajasthan

Beerendra Singh
Kuldeep Sharma

Banana is one of the important fruit crops of many tropical and subtropical regions of India, which belongs to the *Musa* species. It is an important fruit crop and food source of million people for its nutritional and medicinal value. It is very important for their year-round availability, affordability, varietal range, taste; nutritive and medicinal value makes it the favorite for all classes of people. In traditionally banana plant are propagated by vegetative using suckers which grow from lateral buds originating from corms and suckers are used for producing individual plant. Conventional vegetative multiplication process of banana is very slow and it has been found to express several negative impacts which include low production, transmission of diseases and poor preservation of original plant genetic material. The significant commercial value of banana crop production mainly depends on its availability of reliable and higher quality disease free planting material. The commercial value of banana crop production requires consistent supplies of good quality banana plant which are capable to produce more vigorous, higher yielding, disease free and better quality fruits. The genetically uniform, pest and disease free planting material can be achieved by plant tissue culture. Plant tissue culture is the technique, which can solve these problems and produced disease free higher yielding plant material in controlled condition. In vitro banana production technology is a superior technology over traditional method for their uniformity, optimal yield, and disease-free planting material and true to type plants. In micropropagation, the meristem tip culture technique mainly used for producing higher quality disease free plant and many steps are required; such as selection of explants and their sterilization, inoculation of explant in media for shooting and rooting and after that plantlets are transferred for hardening and so on.

Methodology

Explant selection

Shoot tips from young suckers of 40-100 cm height are commonly used as explants for rapid in vitro multiplication of banana. From the selected sucker a cube of tissue of about 1-2 cubic cm containing the apical meristem is excised. Generally bigger explant size (3 mm to 11 mm) is not suitable due to create a darkening and pollution problem. So, the explant size approx. (0.5 mm to 1 mm length) containing meristem is mainly used for elimination of viruses for producing large number of plants.

Sterilization of explants and fresh inoculation

(i) Wash the suckers thoroughly in tap water, roots and leaf sheaths are removed and then cut the basal portion of the corm approx. 12X12X15 mm size.

(ii) Keep the explants under running tap water for 30 minutes and after that soaked water containing cleanser clean sole (detergent) for 30 minutes and shake continuously. They are washed with distilled water to remove the detergent particles.

(iii) Then treat with fungicide (Carbemdazim 12% + Mancozeb 63% WP) for 30 minutes followed by distilled water wash. After that transferred to laminar air flow chamber for further sterilization process.

(iv) The explants are treated with 70% ethanol for 2 min and then wash by the sterile water. Then the explants are treated with 0.1% $Hgcl_2$ for 5 min. After those three times explants are rinsing of 5 min with sterile water.

(v) The explants are trimmed to the final size of 1×1 mm and then inoculated on MS media with containing 3 mg/l BA1 in the sterile condition.

(vi) Incubate the culture for 16-hour photoperiod and observe the culture regularly for contamination reason and growth condition.

Media preparation for shoot initiation and multiplication

Subcultures shoot tips are required after the inoculation of explant for increase the shoot initiation and multiplication. When the growing shoot is almost 2 mm tall, the shoot tips are subculture in the fresh sterilized tissue culture media. Mainly MS media are commonly used for shoot initiation and multiplication. The media contains sucrose sugar approx. 30 to 40 gm / liter provide carbon source is added with gelling agent agar 5 gm to 8 gm / liter for giving semisolid base for culture and cytokines are also used for development and morphogenesis of the tissue properly. BAP and kinetin are mainly used according to more study BAP combined with kinetin proved best for shoot initiation. For shoot initiation the MS media containing with 1.0 mg /l BAP + kinetin 0.5 mg/l proved better as shoots started to initiate within a week. Increase the multiplication rate of shoots also depends of the proper combination of plant growth regulators, 2.0-2.5mg/l BAP with 2.0-2.5mg/l kinetin are more suitable for shoot multiplication. Repeat the sub culturing process for approx. 4-5 cycles, the new shoot tips transfer in new medium for each 1-2 weeks. When the number of shoots grown properly then separate individual shoots from the clusters and transfer them to a rooting medium.

Rooting medium

Multiplied shoots are transferred on MS media supplemented with two auxins (IBA and IAA) mainly, their concentration approx. 1.5 mg/l each hormone requires for root induction. After the shoots are transferred into the rooting medium, the cultures are incubated for 4-6 weeks to form the roots. The cultures are maintained at 22°C with a light/dark cycles of 16/8 hours. The cultured plants with expanded leaves and well grown roots, the rooted plantlets are transfer to the soil.

Hardening

The rooted plantlets transfer from culture area to green house for acclimatization. For this purpose, rooted plantlets remove from culture jars and wash in running tap water to remove agar from root surface. Then the rooted plantlets are transplanted to plastic bag, which containing FYM + soil with ratio (1:1) and placed in green house. After 5 weeks generally 82% to 88% plants survive and able to grow in a natural environment. The hardening process is must for tissue culture plants for better acclimatization.

Fig. 1 Preparation of banana plant through tissue culture

Advantages of tissue culture

- ✓ Tissue cultured plant exactly cloned like its mother plant without variations.
- ✓ They produce disease free plants in a large number and provide disease free seedling.
- ✓ Tissue culture plants grown throughtout the year and also banana sample may be available for tissue culture practice.
- ✓ The banana fruits are uniformly mature, which makes the harvesting process easy and also reduce the labor cost.

High profit obtains because of the high benefit to cost ratio (Approx. 95% to 98% plants bear fruit bunches).

******

EROSION- A MEDIUM OF HARASSING SOIL PROPERTIES

Abhishek Tiwari
Hanuman Pandey
DR. R.K. Pathak
Department of Soil Science and Agricultural Chemistry
CSAUAT, Kanpur

Soil erosion refers to the loss of soil particle from land surface by detachment and transportation of soil by water, wind or gravitational forces from one place to another place. Soil erosion is the most destructive phenomenon which affects the fertile soil, degrading the environment and reduces the storage capacity of water bodies. The highest losses of soil have been recorded in bare soil followed by cultivated and least in natural vegetative soil. The loss of soil from agricultural and nonagricultural lands is a serious problem throughout the world. Soil erosion by water is a seriousproblem in India. Of the total degraded land in India, more than 80% is affected by soil erosion and out of that about 80% occurs by water. The red soil covering about 70 Mha are subjected to severe water erosion. The loss of soil due to shifting agriculture is no less pronounced in India especially in north -eastern region. Erosion affects productivity both directly and indirectly. Directly, the erosion induced reduction in crop yields is attributed to loss of rooting depth, degradation of soil structure, decrease in plant available water reserves, reduction in organic matter, and nutrient imbalance. Depending on soil properties and the degree of degradation, adverse effects of erosion on crop yields can be mostly compensated by additional inputs of macronutrients (N, P, K), micronutrients, organic matter and irrigation. For some soils, e.g., tropical soils, crop yields from severely eroded soils are significantly lower than those from uneroded lands and are often uneconomic inspiteof additional inputs. Erosion is a natural process that gradually occurs over long periods. The most alarming thing about soil erosion is that the nutrients within soil are dispersed away and your farmland can become much lesser fertile. In all type of soil erosion sheet erosion is very dangerous form of soil erosion. Because in the sheet erosion uniform removal of soil layer and top fertile soil layer is washed away from the arable land. This type of soil erosion is mostly unnoticed by the farmers. Soil deterioration and low water quality due to erosion and surface runoff have become severe problems worldwide. Controlling the sediment must be an integral part of any soil management system to improve water and soil quality. Eroded topsoil can be transported by wind or water into streams and other waterways. Soil erosion by water occurs when bare-sloped soil surface is exposed to rainfall, and the rainfall intensity exceeds the rate of soil intake, or infiltration rate, leading to soil-surface runoff.

Soil erosion can occur in two stages

- Detachment of soil particles by raindrop impact, splash, or flowing water; and
- Transport of detached particles by splash or flowing water.

Therefore, soil erosion is a physical process requiring energy, and its control requires certain measures to dissipate this energy. Water erosion can also carry chemicals or toxic minerals into streams where it can eventually enter in the human through food.

Harmful Effect of Erosion

The effect of soil erosion are that it reduces the thickness of the rooting medium for plants and the soil water-holding capacity, making productive agriculture more difficult. Wind carries away the upper soil layers (topsoil) which are often rich in organic matter and increases soil fertility. In the case of a base for construction (roads, buildings), soils are usually removed by machines to provide a more solid base.

- ✓ Loss of soil and in some places the losses have been dramatic leading to lower soil productivity
- ✓ Erosion in many cases feeds on itself in that. An example is once it has formed ruts in the earth they are difficult to control and mitigate and requires in many cases large sums of money to mitigate
- ✓ Fragmentation of land mainly in gully erosion.
- ✓ Adverse effect on plant growth and yield.
- ✓ Increases mainly of air and water pollution.

Nutrient Loss

During the erosion process, nutrient rich topsoil is generally erodes first and the soil that becomes exposed, is less likely to contain enough nutrients to sustain plant life. In agricultural areas that rely on nutrients for growth, the application of fertilizer is necessary to add the essential nutrients such as nitrogen, phosphorous and potassium to the soil.

Water-Related Effects

As the topsoil erodes, the process exposes deeper soil at the land's surface. This deeper soil often does not hold water well, because it is very compact and has reduced drainage capacity. Therefore, runoff increases in these areas. The loss of organic matter in the topsoil is the largest contributor to the reduction of water retention in the soil.

Control of Soil erosion

The 3 main principles to control erosion are to:

- ✓ Use land according to its capability
- ✓ Protect the soil surface with some form of cover
- ✓ Control runoff before it develops into an erosive force.

Surface cover and control runoff

Surface cover is a major factor to control erosion because it reduces the impact of raindrops falling on bare soils and wind removing soil particles. It also reduces the speed of water flowing over the land. Erosion risk is significantly reduced when there is more than 30% soil cover.

Tillage

Conservation cropping practices that maintain cover on soils include minimum and zero tillage practices. Nowadays during the fallow period, farmers use tillage implements that kill weeds without burying stubble and herbicides to minimize the frequency of tillage.

Contour banks and strip cropping

Runoff concentration is managed by structural measures such as contour banks in upland areas, or strip cropping on floodplains.

Green cane harvesting

Another measure that maintains soil cover is green cane harvesting or ‘trash blanketing’. When a cane crop is harvested, the leaves and tops of the cane are left on the ground as a ‘trash blanket’. This protects the soil from erosion by raindrop impact. This practice has been widely adopted in many countries.

Mulch Tillage

It is a plowing operation, where leaves the residual of vegetative materials such as leaves and crop residues on the surface, that is also called mulch. Leaves, stems, and plant debris reduces flow velocity and thus control erosion. Mulching reduces the kinetic energy of falling raindrops. Also, they control the soil temperature.

*****

SOIL FERTILITY AND NUTRIENT MANAGEMENT PRACTICES

Sandeep Yadav*
Nandan Singh
Virendra Bahadur
Ph.D. Scholar
Soil Sci. and Agril. Chem.
ANDUA&T, Kumarganj, Ayodhya

For the better growth of plants, a total of 17 essential elements are required, nowadays, due to the use of high-yielding species and taking 3 to 4 crops in a year, gradually the deficiency of elements is often seen in the crops. Therefore, there is a need to focus on fertilizer management, especially on the management of rich nutrients. Here are some useful tips as given below for improving soil fertility are,

Soil test

Use of nutrients on the basis of soil test, today's expensive fertilizers should be used in a balanced manner. Soil sampling should performed by making V shaped mark in soil up to 15 cm soil from top to bottom. After mixing one soil and dividing it into four parts, we kept on throwing the pile from face to face and mixing the remaining two heaps and kept doing the same action till the sample was about half a kilogram, by filling this sample in the bag, the number of the farmer's field. Name the crop for which the sample was taken today, write the information and send it to the soil testing center by putting one inside one outside, while taking the sample, do not take samples from the low places of the field on the side of the bunds and the place of the compost heap, make sure to use the fertilizer according to the soil test.

Fauna Reversion

Generally, 2 to 3 tons of waste biomass is available per hectare, if we can use this biomass provided by nature in the fields by making compost, then not only will the dependence on other banks be reduced, but we will be able to fulfill our immediate needs even after meeting our natural needs. The resources, land, water and air, will also be able to clean and hand over all living beings to their future generations in a healthy and safe way. Nadep method is more effective for making biomass compost. In this method, 3 feet high 6 feet wide 12 feet long hole structure is used. In the ready-made structure, put 6 inches of waste from the dung solution, let it dissolve the soil waste, apply 2 inches of soil, fill the structure with wet soil and close it. In comparison to other methods, twice as much manure is obtained from the use of soil as compared to other methods. To increase the quality of organic manure, 50 kg of rock phosphate should be mixed with the soil at the time of filling and after three months 500 g Azotobacter dissolve 100 to 200 liters of water and make holes from place to place and put that solution in it, similarly by Indore method and Bangalore method,

3 feet deep, 6 feet wide, 12 feet long, three to four pits as per requirement. You can prepare good compost by digging and stuffing crop residues with cow dung.

The use of green manure

After the harvesting of wheat, till the first week of May, the soil was filled and the problem-prone lands were planted in the structure and in the high and sandy lands, and by the end of June or the first week of July, the paddy was transplanted at the stage of 45 to 50 days. In the event of stopping the paddy by immediately reversing, the quantity of urea per hectare should be increased to 20 kg and given at the time of reversing, thus changing the crop cycle of paddy wheat by taking green manure in zaid, along with biological reversion, the problem of weeds in paddy is reduced. It is found that along with providing all the necessary nutrients for the plants by providing green manure, the soil structure improves the amount of organic matter and biological activities.

Use of bacteria Rhizobium culture

It is a symbiotic bacterium of leguminous crops, which after obtaining nitrogen from the atmosphere, stabilizes it in the soil, after boiling 50 grams of jaggery in half a liter of water, after cooling it, 10 kg of seeds are sown in the shade.

Azotobacter

These asymbiotic bacteria found in soil and collect nitrogen from the atmosphere and stabilizes it in the soil. It is used like Rhizobium culture by treating it with seeds and mixing two to three cultures of 30 kg decomposed cow dung directly into the soil at the time of preparation of the field or vertically. After dissolving a kilogram of culture in 20 liters of water in the crop and transplanting crops by immersing the nursery plant for 10 minutes, the bacteria develop in the soil and collect nitrogen from the atmosphere.

Phosphorus solubilising bacteria or fungi

By converting the fixed phosphorus in the soil into the soluble state, these bacteria and fungi provide 15 to 20% of the amount of phoshorus to the crops, it is also used in the same way as Azotobacter. Precautions in the use of bacteria-

- At least 4 days after the seed treatment, the bacteria should be treated with the seeds.
- After use in the soil, mix it in the soil by giving a pat and use it in the standing crop or immediately run the water.
- Protect bacteria from dying in the sun.

Vermiculture

Earthworms are called worms and their group is called vermiculture, earthworm dung is called vermicompost or vermicasting, it is called systematic biotechnology, by which organic manure earthworms are produced simultaneously, for this 6" rotten dung like 6" dry fodder Keeping earthworms on it, put 6" of litter and cover it with water-soaked sackcloth, to protect it from direct sunlight, a shed is made over it. In this way, the bacteria which are in the stomach of the earthworm in the preparation of vermicompost, contain gum-like substance. It expels and hardens the dust particles, making the land ventilated and useful for water disposal. Its feces contain peritracheal membranes that prevent evaporation by clinging to the dust particles. Also beneficial humus by eating dirt-causing bacteria. Earthworms pollinate the land day and night to increase the water holding capacity in the soil. It should be used at 1 ton per acre in fields, 100 to 200 grams in trees and 50 grams in pots.

How to increase urea utilization

The use of urea mixed with 15 to 20% neem cake or 500 ml neemin per bag of neem growers slows down the process of nitrification. In this way, urea is gradually obtained by the plants. Due to which plants get most of the urea and reduce the nitrate pollution in the groundwater and increase production. Its use is absolutely necessary for the waterlogged paddy fields. ●

CROP RESIDUES BURNING

Hariom Mishra
ANDUAT, Kumarganj, Ayodhya
Shubhendu Singh
ANDUAT, Kumarganj, Ayodhya
Abhishek Tiwari
CSAUAT, Kanpur

Biomass burning causes poor air quality worldwide. Chemically and radioactively of trace gases and aerosols is global atmospheric chemistry. Direct or indirect effect on the radiation balance of earth climate is global climate change. Satellite observations have revealed elevated levels of O_3, CO and aerosols. It is estimated that burning of crop residues in situ releases about 627 kilo tonnes (Kt) of PM10 and 4677 Kt of carbon monoxide to the atmosphere annually in India.

Major pollutants emitted during crop residue burning

Category	Pollutants	Source
Particulars	SPM (PM100)	Incomplete combustion of in organic material, particle on burnt soil
	PM10	Condensation after combustion of gases and incomplete combustion of organic matter
	(PM 2.5)	
Gases	CO	Incomplete combustion of organic matter
	NO_2	Oxidation of N_2 in air at high temperature
	N_2O	
	O_3	Secondary pollutant, form due to Nitrogen Oxide and Hydrocarbon
	CH4/ Benzene	Incomplete combustion of organic matter
	PAHS	Incomplete combustion of organic matter

SPM (Suspended particulate matter); PM (particulate matter); FPM (fine particulate matter)

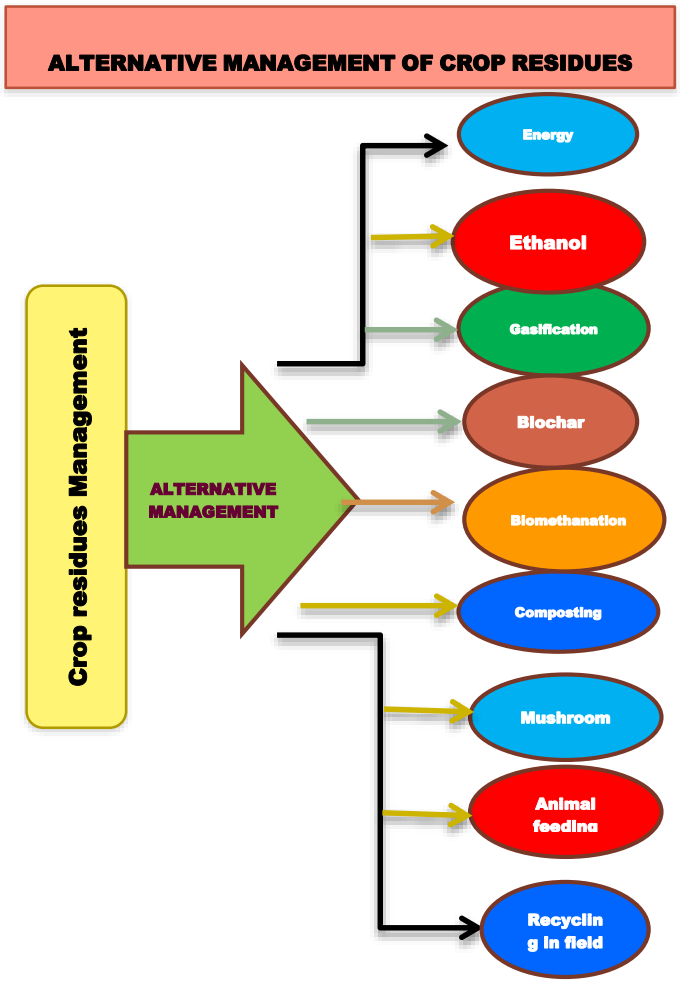
Crops residue generation in India

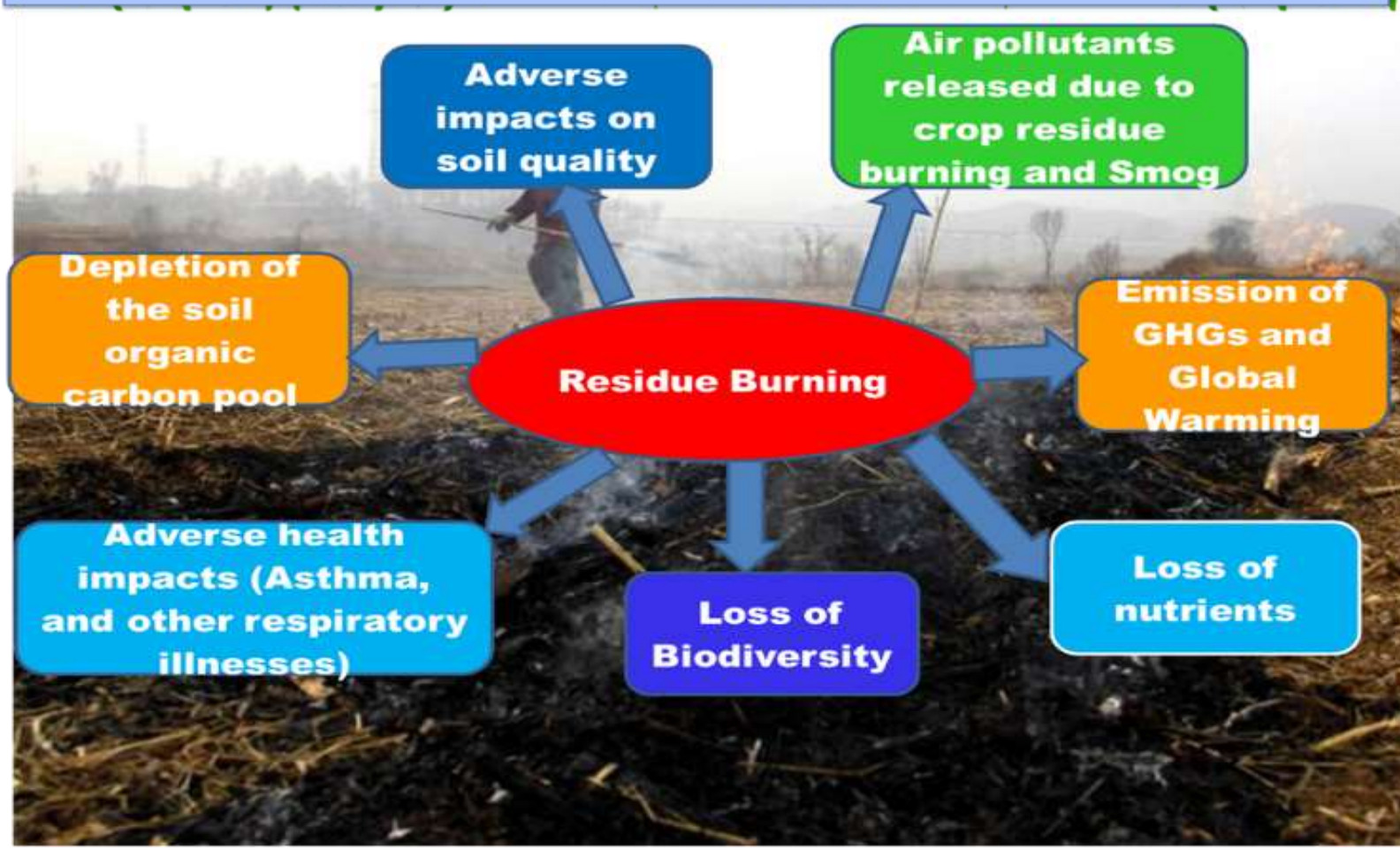
600-650 Mt/year (crop residue)

S. No.	Crop	Generation (Mt)
1	Rice	104.6
2	Wheat	93.9
3	Maize	21.6
4	Millets	20.7
5	Sugarcane	357.7
6	Fibre crops	8.1
7	Pulses	17.2
8	Oilseeds	30.0

Why Farmers Do Crop Residue Burning

Farmers are frequently doing this practice due to the following





1. Quickly clears the field and is cheap
2. Kills weeds, including those resistant to herbicide
3. Can reduce nitrogen tie-up
4. Use of harvesters
5. Scattered, collection is time and labour consuming
6. No economic alternate use
7. Declining number of livestock
8. Long period for composting
9. Require higher tillage operations

Alternative management of crop residues

Energy

1. According to the estimates of MNRE the total power production potential of surplus agro-residues is 18729 MWe^2.
2. Kalpataru Power Transmission Limited (KPTL), Rajasthan is successfully generating energy from crop residues in Ganganagar and Tonk districts of Rajasthan.
3. The plant is utilizing 80,000 tonnes of biomass of mustard crop, annually to generate 1.5 lakh kW energy per day (Gupta, personal communication).
4. However, the plant also produces a large amount of ash which has to be managed in a profitable and environment friendly manner.

Ethanol

5. The conversion of ligno-cellulosic biomass into alcohol and used as a neat fuel in internal combustion engines.
6. The theoretical estimates of ethanol production from different feedstock (corn grain, rice straw, wheat straw, bagasse and saw dust) varies from 382-471 l tonne-1 of dry matter (Demirbas and Sahin, 2009).

Gasification

- One ton of biomass can be used for generation of 300 kWh of electricity
- As per another estimate energy potential of rice (41 Mt yr-1), maize (6.2 Mt yr-1), sugarcane (240 Mt yr-1) and others residues (163.5 Mt yr-1; cotton, and coconut shell and fronds) is 4700 MW, 700 MW, 8900 MW and 28000 MW, respectively

Biochar

A. There is a need to develop low cost pyrolysis kiln for the generation of biochar to utilize

surplus crop residues, which are otherwise burnt on-farm

B. However, if all the products and by-products such as heat energy, H2 and bio-oil are captured and used in the biochar generation process, it would become economically-viable

Biomethanation

1. Approximately 70-75% of dry weight of biomass is converted into condensable vapours, which on cooling within a couple of seconds, yields a dark brown viscous liquid known as bio-oil (TERI).
2. The calorific value of bio-oil varies between 16-20 MJ kg-1 (Demirbas, 2008).

Composting

1. The residues of rice from one hectare give about 3.2 tonnes of manure as rich in nutrients as farmyard manure (FYM) Indian Agricultural Research Institute (IARI), New Delhi, has successfully developed a biomass compost unit for making of good quality compost.

2. This mechanized unit efficiently uses waste biomass and crop residues generated in the IARI farm.

Mushroom

1. Wheat and rice straws are excellent substrates for the cultivation of *Agaricus bisporus* (white button mushroom) and *Volvariella volvacea* (straw mushroom).

2. Paddy straw is key ingredient to be utilized as a raw matter for mushroom culture in Punjab but in general farmers are in use of wheat straw as raw material

3. For production of button mushroom, some operations like washing of straw and draining of excess water, cutting of straw, and preparation of bundles are necessary

Animal feeding

1. Feed to domestic animals in forms ranging from traditional stubble-grazing of harvested grain fields to preparation of chopped residue.

Residue management through C.A. Practices

1	Stubble shaver	Cuts and mixes the straw in the field and reduced subsequent farm operations.
2	Happy combo seeder	Simultaneously cuts the standing straw, plants wheat and throw the straw on the planted seeds.
3	Straw baler	It cuts the straw from combine harvested fields and makes bundles. Straw burning causes environmental pollution.
4	Straw reaper	It cuts the standing straw left in the field after combining and throw it in a trolley at the rear. 1000 kg of straw/ha & 40-50 kg/ha grain can be recovered.

Benefits of residues retention on soil

- Moisture conservation
- Nutrient supply
- Weed control
- Soil temp. moderation
- Pollution control
- Reduced GHGs emission
- Carbon sequestration
- Pest control

Other Measures Can Be Taken To Prevent Crop Residue Burning?

1. Legal ban and penalty on crop residue burning as an offence under the Air Act of 1981

2. Technology use for monitoring and prevention

3. Establishment of a market place for crop residue

4. Campaigns on adverse effects of crop residue burning for public awareness

5. Subsidy on Agri-implements.

6. Crop diversification

*****

DORMANCY: A CONSTRAINT TO SEED QUALITY

Senthilkumar V.
(Ph. D. Research Scholar)
Dept. of Genetics and Plant Breeding
College of Agriculture,
G.B.P.U.A.T., Pantnagar, Uttarakhand

Quality in seed is determined by its physical, genetic, physiological and health components. Dormancy observed in seed is a physiological factor which has considerable bearing on seed quality**.** Seed dormancy is the temporary failure of a viable seed to germinate, after specific length of time and in a particular set of environmental conditions that allow germination after the restrictive state has been terminated by either natural or artificial conditions. Seed begins its development from an ovule, grows in size, accumulates large quantities of food reserves, loses moisture and enters a variable period of dormancy before it germinates and give rise to next generation. Since, young plants are vulnerable to drought and extremes of heat and cold, it is advantageous for the seed to remain in an inactive condition until it reaches a time and space appropriate for germination.

Biological significance of dormancy

- Dormancy is advantageous in adapting the growth cycle of plants.
- To escape the detrimental effects of adverse natural environments and enhances chance of survival.
- Dormancy is important for preventing vivipary and precocious germination.
- To "Mother Nature", dormancy is a blessing that insures the continuation of the species over time and through periods of environmental stress.

Advantages of seed dormancy

a. Seedling survival.
b. Creation of seed bank.
c. Seed dispersal
d. Prevent premature germination of seed in field

Problems due to dormancy

a. Delay in generation
b. Problems encountered during seed germination and grow out tests.
c. Problems in maintaining optimum stands in commercial/seed fields.
d. Contributes to longevity of weed seeds.

Types of Dormancy

Several classifications have been proposed by different Scientists.

1. Crocker (1916):

a. Immature or underdeveloped embryo.
b. Seed coat impermeable to water.
c. Seed coat presents mechanical resistance to germinating embryo.
d. Seed coat poorly permeable to gases.
e. Metabolic block within the embryo.
f. Combination of above factors.
g. Secondary dormancy.

2. Roberts (1972)

A. Innate.
B. Induced
C. Enforced

3. Baskin and Baskin (2004)

1. Physiological dormancy (Deep, Intermediate, Non-deep)
2. Morphological dormancy
3. Morpho-physiological dormancy
4. Physical dormancy
5. Combinational dormancy.

4. Nikolaeva (1969, 1977)

A. Exogenous dormancy
B. Endogenous dormancy
C. Combined dormancy
D. Secondary dormancy

Breaking seed dormancy

Dormancy breakdown is observed under natural as well as artificial conditions.

- **Natural**
- **Treatments to break dormancy:**

Scarification-Rubbing, Piercing, Complete removal or breaking of seed coat, soaking seeds in conc. H_2SO_4.

Stratification- Pre-chilling, Pre-heating, Hot water treatment

- **Growth regulator & other chemicals- Gibberellic acid, KNO_3, Thiourea**

Involvement of hormones and growth regulators in seed dormancy

The mechanisms of dormancy and its release involve the action of inhibitors and other growth promoting hormones e.g., Gibberellins, ABA, Cytokinin, Ethylene.

Maurya *et al*. (2002) evaluated 11 genotypes of mustard in which dormancy period ranged from 4 to 8 weeks and found that pre-chilling at 5^0C and 10^0C for 3 days period was effective in overcoming dormancy, while potassium nitrate did not show significant response.

Shanmugavalli *et al.* (2007) observed combination of treatments on germination and seedling characters in fodder sorghum *cv.* COFS29 and found that seeds scarified with sulphuric acid for 6 minutes and soaked in KNO_3 increased germination percentage to higher extent.

Rahman *et al.* (2006) conducted experiment to evaluate effect of GA_3 on sprouting of garlic cloves and found that 250 ppm concentration of GA_3 gave maximum sprouting.

Rout et al. (2009) conducted study on *Elephantopus scaber* and found that scarification, cold stratification at 5±1ºC for a period of 40 days and gibberellic acid at conc. of 1000 mg/l was effective in breaking seed dormancy.

Ersin (2009) found that all *Medicago* species except for *Medicago polymorpha* showed improvement in germination rates using MSS (Mechanical Scarification + Sodium hypochlorite). The seeds of *M. polymorpha* showed higher germination rates with CSA (Chem. scarification with $H_2SO_{4)\ or}$ IWB (Incubation in water bath at 90^0C) than MSS. For *Trifolium* species, results indicated that there was a great variability among species with regard to the treatments.

Ertkin and Kirdar (2010) found highest germination percentage in strawberry seed with combination of treatments i.e., stratification at 4^0 C for 60 days and soaking seeds in 50 mg/100ml polystimulin for 48 hr.

Koyuncu (2004) worked on Black Mulberry seeds and found that 1000 mg/l GA_3 was more effective and seeds stratified for 100 days showed maximum germination. The combined treatment of 250 mg/l GA_3 and 100 days of stratification showed maximum germination.

Girashe *et al.* (2002) worked on *Acacia* species and found that most of the species exhibited seed coat-imposed dormancy. The best treatment for breaking dormancy was found to be scarification, treatment with conc. sulphuric acid for 5 min. and hot water treatment.

Conclusion

Dormancy is failure of an intact viable seed to complete germination under favorable conditions. Seeds of some species are prevented from completing germination because the embryo is constrained by its surrounding structures. Dormancy is regulated by interaction of growth promoters and

inhibitors. ABA and GA are important factors controlling dormancy in most seeds. Dormancy breaking treatment can be given to the seed based on the type and place of seed dormancy. Scarification is used to overcome coat-imposed dormancy and stratification to embryo-imposed dormancy. Soaking seeds in KNO_3, IAA, Thiourea and H_2SO_4 helps to overcome dormancy. Combination of different treatments are more effective in breaking dormancy of most seeds.

Future Thrust

- Focusing on primary events of dormancy: Perception and transduction of the dormancy breaking signals.
- Genetic factors associated with dormancy should be investigated.
- Molecular mechanisms involved in dormancy of seeds should be properly understood.
- Role of pre- and post-harvesting factors leading to dormancy should be studied.
- For management of dormancy, storage conditions and marketing of the seed should be studied thoroughly.

******

HONEY BEES ARE BOON FOR THE PRODUCTIVITY OF NIGER (*Guizotia abyssinicacass.*) IN TRIBAL AREAS OF ANDHRA PRADESH

P. Seetharamu
Senior Scientist (Entomology)
ANGRAU, Regional Agricultural Research Station,
Chintapalle,Visakhapatnam District (A.P.)

D. Sekhar
Senior Scientist (Agronomy)
Regional Agricultural Research Station,
Chintapalle, Viakhapatnam District (A.P.)

G. Ramarao
Associate Director of Research
ANGRAU, Regional Agricultural Research Station,
Chintapalle, Visakhapatnam District (A.P.)

Pollination is an essential ecosystem service that enables plant reproduction. More than 75% of leading food crops depends on animal pollinators. Of the approximately 300 commercial crops, about 84% are insect pollinated. Among these honeybees are substantially important in world's agricultural economy, in that 35% of the world's food production relies on pollinators, of which the honeybee accounts for 70-80% which is the largest portion. This is attributed to the body structures, social and instinctive behavioral characteristics of the honeybee. Honeybees are regular visitors of the flowers to be pollinated. They can visit many flowers and plants per unit time. As well as honeybees have a well-developed communication system that enables individual bee to be alerted to the needs of the colony and to the location of suitable food source. The pollinating potential of a single honeybee colony becomes evident when it is recognized that its bees make up to 4 million trips per year and that during each trip an average of about 100 flowers are visited. These indicate that pollen or nectar gatherers spend much less time at each flower, which means that they visit more flowers per unit of time, thereby increasing their effectiveness as pollinators. These extraordinary activities of the honeybee play an important role in its function as a successful insect pollinator. The value of additional yields obtained by pollination service rendered by honeybees is 15-20 times more than the value of all hive products put together (Sujatha, 1993, Bareke, 2019). In general, a lot of crops are benefited from honeybees worldwide in general and some of them are listed below: From oilseed crops *Guizotia abyssinica* (niger), *Linum usitatissimum*, *Brassica carinata*, *Carthamus*

tinctorius, *Sesamum indicum* and *Arachis hypogea*; pulses, *Vicia faba*, *Medicago sativa*, *Lathyrus sativus*, and *Cicer arietinum*, *Pisum sativum*, *Lentis culinaris* and horticultural crops *Malus sylvestris*, *Allium cepa*, *Citrus aurantium*, *Carica papaya*, *Mangifera indica*, *Coffea arabica*, *Citrullus lanatus and Lycopersicon esculentum* etc.

India is one of the largest producers of oilseeds in the world and it occupies an important position in the Indian agricultural economy. There are nine important oilseeds crops grown in India out of which seven are of edible oils (Soybean, Groundnut, Rapeseed Mustard, Sunflower, Sesame, Safflower and Niger) and two are of non-edible oils (Castor and Linseed). Among all edible oilseed crops, Niger (*Guizotia abyssinica* Cass.) is one of the important oilseed crops of Southern and Central India. The genus *Guizotia* belongs to family compositae (Asteraceae), tribe heliantheae and sub tribe coreopsinidae. Niger (*Guizotia abyssinica* Cass) is a crop of tribalregion and is one of the most important minor oilseed crops of India. Niger hasmany different local names but, the most commonly is as ramtil, jagni or jatangi (Hindi), ramtal (Gujarati), karale or khurasani (Marathi), uhechellu (Kannada), payellu (Tamil), verrinuvvulu, valiselu/adusulu(Telgu), alashi (Oriya), sarguza (Bengali), ramtil (Punjab) and sorguja (Assamese) in various parts of the country. In addition, it is cultivated to a limited extend in Ethiopia, South Africa, West Indies, Zimbabwe and India. In India, it is mainly cultivated in tribal pockets of Madhya Pradesh, Orissa, Maharashtra, Bihar, Karnataka and Andhra Pradesh. It is also grown sizeable area in certain region of Arunachal Pradesh, Gujarat, Uttar Pradesh, Tamil Nadu and Rajasthan. In India it is being cultivated in an area of 3.824 lakh hectare and with an annual production of 1.064 lakh tones (Rai *et al*., 2016). The productivity of Niger is low, around328 kg/ha in India. In Andhra Pradesh, Niger is cultivated in 6 thousand hectares of area with production of 20 thousand tonnes with productivity of 390 kg/ha (Anonymous, 2014-15). The high altitude tribal zone of Andhra Pradesh receives heavy rainfall more than 1200 mm particularly comprising of the tribal areas of Srikakulam, Vizzianagaram and Visakhapatnam districts are very potential areas where Niger is grown as a major oilseed crop for the tribal farmers in this zone. Niger is a completely out crossing species with a self-incompatibility mechanism (Jagtap *et. al*., 2014). Agriculture plays a role in declining native pollinators through the modification and elimination of pollinator habitats and the use of excess agricultural chemicals including pesticides, herbicides and fertilizers (Donaldson, 2002). Higher yields of Niger could be achieved of crop should be planted on suitable date of avoid rains coinciding flowering period of crop when visit of bee is essential for seed set. Utilization of bees in pollination not only increased the yield of various crops but also improves their quality. It helps for uniform maturity and early harvest of the crop. In Niger crop, open pollination (OP) and bee pollination (BP) increased the number of filled seeds, yield and also oil content percent. Thus, exploitation of bees for pollination is one of the best strategies for enhancing the crop production.

Indian bee (*Apis cerana indica*)

Europian bee (*Apis mellifera*)

Out of the total pollinators on niger four species of flower visitors were observed during the flowering period belonged to orders Hymenoptera (4

species), Lepidoptera (2 species) and Diptera (1 species). The overall diversity of pollinators were more during morning hours (9.00AM to 11.00AM) and gradually decreased after 12.00PM to 3.00PM. Among different pollinator species *Apis ceranaindica, Apis florea* was more abundant followed by *Apis dorsata and Apis mellifera*. The peak activity of *A. florea* was observed at 10.00AM followed by *A. ceranaindica* and *Apis mellifera* at 10.00-11.00AM and *A. dorsata* was at 9.00AM. The highest number of probing was observed in *A. florae* (7.52) followed by *A cerenaindica* and *A. mellifera*. The time (sec) taken for one probing was highest in *A. ceranaindica* followed by *A florea* and *A. dorsata*. The highest amount of pollen collection was observed in *Apis mellifera*. The number of filled seeds observed 37.66% less in caged condition when compare with open pollination and there was significant decrease in the yield in caged condition when compare with open pollination indicating importance of pollinators specifically honey bees for successful production of Niger (Rao and Suryanarayana, 1990). Keeping in view of the role of the bee pollinators, it is recommended to keep sufficient number of honeybee colonies in the vicinity of *G. abyssinica* fields during its flowering period to increase the pollination efficiency and thereby enhance seed productivity and also uplift the tribal farmers income by this integration of niger and apiry in the tribal areas of Andhra Pradesh.

Conclusions

Pollination is an important ecosystem services and honeybee is valuable pollinator. Honeybee pollination improve the yields of niger, onion, apple etc., However, unwise use of pesticides application affect the integration of beekeeping and crops. Unwise application of pesticides during the flowering period of target crops should be avoided and to ensure the protection of honeybee health. Farmers should use eco-friendly organic insecticides derived from plant extract and integrated pest management practice should be promoted for control of pests in their agriculture field.

******

COCCIDIOSIS IN POULTRY: TREATMENT AND PREVENTION

Hitesh Muwal
Ph.D. Research Scholar
Department of Animal Production, MPUAT, Udaipur

Vinod Bhateshwar
Ph.D. Research Scholar
Deptt. of Dairy Science and Food Technology
Institute of Agricultural Sciences, BHU, Varanasi

Coccidiosis is the most important protozoan disease of poultry which is caused by the intracellular parasite of genus *Emeria* and resulting in significant economic losses worldwide. This disease is endemic in most of the tropical and subtropical regions of the world and transmitted through feco-oral route. It commonly affects young chickens and chickens managed under intensive system. Poultry coccidiosis is characterized by bloody diarrhea, ruffled feathers, dehydration and paleness of comb clinically and thickening of intestine, hemorrhage and necrotic enteritis at the specific site of intestine of chickens during necropsy depending on the species of *Emeria* involved. Diagnosis is based on clinical signs, coprology and post mortem examination routinely though various biochemical and molecular methods have also been used in recent years. Coccidiosis causes huge economic losses mainly due to production losses and costs of treatment or prevention. It is concluded that poultry coccidiosis is still the most important protozoan disease of poultry and have a great economic impact worldwide; and good manage mental practices including good hygiene and bio security measures should be applied for the control and prevention of the disease.

Geographical distribution of this disease

Coccidiosis is a widespread disease in growing chickens around the world that can seriously restrict the development of poultry production. The disease is endemic in most of the tropical and subtropical regions where ecological and management conditions are favorable for sporulation of oocyst and development the causative agent. In the past years coccidiosis used to be the most important cause of mortality in all farms. Incidences of the disease were as high as 80% usually occurring in the form of outbreaks. The disease contributed to be a problem with prevalence rate of 50.8% and 11% in deep litter intensive system and backyard poultry production systems, respectively.

Epidemiology of chicken coccidiosis

Coccidiosis disease is promoted by poor housing and management system of poultry. The disease is more widespread in the intensive deep litter system. This kind of system does not only support the breeding of oocyst but also increases the incidence of infection among chickens. Coccidia oocyst sporulate under warmth condition of about 25–30 °C with adequate aeration and water while dry condition at 10 °C delays sporulation. Coccidiosis affects chicken of all ages, but the infection begins at younger age when the immune system is immature. The disease affects both the intestine and caecum with incubation period of 5–6 days respectively. Coccidia infection outbreak occurs when chicks ingest large quantities of sporulated oocyst. Reduced food intake, bloody diarrhea and loss of weight are some of the symptoms associated with infected birds. The severity of the disease is dependent on the number of Eimeria species that co-infect the birds. Coccidia oocysts are shed by infected chickens through their fecal droppings and these contaminate water, food and soil.

Lesions and pathogenicity of *Eimeria* species in chickens

The presence of intestinal lesions depends on the *Eimeria* species. The most important poultry Eimeria species are: Currently, seven species of *Eimeria* are known to infect chickens and differ in pathogenicity: *Eimeria maxima, E. tenella, E.*

acervulina, E. bruneeti, E. mittis, E. necatrix and *E.praecox.*

Life cycle of cocsodiosis

- The life-cycle is short and starts with the bird ingesting sporulated oocysts.
- The sporulated oocysts contain four sporocysts, each containing two sporozoites and the mechanical and acidic environment in the gut result in the release of these sporocysts and sporozoites into the gut.
- The sporozoites invade the duodenal mucosa epithelial cells before undergoing phases of growth and multiplication with periodic release of merozoites into the gut.
- Merozoites develop within the duodenal cells as gametes, in the form of both macro- and microgametocytes.
- These develop into a zygote and then an oocyst which is shed in the faeces.
- These oocysts require moist conditions to undergo sporulation, a process that requires oxygen and takes about 24 hours, at which point they become infective.

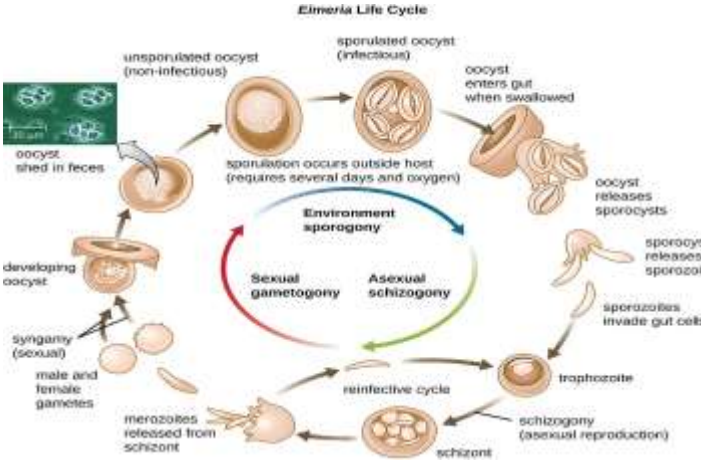


Fig.1: *Eimeria* life cycle in chicken.

Clinical symptoms

- Affected birds appear dehydrated with drooping wings and ruffled feathers.
- They may huddle together and severe watery or bloody diarrhoea.
- Droppings of affected birds usually contain blood, fluid, and mucus.
- Emaciated and anaemic appearance.
- High mortality and most occurs between 5 and 6 days following infection.
- Causes poor weight gain and
- Egg production may be reduced in laying birds.

Fig. 2: Clinical symptoms of cocsodiosis disease in chicken.

Gross lesions

- ✓ Caeca enlarged with clotted blood.
- ✓ Middle portion of the small intestine is distended to twice its normal size.
- ✓ Intestinal lumen filled with blood.
- ✓ Lining of the small intestine covered with tiny hemorrhages.
- ✓ Intestinal mucosa swollen and thickened.

Fig. 3: Gross lesions of cocsodiosis disease in chicken.

Prevention and control of cocsodiosis in chicken

- ✓ Coccidiosis is far more easily prevented than treated.
- ✓ Control depends mainly on drugs, although an effective vaccine is now available for breeder or layer replacements.
- ✓ Two types of vaccines have been used to obtain immunity (protection) against coccidiosis.
- ✓ Birds are vaccinated through drinking water between the age of 5 and 9 days.

- ✓ The use of one anticoccidial in the starter and another in the grower feed is called a 'shuttle programme'.
- ✓ Hygiene and biosecurity along with measures to prevent contamination of feed and water with droppings can prevent the occurrence of infection.
- ✓ Dry litter and raking of litter at regular intervals prevent sporulation of oocysts, thereby minimizes chances of infection.
- ✓ During rainy season lime powder can be used to dry the litter and to render the oocysts ineffective.
- ✓ Use of anticoccidial in feed as feed additives (e.g.; lonophores, sulphonamides, and quinolones) can avoid acute outbreak.
- ✓ Rotation of anticoccidial every 4-6 months are helpful in maintaining their efficacy and restricting the development of resistance.

Fig. 4: Material uses in control of coccsodisis disease in chicken.

*****

MOLECULAR APPROACHES IN ENTOMOLOGICAL RESEARCH ASSOCIATED WITH SF TRANSGENIC TECHNOLOGY AND IMPLICATIONS

Dwarka*
Ph.D. Research Scholar
Deptt. of Entomology
JNKVV, Jabalpur M.P.

Babli
Ph.D. Research Scholar
Deptt. of Plant Pathology
RVSKVV, Gwalior, M.P.

Shiv Kumar Ahirwar
Ph.D. Research Scholar
Deptt. of Hort. (Fruit Sci.)
JNKVV, Jabalpur M.P.

Transgenesis consists of introducing an exogenous DNA sequence into the genome of a pluricellular organism, which then becomes present in most cells and is transmitted to progeny. Transgenesis is different from gene therapy. In the latter case, the germ cells do not harbour the foreign DNA. The DNA fragments used to generate transgenic organisms are genes containing a sequence preceded by a promoter driving its expression to an RNA or a protein. The gene transcript may be an RNA not translated into a protein: Antisense RNA, ribozymes etc.

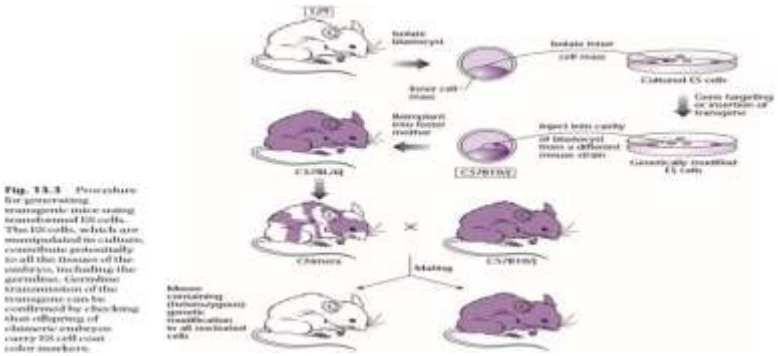
Aim of transgenesis

1. To add foreign genetic information to a genome.
2. To suppress an endogenous gene.
3. To replace a functional gene by another functional gene.

The foreign gene may be a mutant of the endogenous gene or a completely different gene.

Applications of Transgenic Technology

1. Genetic bases of human and animal disease- Design & Testing of therapy.



Embryonic stem cell method

2. Disease resistance in humans and animals. Gene Therapy Drug and product testing and screening.
3. Novel product development through "molecular pharming".
4. Production Agriculture.

Embryonic stem cell method

- In the ESC method, cells at Blastocyst stage are proliferated in a cell culture.
- Foreign DNA is inserted into the ESCs by electroporation or microinjection method and the desired segment is identified with the help of PCR and marker genes.
- The gene construct of interest is fused to blastula cells and the modified blastula is implanted into the host mother.
- The offspring obtained from this are mated with normal animals to obtain transgenic species.
- The advantage of this technique is that the DNA of interest can be inserted to the exact locus.
- First offspring produced from such animals are chimeras.
- True transgenic animals are obtained in the second generation.

Pronuclear microinjection

1. Pronuclear microinjection involves the direct transfer of DNA into the male pronucleus of the fertilized mouse egg.

2. Just after fertilization, the small egg nucleus (female pronucleus) and the large sperm nucleus (male pronucleus) are discrete.
3. Since the male pronucleus is larger, this is usually chosen as the target for injection.
4. About 2 pl of DNA solution is transferred into the nucleus through a fine needle, while the egg is held in position with a suction pipette.
5. The injected embryos are cultured in vitro to the morula stage and then transferred to pseudopregnant foster mother.
6. The procedure requires specialized microinjection equipment.
7. The resulting animal may be transgenic or may be mosaic for transgene insertion.
8. The technique is reliable, although the efficiency varies, so that 5–40% of mice developing from manipulated eggs contain the transgene.
9. Once the transgene is transmitted through the germline, it tends to be stably inherited over many generations.
10. The exogenous DNA tends to form head-to-tail arrays prior to integration, and the copy number varies from a few copies to hundreds.
11. The site of integration appears random and may depend on the occurrence of natural chromosome breaks.

Retroviral Vector Method

This technique has generally been used to produce transgenic mice where DNA fragments of small size (8 kb) could effectively be transferred.

Drawback:

1. Retroviral contamination, which can interfere in the signal that determines expression of the inserted gene.
2. Risk of losing regulatory sequences.
3. It is therefore not a commonly used method
4. Recombinant retroviruses provide a natural mechanism for stably introducing DNA into the genome of animal cells.
5. Retroviruses are able to infect early embryos (as well as ES cells), so recombinant retroviral vectors can be used for germline transformation.
6. An advantage over the microinjection technique is that only a single copy of the retroviral provirus is integrated, and the genomic DNA surrounding the transgenic locus generally remains intact.

Conclusion

The goal of modern molecular cell biology is nothing short of understanding the biochemical, cellular, and organism functions of all the proteins encoded in the genome. In the preceding sections, we have discussed the isolation and analysis of mutants, the genetic mapping of mutations, and finally the isolation and cloning of mutation-defined genes. This approach can provide valuable information about the molecular mechanisms underlying the cellular processes affected by the original mutations and the in vivo functions of the normal proteins encoded by the affected genes.

*****

LASORA:

FUTURE FRUIT FOR ARID & SEMI-ARID ZONE

D. Vidhya
Assistant Professor (Horticulture)

M.S. Aneesa Rani
Professor (Horticulture)
Department of Fruit Science
Horticultural College and Research Institute
TNAU, Coimbatore, Tamil Nadu

Lasora (*Cordia myxa* L.) is an underutilised fruit and an important herbal tree in our rural India. Botanically lasora belongs to Boraginaceae family. In India this fruit tree is otherwise called as Gonda or Lasoda (Lasora) or lehsua or Indian Cherry or Naruvali in tamil. Globally, this fruit is commonly called as Assyrian Plum, Pidar, Panugeri, Geduri, Spistan, and Burgund dulu wanan. This tree is found growing not only all over Asia but nearly whole of the globe, especially in tropical regions having the right type of geophysical environment. In the Indian subcontinent, lasora is seen coming up naturally and growing abundantly from Myanmar in the East to Afghanistan in the West. It is a smaller, medium sized tree with crooked stem grown in arid and semi-arid regions of India except higher elevation. Its systematic cultivation is lacking but it finds place as wind break in orchards, planting along street, roads as an avenue planting etc. and they were grown without care and management as well as grown singly in shady ravines and valleys. The crop has the capacity to tolerate drought and hence quite widespread in arid and semi-arid regions of north India. Lasora is a multipurpose plant, it has long been associated with health, nutrition and other diversified uses.

Importance of Lasora

The tree has multipurpose values to the human kind. The fruit has medicinal property such as astringent, anthelmintic, diuretic, demulcent and expectorant. Leaves are used for making leaf plate, bark is used for making paper pulp, and wood is durable in water and is used for building boats, furniture, agricultural implements as well as fuel wood. It is rich source of carbohydrate; pulp content varies from 94 to 97%. Total soluble solids (TSS) of the pulp varied from 6-7%, acidity from 0.08 - 0.1 % and Vitamin C from 32 to 48 mg/100g (Singh, 2001). The immature fruits of gonda are used as vegetable, pickled with raw mango and can be dehydrated for use in off season. Ripe fruits are also eaten freshly and may be used for preparation of liquor. The fruits and other plant parts are used in curing various ailments *viz*. skin diseases, dropsy, dysentery, dyspepsia, cholera and headache *etc*.

Climate and Soil:

The lasora plants are tolerant to drought and moderate shade. It can tolerate temperature as high as 49°C. Rainfall to the extent of 250-300 mm is sufficient to meet out the requirement. Lasora is not very strict in soil requirement and can be grown successfully in wide range of soil. However, it grows well on sandy to clay loam soil and is tolerant to salinity.

Varieties

Maru Samridhi

This variety has been released by Central Arid Zone Research Institute, Jodhpur recently. It is

Young tree

Bearing tree

Immature fruit

Matured fruit

an improved high yielding variety with an averages fruit yield of 85 kg fruits/plant. Mean plant height and canopy diameter is 4.5 m and 7 m respectively. It is regular fruit bearer, and starts fruiting in third year of planting. Its flowering occurs during February-March and fruits mature during April-May. Average fruit weight is 10.5 g, edible part 84.61%, crude protein 11.06% (dry weight basis), crude fibre 13.4% (dry weight basis) and dry matter 15.37%.

Thar Bold

A prolific and early bearing lasora (*Cordia dichotoma*) has been identified as "Thar Bold" (CIAH/ LS-3) through selection. It bears bold fruits in cluster with high production of 1.5-2.0 q tender fruits per tree per year. The tender fruits are suitable for making vegetable, pickles and for dehydration purpose. Fruits can be also utilized as table fruit and also for processing purpose. This variety is recommended for commercial cultivation both as block plantation and also a component of agro-forestry system in arid and semi-arid region of the country.

Karan Lasora

Variety released by Sri Karan Narendra Agriculture University (SKN), Jobner centre with the name 'Karan Lasoda'. The genotype is perennial in nature and vigrous in growth habit. The buded plants grow fast and attain good growth (5.45m) and yield fruits in 4-5 years. The bigger size leaves are green to dark green in colour with a leaf length (17.20 cm).

Propagation:

Lasora can be propagated by seeds as well as by vegetative means. The seeds extracted from freshly harvested ripe fruits are sown in polybags during June-July. Among the vegetative methods, “T” budding has been found successful with more than 90% success was obtained during August month. For budding it is recommended that 60-75 days old seedling rootstocks need to be used as a rootstock and bud wood from actively growing shoots was found to be the most congenial for

propagation by budding. *Cordia gharaf* was found superior rootstock over *Cordia dichotoma*. Seed treatment with GA_3 (250 ppm for 2 hours) improved germination to 50% as compared to only 10 % in control. However, the highest germination was recorded when this treatment was preceded by mechanical scarification. Maximum bud take was observed when it was done on 15thAugust (95%) on gonda rootstock and, though it could be done till 15th September with identical success.

Planting:

Under arid conditions, the best planting time is during July-August. Systematic planting can be done at a spacing of 5-7m depending upon the rain fall and soil types. Pits of the size of 60 x 60 x 60 cm are dug out during May- June to ensure natural sterilization of soil through intense solar radiation. Pits were filled with using FYM and top soil in the ratio of 1:1. Lasora can be planted as a boundary plantation for shelter belt purpose, for this planting should be done at 5 meters spacing while commercial plantation of improved varieties in arid region should be done at 6x6 m spacing.

Training and Pruning:

The budded plants tend to grow laterally. Heading back of the main shoot is done after about two months of the planting leaving about 20-25 cm from ground level. This induces secondary shoots from the remaining portion of the shoots. The upright growing shoots are retained and the rests are pruned. In due course of time 3-4 well spaced upright growing limbs are allowed to develop as main scaffold. The sprouts coming from rootstock portion should invariably be removed as and when they appear. All dried up and over crowded branches should be pruned during the first week of February. Many branches get dried due to gummosis during March-April, such branches should be thinned out after fruit harvest.

Irrigation:

Regular irrigation is required during initial three years. In general, irrigation at 15 days during winter and at 7-10 days interval during summer is sufficient for newly planted plants. Irrigation should be provided during active growth period. Light irrigation should be done at weekly interval during flowering to maintain turgidity to prevent fruit drop. Agro techniques have been developed to take early and uniform fruiting by defoliation and irrigation scheduling. No irrigation is given during monsoon and winter season except occasional lifesaving irrigation. This facilitates leaf fall during December-January. The natural leaf fall is supplemented with manual defoliation to complete the process. Chemical defoliation may also be done with foliar spray of 1000 ppm of 2-Chloroethyle phosphonic acid during first week of January. The harvested leaves of each tree are spread in the basin of same tree and covered with thin layer of soil. This helps to conserve moisture besides bringing down the soil temperature. Manuring and irrigation are started from first week of February onwards with the rise in temperature. This ensures new growth and flowering which occur almost simultaneously. Regular irrigation is given after this till April or when fruit harvest is completed. The fruits attain marketable maturity after 40-50 day of fruit setting. Mature green fruits are harvested before ripening. On ripening fruits turn yellowish brown. Ripened fruits are harvested for extraction of seeds for raising nursery.

Manure and fertilizers:

The amount of fertilizer largely depends upon the age and size of tree. The nutrient requirement of the plant has not been standardized. However, application of well rotten FYM 20 kg per plant during July-August and 20 kg per plant during February before flowering is sufficient for optimal fruiting. The exact nutrient requirement is yet to be determined after experimentation.

Disease and Insect:

Gummosis induced drying of branches occur invariably on *lasora* plants during March-April, September-October. The gum flow in the phloem

region of branches impedes the sap flow which causes the terminal branches to dry. The exact cause of gummosis is still not known. The adverse impact of gummosis can be reduced by pruning of dried up branches and scrapping of the branches affected by gum oozing and spray of Bordeaux solution. There is no serious pest on *lasora* except that sometimes aphids/jassids infect the young leaves and inflorescence during cloudy days which normally do not affect much to the plants as they disappear during sunny days. In case the infection persists, it can be controlled easily with the spray of monocrotophos 25% SL @1 ml/liter water.

Harvesting and Yield:

Flowering starts in last week of February and fruit set in the month of March-April. The fruits are ready for harvest after about 30-45 days of fruit set. The fruits are harvested at mature green stage before initiation of ripening for culinary purposes. The harvesting has to be done in staggered manner as all fruits do not mature at the same time and should be completed by first week of May. Fruits start ripening during first week of May. Fruits turn yellowish cream upon ripening and are very sweet. The TSS of fully ripened fruit has been recorded up to 25^0 Brix. Though, ripened fruits have no market value, but they are best for extraction of seeds for raising nursery for use as rootstocks and hence they can be sold to commercial nurseries at premium rate for addition income.

Conclusion

More studies are needed to advance understanding of the fruit's production and postharvest technology improvement and to develop useful postharvest technologies to help maintain quality and extend shelf life. Those area of research need to not only encourage farmers to grow more lasora, but also would promote culinary uses and research into other applications especially pharmacology applications.

*****

THE UNTAPPED NUTRIENT SOURCES OF LEGUME

P. Kavya, A. Sowjanya
B.N. Sandeep Naik and G. Rama Rao
RARS, Chintapalle, Vishakhapatnam Dist.
(A.P.)

Legumes have proven to be an affordable source of nutrients as well as subsistence income for farmers. In addition, the features like nitrogen fixation, suitability to different cropping systems, adaptation to biotic and abiotic stress conditions has made legumes an important crop for the farmers. But most cultivated legumes include black gram, green gram, red gram, chick pea. Etc which has become a part in daily cuisines, where the production is limited and to meet the demand we are depending on imports from other countries. Because of this situation legumes are not affordable to low income groups which is leading to malnutrition. To overcome this situation, the best alternative is to be identified. One among them is utilization of under neglected grain legumes. Based on the local usefulness, localized domestication, adaptation and abandonment, underutilized species are identified. Few among them along with salient features are presented below.

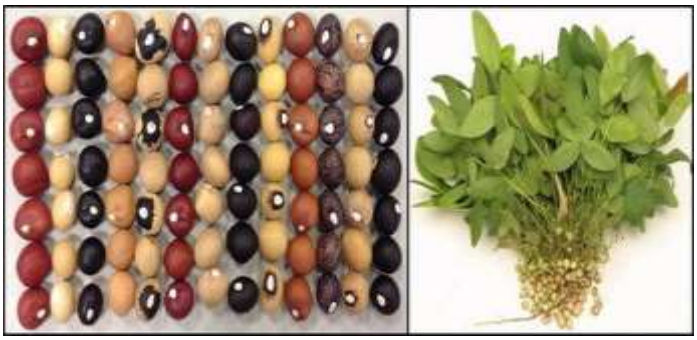
Adzuki bean

Vigna angularis, also known as the adzuki bean or red mung bean, is short duration vine crop widely cultivated throughout East Asia for its small bean. The cultivars have a uniform red color, but there are also white, black, gray, and variously mottled varieties. The adzuki bean is mainly cultivated in China, Japan, South Korea and Taiwan. In Japan, the adzuki bean is the second most important legume after the soy bean. Optimal temperature range for adzuki bean growth is between 15 °C and 30 °C. The adzuki bean is usually cultivated as rain fed crop and can withstand drought. In East Asian cuisine, the adzuki bean is commonly sweetened before eating. In particular, it often is boiled with sugar, producing red bean paste (*anko*), a very common ingredient in cuisines. Cooked adzuki beans are 66% water, 25% carbohydrates, including 7% dietary fiber, 8% protein, and contain negligible fat. Besides of culinary purpose it can also be used as medicinal purpose.

Bambara Groundnut

Vigna subterranea (Bambara groundnut, earth pea, ground-bean or hog-peanut). It is originated in West Africa. Like the peanut, pods ripen in underground. They can be eaten fresh or boiled after drying and can be ground either fresh or dry to make puddings. The growth cycle is between 90–170 days and under optimal conditions the cycle is about 120–150 days to pod maturity. It can be cultivated as single crop or as intercrop. Best suited intercrops

are sorghum, millet, maize, peanut, yams and cassa va. It is very drought resistant crop. The minimal annual rainfall requirement is about 300 mm. Optimal soils are sandy soils to prevent waterlogging. Bambara groundnut has nutritive value ranging between 57.9% to 61.7% carbohydrate and 24.0% to 25.5% protein content.



Broad bean

Vicia faba L. commonly known as the fava bean, or faba bean, It is widely cultivated as a crop for human consumption, and also as a cover crop. Crop duration varies from 60-90 days. Raw mature fava beans are 11% water, 58% carbohydrates, 26% protein, and 2% fat. Beans generally contain phytohaemagglutinin, a lectin that occurs naturally in plants, animals and humans. The relatively low toxin concentrations found in *V. faba* can be largely destroyed by boiling the beans for 10 minutes. Broad beans are generally eaten while still young and tender and also as fried snack. In India, fava beans are eaten in the North eastern state of Manipur.

Sword bean

Canavalia gladiata, the sword bean or scimitar bean, is a domesticated lant species. It is used as a vegetable in interior central and south central India, though not commercially farmed. It is an important food source, medicine, leafy vegetable. The unripe pods are also eaten as a vegetable in Africa and Asia. The red sword bean is one of the edible beans of china reportedly rich in antioxidant polyphenols with great medicinal uses. The crop matures in six to ten months after planting and is resistant to pests and diseases.

Rice bean

It is called as *Vigna umbellate*. It is regarded as a minor food and fodder crop and is often grown as intercrop or mixed crop with maize, sorghum, as well as a sole crop in the uplands, on a very limited area. Grown mainly as a dried pulse, it is also important as a fodder, a green manure and a vegetable. It is mostly cultivated by subsistence farmers in hill areas of Nepal, northern and north eastern India, and parts of South East Asia in small areas. Rice bean grows well on a range of soils. It establishes rapidly and has the potential to produce large amounts of nutritious animal fodder and high quality grain. It is having good source of protein, essential amino acids, essential fatty acids and minerals and the dried seeds make an excellent addition to a cereal-based diet. Till date, it is little researched and exploited. However, the use of rice bean as a green manure crop revealed that it is one of the best legumes for the purpose due to high biomass production over a short period of time, is

easy to incorporate into the soil, and decomposes rapidly.

Moth bean

Vigna aconitifolia is a drought-resistant legume, commonly grown in arid and semi-arid regions of India. It is commonly called mat bean, moth bean, matki or dew bean. The pods, sprouts and protein-rich seeds of this crop are commonly consumed in India. Moth bean can be grown on many soil types, and can also act as a pasture legume. Due to its drought-resistant qualities, its ability to combat soil erosion and its high protein content, moth bean has been identified as possibly a more significant food source in the future. It is a short-day crop, is one of the most drought-resistant pulses in India. Whole or split moth bean seeds can be cooked or fried. Breeding work is in progress on the moth bean.

Winged bean

The winged bean (*Psophocarpus tetragonolobus*), also known as cigarillas, goa bean, four-angled bean, four-cornered bean, manila bean, princess bean, asparagus bean, dragon bean, is a tropical herbaceous legume plant. Winged bean is widely recognized by farmers and consumers in southern Asia for its variety of uses and disease resistance. The entire winged bean plant is edible. The leaves, flowers, roots, and bean pods can be eaten raw or cooked; the pods are edible even when raw and unripe. The seeds are edible after cooking. Each of these parts contains vitamin A, vitamin C, calcium, and iron, among other nutrients. The tender pods, which are the most widely eaten part of

the plant. The seeds are about 35% protein and 18% fat. They can be eaten dried or roasted. The beans are rich not only in protein, but in tocopherols. Winged bean is a potential food source for ruminants, poultry, fish, and other livestock. Winged bean is an effective cover crop; planting it uniform with the ground suppresses weed growth. As a restorative crop, winged bean can improve nutrient-poor soil with nitrogen when it is turned over into the soil.

Hyacinth bean

(Lablab purpureus L.) is also known as Tonga bean, papaya bean, poor man bean cultivated for its edible seeds and pods. It is mainly grown in Africa and Asia as source of food in the form of vegetable, green pods, and seeds. The species is drought tolerant and water efficient and produces high yield. The protein content is comparable to that of soybean. It *has potential to* be a source of pharmaceuticals and nutraceutical as medicine and traditional medicine in Asia and Africa.

Jack bean

Canavalia ensiformis known as jack bean is the most economically important species in the genus *Canavalia*, with enormous potentials to serve as food for both humans and livestock. It is widely distributed in Africa, Asia, and America, with large-scale cultivation reported in Congo and Angola. It is rich in protein and thrives well in poor and acidic soils. Jack bean is mainly grown for its nutritious pods, seeds, and as fodder. It is a forage crop with high green manure capacity to enrich the soils and also to control soil erosion. The crop tolerates adverse environment, drought, heat, and leached soils; also it resists pest attacks. The leaf of jack bean contains crude proteins and fiber comparable to other legumes. Jack bean possesses deep root system which enables the plant to penetrate deeply into the soil which enables it to withstand very dry conditions.

Though these legumes have ample nutrients but they are undermined and needs light of focus. There is limited source of genetic enhancement in these crops. The germplasm of these crops need to be collected and studied, the breeding and biotechnological methods should be applied collectively to improve the genetic architecture, yield, nutritional contents, to reduce ant nutritional elements. The value addition of these crops should be focused and highlighted among the public. Funding of research projects to study these crops is the need of hour. Consumer awareness is to be created about the nutrient profile of these crops to create market value which would be remunerative to the farmers. Overall the cultivation of these crops reduce the dependency on major legumes by providing subsistence income to farmers as well benefits the consumers with nutrient surplus.

*****

HERBAL SUPPLEMENTS BENEFITS

IN DAIRY ANIMALS DURING THE TRANSITION PERIOD

Vinod Bhateshwar
Ph.D. Research Scholar
Deptt. of Dairy Science and Food Technology
Institute of Agricultural Sciences, BHU, Varanasi

Hitesh Muwal
Ph.D. Research Scholar
Department of Animal Production, MPUAT, Udaipur

Proper animal husbandry management may help to improve and maintain dairy animal performance. Long-term use of antibiotics and hormone therapies in farm animals to increase milk production is linked to health issues such as antibiotic residues and hormonal imbalances, resulting in poor farm animal health. Supplementing herbal preparations with antibiotics and hormones in dairy animals during the late dry period and early lactation period for desired production performances, reduced subclinical mastitis cases, and reduced negative energy balance in farm animals emerged as a useful and efficient possible substitute for antibiotics and hormones. More than 300 medicinal spices have been discovered throughout the world, according to reports. As described in Fig. 1, choosing suitable herbs for supplementing dairy animals has the potential to improve farm animal health and performance. The primary cause of most of the production losses and overall profitability of dairy farms is an excessive negative energy balance caused by nutrient mobilization during the transition period. The transition period (also known as the periparturient period) is the most important time in a dairy cow's life. The time from 3 weeks before parturition to 3 weeks after parturition is known as the transition period, and it is critical for the dairy cow's production and health. Dairy cows are more susceptible to metabolic disorders and infectious disease at this stage. During the transition from prenatal non-lactating to lactating condition, the cow undergoes significant nutritional, physiological, immunological, and metabolic changes. As a result, herbal supplementation during the transition period may benefit dairy animals, and it may be a viable alternative to antibiotics and hormonal therapies for dairy animals.

Fig. 1: Benefits of herbal supplementation in transition dairy animals

Benefits of herbal feeding on production performance

In the life cycle of dairy animals, the transition period is critical. Animals need extra energy at this period to support the initiation of lactation. However, during this period, animals' feed intake is reduced prior to calving, and then gradually increased after calving. Among the many substances used to decrease oxidative stress and improve production performance in transition animals, poly-herbal combinations are superior alternatives for feed supplementation. Animals may safely use poly-herbal feed additives to boost milk production. Shatavari has been found to increase milk production in many researches over the years. When ½ kg of fresh root part of Shatavari is given to the concentrate diet during lactation time, it significantly increases milk production. With butyrate in the transition period, milk yield and milk composition increased when cows were fed a poly-herbal mixture that included Saunf (*Foeniculum vulgare*), Ajwain

(*Trachyspermum ammi*), Methi (*Trigonella foenum-graecum*), Sundh (*Zingiber officinale*), and Cardamom (*Elettaria cardamom*), all of which are administered in 25-gram single doses.

Benefits of herbal feeding on reproduction performance

For the first lactation animals, feeding herbal choline improved fertility and decreased abortions while decreasing post-partum anestrous in animals fed with a poly-herbal combination. Herbal feeding promotes uterine health, which reduces the service period and increases the rate of conception and pregnancy. Reduced uterine infection in animals given the herbal combination is linked to anti-inflammatory and immune-modulating activities.

Benefits of herbal feeding on udder health status

Milk quality is evaluated by counting the number of somatic cell counts (SCCs) in a sample. Somatic cells have a strong connection to the health of the udder and the quality of the milk it produces. Somatic cells are produced to keep udders healthy and to prevent tissue damage and infection during lactation. Herbal feed additives are thought to enhance udder immunity by reducing milk SCCs because of their immuno-modulating and anti-inflammatory properties. Transition cows' udder health improves when given a poly-herbal combination containing butyric acid. Animals fed with a poly-herbal combination and butyric acid show significant reductions in SCCs. At the initiation of lactation, feeding cows a Baikal skullcap or Chinese skullcap (*Scutellaria baicalensis*) extract decreased the number of milk SCCs and the incidence of mastitis. Milk somatic cell reduction was found in lactating cows fed with *Moringa olifera* leaf meal and a decrease in SCCs in transition cows supplied with herbal vitamin E and selenium complex in animals supplemented with herbal combination to reduce mastitis incidence and milk SCCs reduction. Herbal vitamin E supplementation improves udder health by increasing antioxidant activity and extending milk shelf life by preventing milk from auto-oxidation.

Conclusion

The addition of herbal preparation to dairy animals has given dairy herders a better chance of obtaining higher-quality milk and more of it from their animals with less risk. As opposed to antibiotic or hormone treatment of dairy cows for increased milk production, herbal supplementation is safer since it does not have food safety concerns for human health like antibiotic residues and hormone imbalances. It is possible that transition period supplementation of herbal preparations to farm animals will have far-reaching beneficial effects on their production, reproduction and health performance of dairy animals by channelizing nutrients available to the animal's body and thereby maintaining proper body condition and reducing negative energy balance. Herbal supplements during the transition phase will be covered in this review in a simple, but succinct and instructive manner.

*****

METHODS AND APPLICATION OF ELISA

Rahul Singh Raghuvanshi*
Ph.D. Scholar
Deptt. Plant Pathology
ANDUAT, Ayodhya

Sakshi Pandey
M.Sc. (Ag)
Deptt. Plant Pathology
ANDUAT, Ayodhya

Abhishek Singh
Ph.D. Scholar
Deptt. Plant Pathology
ANDUAT, Ayodhya

Immunoassays are antibody-based analytical methods for quantitative/ qualitative analysis. Since the principle of immunoassays is based on specific antigen–antibody reaction, the assays have been utilized worldwide for diagnosis, pharmaco-kinetic studies by drug monitoring, and the quality control of commercially available products. Berson and Yalow were the first to develop an immunoassay, known as radioimmunoassay (RIA), for detecting endogenous plasma insulin, a development for which Yalow was awarded the Nobel Prize in Physiology or Medicine in 1977. Even today, after half a century, immunoassays are widely utilized with some modifications from the originally proposed system, e.g., radioisotopes have been replaced with enzymes because of safety concerns regarding the use of radioactivity, which is referred to as enzyme immunoassay/ enzyme-linked immunosorbent assay (ELISA). In addition, progress has been made in ELISA with the recent advances in recombinant DNA technology, leading to increase in the range of antibodies, probes, and even systems. This review article describes ELISA and its applications for the detection of plant secondary metabolites.

ELISA Stand for Enzyme Linked Immuno sorbent Assay. It is a serological test in which the sensitivity of antibody, antigen reaction s increased by attaching an enzyme. Elisa was developed by (Engvall and Pearlman in 1971) and first to detect the plant virus by Voller *et al.* in 1976. Double antibody sandwich was developed by Clark and Adome in 1977. The main principle of ELISA is the substrate begin to change the color due to presence of ezyme and even low concentration of viruses can be quantified by measuring the intensity of color of the substrate. Since the development of radioimmunoassay (RIA) in 1960, there has been a rapid increase in immunoassay techniques using radioactive labels. However, radioactive labels have been gradually replaced with enzyme labels because of safety concerns associated with radioactivity since the study by Avrameas in 1969, who coupled antigens or antibodies and enzymes using glutaraldehyde. Currently, ELISA has a higher number of immunoassays compared to RIA. Plant secondary metabolites are plant-produced organic compounds that play an important role in the defense of plants against herbivores, pests, and pathogens, as well as in their adaptation to the environment, although they are not directly involved in the growth and development of organisms. Because of their diverse functions, there has been a dramatic increase in their demand in pharmaceuticals, cosmetics, and pesticides, as well as in food additives. Quality control of these commercial products containing secondary metabolites is crucial as the quality directly affects their potential activity. In addition, Cragg and Newman recently reported that 34% of the currently used drugs originate from natural products. Meanwhile, simple, selective, and sensitive analytical techniques are also required in pharmacodynamic studies for monitoring effective concentration, side effects, and metabolism, leading to a better quality of life for patients. Thus far, various analytical methods have been developed for such purposes, mainly based on high-performance liquid chromatography (HPLC). However, ELISA exhibits several advantages over such techniques because of its simplicity, selectivity, and sensitivity. The basic facts about ELISA and its practical use for measuring plant secondary metabolites are described in this review.

General principle of ELISA

ELISA is based on the concept of antigen–antibody reactions, representing the chemical interaction between antibodies produced by the B cells of leukocytes and antigens. This specific immune response plays an important role in protecting the body from invaders such as pathogens

and toxins. Hence, by exploiting this reaction, ELISA permits the highly sensitive and selective quantitative/qualitative analysis of antigens, including proteins, peptides, nucleic acids, hormones, herbicides, and plant secondary metabolites. To detect these molecules, an antigen or antibody is labeled using enzymes, the so-called enzyme immunoassay, in which alkaline phosphatase (ALP), horseradish peroxidase (HRP), and β-galactosidase are commonly used. The antigen in the fluid phase is immobilized on a solid phase, such as a microtiter plate constituting rigid polystyrene, polyvinyl chloride, and polypropylene. Subsequently, the antigen is allowed to react with a specific antibody, which is detected by an enzyme-labeled secondary antibody. The development of color using a chromogenic substrate corresponds to the presence of the antigen. For instance, ALP hydrolyzes *p*-nitrophenyl phosphate to produce *p*-nitrophenol, which can be detected at 405 nm (yellow color), and HRP catalyzes the conversion of chromogenic substrates, e.g., 2,2′-azino-bis(3-ethylbenzothiazoline -6-sulfonic acid) diammonium salt, 3,3′,5,5′-tetramethylbenzidine, and *o*-phenylenediamine into colored products. By using chemiluminescent substrates such as chloro-5-substituted adamantyl-1,2-dioxetane phosphate and luminol for ALP and HRP, respectively, and fluorogenic substrates such as 4-methylumbelliferyl galactoside and nitrophenyl galactoside for β-galactosidase, even more sensitive detection can be achieved. These enzyme–substrate reactions are typically completed within 30–60 min, and the reaction stops with the addition of an appropriate solution, e.g., sodium hydroxide, hydrochloric acid, sulfuric acid, sodium carbonate, and sodium azide, for individual reactions. Finally, colored or fluorescent products are detected using a microtiter plate reader.

Advantages and disadvantages of ELISA

Advantages and disadvantages of ELISA are summarized. ELISA exhibits the following advantages:

- ❖ Simple procedure.
- ❖ High specificity and sensitivity, because of an antigen–antibody reaction.
- ❖ High efficiency, as simultaneous analyses can be performed without complicated sample pre-treatment.
- ❖ Generally safe and eco-friendly, because radioactive substances and large amounts of organic solvents are not required.
- ❖ Cost-effective assay, as low-cost reagents are used.

However, ELISA exhibits the following disadvantages:

- ❖ Labor-intensive and expensive to prepare antibody because it is a sophisticated technique, and expensive culture cell media are required to obtain a specific antibody.
- ❖ High possibility of false positive or negative results
- ❖ Labor-intensive and expensive to prepare antibody.
- ❖ Refrigerated transport and storage are required as an antibody is a protein.

Types of ELISA

DAS ELISA :- (Double antibody sandwich ELISA)

It is called Double antibody sandwich ELISA. Double antigen, sandwiched between two molecules of antibody.

- ➢ Wall of polystrin micro titre plate are first coated with on conjugate specific antibody of particular virus.
- ➢ After incubation unabsorbed antibodies are washed from the wells. And sap samples containing virus are added one sample per well.
- ➢ If virus is present in the sap, it will react with the adsorb antibodies and thus yet bound to the plates. Excess antigen is washed with buffer solution.
- ➢ Each well is treated with antibody conjugated with enzyme (alkaline phosphate). Whenever the virus is bound in a well, the enzyme is bound by means of second serological reaction.
- ➢ The antigen molecule is sandwiched between the 2 antibodies and remains in the well, while the excess material is washed away.
- ➢ A enzyme substrate (P-nitro fenol phosphate) which react with enzyme and give bright yellow color.
- ➢ Degradation of the enzyme substrate occurs leading to production of p-nitro fenol.

- The virus present in the antigen can be measured both qualitatively and quantitatively depending upon the presence and intensity of yellow color.

DAC ELISA :- (Direct antigen coating ELISA)

- The micro titer well are first treated with antigens and then with an antibody produced in rabbit.
- An enzyme conjugated secondary antibody is added to it. After that addition of substrate takes place.
- The virus present in the antigen can be measured both qualitatively and quantitatively, depending upon the presence and intensity of yellow colour.
- It lowers the specificity of the test because there is likeliness that the conjugated antibody binds more with the antigen and thus it may be less strain specific then DAS ELISA.
- It allows the detection wider range of serologically unrelated viruses.

DIBA :- Dot-blot immuno binding assay

- Antigen and antibody are immobilized on to a nitro cellulose membrane (NCM) as solid substrate for ELSA test.
- The virus in the plant extract is electro blotted on to the membrane or membrane is coated with IgG immune globulin G. by soaking it in a appropriate solution.
- After that substrate is being added the enzyme linked with IgG immune globulin G. Convert the substrate in to insoluble coloured material.
- The intensity of the colour stock can be measured by eye od by a reflactence densito metre.
- A simple detection mechanism is by the hydrolysis of substrate (NBT and formamide).

ISEM :- (Immuno sorbent electro microscopy)

- Antigen is placed in microscopic grid and treated with appropriate virus antiserum.
- If virus is present in the sample, antibody decorate it making the virus particle look easier to see.

Advantage :-

- Wide sensitive and even at low titer can be used successfully.
- Used to confirm ELISA results and to develop positive and negative thresh hold of ELISA.

Disadvantage :-

Not suited for large scale screening programmes as each grid must be handle separately and carefully.

Merrits of ELISA :-

- It is extremely sensitive and measures upto 1 to 10 ngm/ml.
- Large number of viruses can be tested at same time from multiple samples.
- Small amount antiserum required.
- The results are qualitative as well as quantitative.
- Can be semi-automated.
- Can be run regardless of virus morphology and virus concentration.
- It also allow to detect the viruses present in minute quantities by using small quantities of antiserum.
- NCM is easy to transport and detect large no. of sample in the field.

Conclusion

To date, various methods for the quantitative or qualitative analysis of plant secondary metabolites have been developed because a lot of marketed drugs are generated from plant secondary metabolites, such as morphine (analgesic drug), vinblastine (antineoplastic drug), paclitaxel (antineoplastic drug), quinine (antimalarial drug), digitoxin (cardiotonic drug), and so on, and the accurate, sensitive, and selective evaluation of these drugs leads to safe clinical and general usages. In this review, ELISA has been discussed in detail; it is representative of various analytical methods because of its several advantages over other analytical methods in terms of simplicity, cost efficiency, and selectivity. However, all types of ELISA exhibit more or less advantages and disadvantages. A barrier for further development of ELISA is the preparation of specific antibodies against the target hapten. Even in this advanced era, there are many important plant secondary metabolites for which antibodies are not available. ELISA would be more familiar to us if the antibody or antibody-mimicking probes that are alternatively used in ELISA could be obtained more easily. ●

Red Rot of Sugarcane: Status, Symptoms and Management

Shivani Chaudhary

Ph. D. Scholar
Dept.t of Plant Pathology
S.V.P.U.A.T., Meerut, U.P

The most serious disease of sugarcane is red rot. It was first time observed by Went in 1893. It is widely distributed throughout the sugarcane growing countries of the world, in some places it is more destructive than others. So, it is the causes epiphytotic in various countries. In 1934 and 1942 the disease was very extensive and virulent in North Behar and Eastern part of the United Provinces. It was so destructive that it wiped out the whole plantation in that area. The most certain symptom of the disease is the reddening of the internal internodal tissues with crossbars of white patches. Infection takes place through mother setts, the cut ends of the seed canes and other injuries. The disease causes reduction in sucrose content.

Symptoms

The first exterior signs of disease are the drooping, withering, and finally color change of leaves from green to orange and finally yellowing of the third and fourth leaves. Because of this the entire leaves die from bottom to top and wilting of entire crown. The reddish spots can be seen on the back side of the leaf on midrib. The exterior symptoms appear after 16 - 21 days after infection and drying of entire cane takes another 10 days' time.

The stem infection is internal so, the disease is not visible externally. Upon cutting the infected cane longitudinally and finding the fibro vascular bundles being reddish near base. There is color change in the protoplasm and a sticky dark-red material discharges out of the cells filling the intercellular spaces. The pigment existing in this ooze, is absorbed by the cell wall producing red rot appearance. Diseased cane gives sour smell and shows red and white bands. Sometimes, the pith inside the cane is filled with blackish brown liquid and exhibited alcohol odor.

Usually at this time the higher leaves of the stem turn pale and slowly bow down. Along the margins and tip the leaves wither. Ultimately the whole plant drops down.in areas where the disease appears in endemic form there the entire crop is lost.

Pathogen

Red rot disease is caused by the fungus *Glomerella tucumanensis* which was previously called *Colletotrichum falcatum*. *Glomerella tucumanensis* (Speg.) is the perfect stage.

The fungus is severely saprophytic than parasitic, and that it cannot attack healthy canes was discovered by some researcher's. While others said that it can attack mature through wounds, but not young plants as they are protected by leaf sheaths. In some places the fungus grows n dead canes also.

Pathogens are existing on leaf sheath and blades, they are solitary or collected, frequently creating brief lines between vascular bundles,

globose, dark brown to black 65-250 µm diameter, wall can be 8 cells thick, sclerotia on outside, ostiole a little papillate and circular. The mycelium grows both inter- and intracellularly in host tissue. The hyphae are colorless, slender, freely branched and septate. Acervuli form just overhead or underneath the nodes that have velvety black bodies. Aseptate conidiophores are 20µ long and 8µ wide, on which conidia are formed that is 16 to 48µ long and 4 to 8µ broad.

Disease cycle

The old fragmented stalks, leaves, ratoon crops and other debris on which the fungus grows saprophytically are the primary source of inoculum. There is a bit of debate whether the fungus is saprophytic or parasitic.

In the acervuli the conidia are developed along the midribs of the diseased leaves during primary infection, form secondary inoculum. They are dispersed by wind, rain, irrigation water and by insects. The germ tube on coming in contact with any hard surface, e.g., soil particles or plant parts, forms appressorium which then later forms infection hypha. Through the nodes at the leaf scars, wound, root primordia and seed-cuttings the pathogens enter. They are frequently injured by insects, especially borers.

It is not a root disease; however, this fungus often infects the roots. High humidity due to water-logging, nonstop cultivation of the same variety of sugarcane in same area, and cultivation of susceptible variety in the neighboring areas are some of the features that aid disease incidence and then epiphytotic.

Management

- The best way to control is to select setts for planting from disease free planting material in disease free area.
- Before planting, each sett should be judiciously inspected and the setts showing redding should be rejected.
- Crop rotation should be followed with rice for one season and with another crop for next year.
- Rising resistant and moderately resistant varieties like Co 86032, CoSi 95071, CoG 93076, CoC 22, CoSi 6. Co 975, Co1148, Co1158, Co1336, CoS 561, BO 3, BO10 and BO47.
- Exclusion of the affected clumps at an early stage
- Soil drenching with Carbendazim 50 WP at 1 gm in 1 litre of water.
- The cut ends and whole setts should be dipped in a fungicide solution such as 1% Bourdex mixture.
- Infected leaves should be destroyed by timely rogueing and burning. Field Sanitation should be upheld by digging out stubbles of diseased canes and burning them.
- Approve sett treatment with Carbendazim before planting Carbendazim 50 WP or Carbendazim 25 DS along with 2.5 kg of Urea in 250 litre of water
- For complete elimination of rot dip the setts in fungicides like Bavistan, Benomyl, Topsin and Aretan at 0.1 % for 18 min. at 52ºC.
- Hot water treatment of setts, in water at 50°C., for 2 hours.
- Treating seed with fungicides like Arasan (0.25 %) is effective.

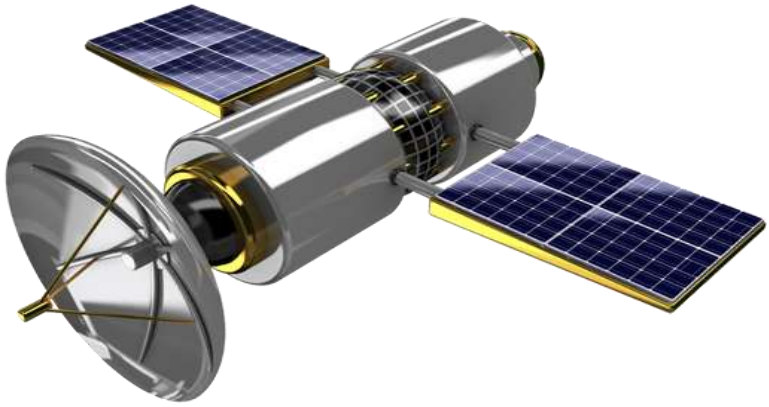
*****

REMOTE SENSING AND IT'S ROLE IN AGRICULTURE

Morajdhwaj Singh[1]
Arnab Khanda[2]
Sanjay Singh Negi[1]
Shailendra Tiwari[2]

[1]Deptt. of Horticulture
Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Dehradun

[2]Deptt. of Agriculture
Dolphin (P.G.) Institute of Biomedical and Natural Sciences, Dehradun



Remote sensing is the process of gathering information about the objects or an area, by measuring its reflected and emitted radiation, without coming into direct physical contact. Remote sensing is a technique for monitoring the earth's resources that combines technology with ground observations to provide greater precision and accuracy. The utilization of electromagnetic spectrum (visible, infrared, and microwaves) for measuring the earth's properties is the principle behind remote sensing. It is a phenomenon that has numerous applications including photography, surveying, geology, forestry and many more. However, it is in the field of agriculture that remote sensing has found significant use. There are very many applications of remote sensing in the agricultural sector. Below is a summary of these applications.

- **Crop Identification:**

Crop identification has also benefited by remote sensing, particularly in circumstances where the crop under observation is mysterious or has unusual traits. The crop's data is collected and taken to the labs, where many components of the crop, including crop culture, are investigated.

- **Development of crop inventory, yield forecasting, conceptual model for the crop forecasting system:**

Uses of remote sensing plays a significant role to distinguish, identify measure and map the agricultural output and yield across a certain area, as well as to derive a reliable estimate, that how much of the crop (yield/ha) will be harvested under various conditions. A continuous engagement of researchers to develop different conceptual models, can forecast the amount of yield over a specific time period, by integrating the thematic and spatio-temporal in an operational method for a specific area very precisely.

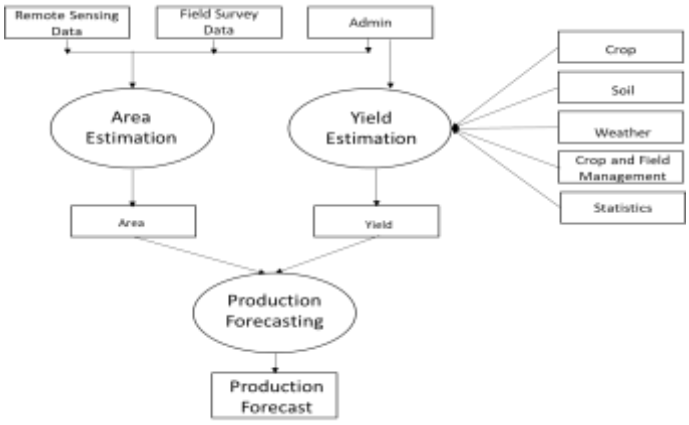
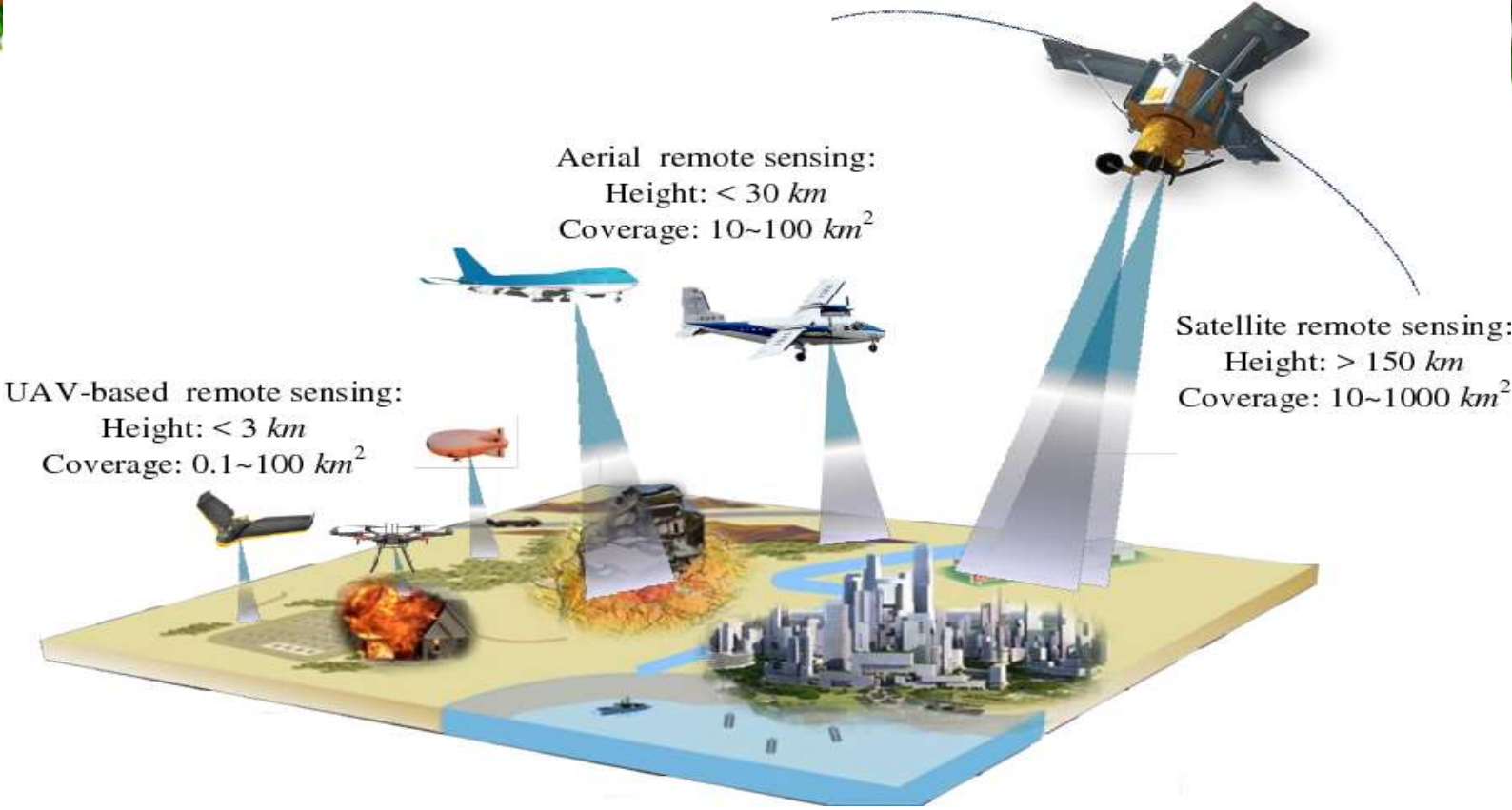


Fig. No 1: Overall design of the crop forecasting system

- **Horticulture, Cropping Systems Analysis:**

The use of remote sensing technologies has also aided in the evaluation of various crop planting strategies. This technology has primarily been applied in the horticultural business, where flower



growth patterns may be examined and predictions produced.

- **Identification of pests and disease infestation:**

Remote sensing technology can also be used to locate pests in fields and provide information on the most effective pest control methods for eradicating pests and diseases on the farm.

- **Soil moisture estimation:**

Without the use of remote sensing equipment, measuring soil moisture can be challenging. Soil moisture data is provided through remote sensing, which aids in identifying the amount of moisture in the soil and, as a result, the type of crop that may be produced there.

- **Irrigation monitoring and management:**

Remote sensing provides data on the amount of moisture in soils. This information is used to assess whether or not a particular soil is moisture deficient, as well as to plan for the soil's irrigation demands.

- **Soil mapping:**

One of the most popular and essential applications of remote sensing is soil mapping. Farmers can use soil mapping to determine which soils are best for specific crops, as well as which soils require irrigation and which do not. Precision agriculture benefits from this information.

- **Monitoring of droughts:**

Weather patterns, especially drought trends, are monitored using remote sensing equipment over a defined area. The data can be used to forecast rainfall patterns in a certain area, as well as to determine the time difference between present rainfall and the next rainfall, which aids in drought monitoring.

- **Land cover and land degradation mapping:**

Experts have employed remote sensing to map out the land cover of a certain area. Experts can now determine which parts of the land have been degraded and which have not. This also aids them in putting measures in place to combat land degradation.

- **Identification of problematic soils:**

Remote sensing has also been useful in identifying problematic soils that have a hard time maintaining optimal agricultural output throughout the planting season.

- **Crop nutrient deficiency detection:**

Farmers and other agricultural professionals have also used remote sensing technology to detect

the extent of crop nutrient deficit and devise solutions to improve the nutrients level in crops, hence enhancing overall crop production.

❖ **Water resources mapping:**

The mapping of water resources that can be utilized for agriculture over a given farmland is made possible by remote sensing. Farmers can utilize remote sensing to determine what water resources are available for use on a given piece of land and whether they are adequate.

❖ **Precision farming:**

Precision agriculture has benefited greatly from remote sensing. Precision agriculture has resulted in the development of healthy crops that provide farmers with the best harvests in a given period.

❖ **Climate change monitoring:**

Remote sensing technology is critical for monitoring climate change and keeping track of climatic conditions, which are crucial in determining which crops may be planted where.

Conclusion

The remote sensing plays an important role within the agricultural sector. Data collected from remote sensing facilitate monitoring weed infestations, damages caused by pests and plant pathogens, thereby making it possible to counteract quickly. The ability to use remote sensing data to determine fertilization needs of plants based on the nutrient content of crops and soils helps to increase yields and improve the quality of harvested seeds and fruits, which is important for improving the crop profitability. Accurate determination of the nutritional requirements of plants at critical stages during the field season helps to optimize fertilization as well as reduce potential adverse impacts associated with offsite transport of agrochemicals. Remote sensing has also been used to assess the water needs of plants and determine the date of commencement of irrigation, making it easier to manage crop production under conditions of water stress. ●

PROPERTIES OF QUALITATIVE AND QUANTITATIVE

Kartik Tomar

Ph.D. Scholar
Deptt. of Animal Husbandry
SVPUAT, Meerut (U.P.)

Qualitative traits

The traits usually determined or controlled by single or few pairs of major genes have sharp distinction among phenotype, exhibits discontinuous variation, can't be measured by any unit of measurement highly heritable and least affected or not affected by environment. A qualitative trait is a feature, that is either present, or not present, depending on whether the gene responsible for that trait is present (or functional) or absent (or non-functional). Qualitative traits are usually encoded by one gene or sometime by a few numbers of genes. These traits usually do not change in response to the environment. Since qualitative traits are discrete values, they can be analyzed by counts and ratios.

Quantitative traits

The traits which are controlled or determined by many pairs of minor genes or poly genes, exhibits continuous variation, can be measured by unit of measurement low to medium heritable and largely affected by environment because the effect of minor genes modified by the environment. Quantitative traits are usually determined by a larger number of genes. These traits can change under the influence of the environment. Since quantitative traits are spread over a range of values, they cannot be analyzed by counts and ratios, but must be analyzed statistically.

Properties of Oualitative traits:

There are following properties of qualitative traits-

- **Genes:** These traits controlled by one or few pairs of major genes. The effect of single gene can be deducted.
- **Heritability:** These traits shows high heritability.
- **Environment effect:** Environment factors such as age, nutrition, management, climate, disease have very little or no effect on the traits.
- **Analysis:** Statistically these traits can be analyzed by making counts and ratio.
- **Distribution:** Quantitative trait follow binomial distribution.
- **Variation:** Quantitative traits exhibits discontinuous variation. Variation is mainly in genetic.
- **Measurement:** These traits can not be measured by any unit of measured by any unit of measurement. These are the character of kind.
- **Example of the traits:** In many beauty mental or psychological qualities, way of working behavior, blood group, coloured *vs* albino individuals. In farm animals, Body colour eg. coat colour pattern in different species eg. Black and red coat colour in Angus cattle; Red, white and roan in short horn cattle, horned & polled or, presence or absence of horn in cattle and sheep.
- **Improvement:** Quantitative trait can be improved through genetically.

Properties of Quantitative traits:

There are following properties of quantitative traits-

- ✓ **Genes:** These traits controlled by many pairs of minor genes or poly genes. The effect of single gene can not be deducted.
- ✓ **Heritability:** These traits shows low to medium heritability.
- ✓ **Environment effect:** These traits are highly affected by environmental factors such as feeding, housing management, health care etc.

- ✓ **Exposed:** Quantitative trait can be described by mean median & mode, variance and covariance.
- ✓ **Distribution:** Quantitative trait follow normal distribution.
- ✓ **Variation:** Quantitative traits shows continuous variation. Variation is genetic and non-genetic both.
- ✓ **Improvement:** Quantitative trait can be improved through environment management.
- ✓ **Statistically:** These traits can be analyzed by measures of central tendency and measures of dispersion.
- ✓ These traits are economic traits for example - milk yield, lactation length, birth weight, weaning weight etc.

*****

LASER LAND LEVELLING: TECHNOLOGY AND RESOURCE CONSERVATION (LLL)

Pramod Kumar
Ph.D. Research Scholar
Deptt. of Soil Science and Agril. Chem.
SVPUAT, Meerut
Amit Kumar
Ph.D. Research Scholar
Deptt. of Horticulture, SVPUAT, Meerut
Shiva Mohan
Ph.D. Research Scholar
Deptt. of Genetics and Plant Breeding
SVPUAT, Meerut
Alamgir
Ph.D. Research Scholar
Deptt. of Biotechnology, SVPUAT, Meerut

The Indo-Gangetic Plain of South Asia, formed by the fluvial action of the Indus and Ganges System, is one of the world's chief food grain producing areas. The area comprising of Bangladesh, India, Pakistan and Nepal supports world's most densely populated areas with more than 562 million people (Census 2001 India, CIA estimates 2005) dependant mainly on the rice wheat cropping system. In order to feed and deliver livelihoods in South Asia, these countries take devoted near half of their total land area of 401.72 million hectares (Mha) to agriculture (FAO,1999). For these nations, intensively cultivated and irrigated rice-wheat system of the IGP is of great significance as it represents 32% of the total rice area and 42% of the wheat area (Ladha *et al.* 2000, Hobbs and Morris, 1996) and donates more than 80% of the total cereal production (Timsina and Connor, 2001). Rice-wheat system thus is the mainstay of the food security of the area, and is fundamental for providing employment, income and livelihoods for hundreds of millions of rural and urban poor in the IGP of South Asia (Evans, 1993; Paroda *et al.* 1994).

Levelling: A prerequisite for other farming operations

Surface irrigation systems depend on gravity and slope that make the water flow in a field. The water retention features of the soil generally have spatial variability within the arenas. Preferably, irrigation should apply water in a manner that accounts for field spatial variability. All major farming actions from land preparation to seedbed preparation, seed placement and germination require an optimal soil moisture condition. The traditional method of levelling is not cost effective. A supposition is normally complete that the soil water shortage at the time of irrigation is uniform over the total field. This chiefs to the requirement that irrigation systems apply water in a manner that results in uniform infiltrated depth throughout the field. This is rarely attained in exercise as it depends on stream size, land conditions and soil type. Higher levels of uniformity of irrigation water application may be achieved by precise land levelling and using appropriate stream sizes based on infiltration rate of the soil. (Khepar *et al*. 1982).

Land levelling: Concepts and techniques

Land levelling is done to enhance use efficiency of water and fertilizer nutrients, and to improve the crop stand and yields. However, in the initial year's crop yields at times are adversely affected, that can be avoided if some of the relevant conditions described below are taken into considerations.

- ✓ **Level maintenance:** With appropriate tillage practices
- ✓ **Fertilizer needs of cut areas:** Cut areas require additional nutrition. Compound fertilizer (N and P) can be applied at around 50 -100 kg/ha
- ✓ **Subsoil considerations:** Make sure that exposed subsoil is not challenging (acidity, salinity, sodicity, higher percolation rate, etc.) while going for heavy cuts
- ✓ **Efficiency:** Identify higher and lower-level grades in the field to minimize soil movement
- ✓

- ✓ **Operator's skill:** Efficient land levelling depends on operator's skill and experience.

Laser land levelling

The introduction of laser levelling in the 1970's produced a silent revolution that has raised potential of surface irrigation efficiency to the levels of sprinkler and drip irrigation (Erie and Dedrick, 1979). Laser-controlled land levelling equipment grades fields to outline the land for unlike irrigation practices. Sprinklers, a perfectly level field conserves water by reducing runoff and permitting uniform distribution of water. Furrow irrigation systems requirement a slight but uniform slope to use water greatest efficiently. Laser levelling can reduce water use by 20-30% and increase crop yields by 10-20%. The quality of land before starting the laser land levelling process, the field should be ploughed and a topographic survey be carried out. Level fields permit for a more uniform flood depth, using less water and reducing pumping costs. Benefits from precision levelling of land extend for many years, although some minor land smoothing may be required from time to time due to field operations and weather conditions. Laser-controlled precision land levelling helps to:

- ✓ Save irrigation water
- ✓ Increase cultivable area by 3 to 5% approximately
- ✓ Improve crop establishment
- ✓ Improve uniformity of crop maturity
- ✓ Increase water application efficiency up to 50%
- ✓ Increase cropping intensity by about 40%.
- ✓ Increase crop yields (wheat 15%, sugarcane 42%, rice 61% and cotton 66%)
- ✓ Facilitate management of saline environments
- ✓ Decrease weed problems and improve weed control efficiency

Types of laser land levellers

- **Manual levelling lasers**

Set-up of a laser levelling instrument requires the operator to manually level the unit by using the units' screws and bubble vials. These lasers rely on tubular bubbles for levelling. The user needs to level the laser in both the X-axis and Y-axis and rely on the bubbles for accuracy. These lasers can attain a maximum accuracy of 1 cm at 100m.

- **Semi self-levelling lasers**

These lasers adjust themselves automatically within a range using a compensator. To get to a prescribed range, the laser is equipped either with a circular bubble with a bull's eye, or electronic lights that turn green when you reach the self-levelling range. These lasers are very accurate and have a shut-off feature if the laser is bumped or goes out of the self-levelling range. They can achieve accuracy of at least 1 cm at 100 m.

- **Fully self-levelling lasers**

These lasers automatically find and uphold level within a specified range. These lasers are prepared with an electronic level vial and servomotors. The servo motors level the instrument electronically and when levelled, the laser starts spinning. They are the easiest to use and can attain accuracy of up to 2.5 mm at 100 m.

- **Split-beam lasers**

These lasers emit simultaneous horizontal and vertical beams to establish both level and plumb reference lines.

Components of laser land levelling system

The laser leveller includes the use of laser (transmitter) that releases a quickly rotating beam parallel to the essential field plane, which is picked up by a device fitted to a tractor towards the scraper unit. The signal received is converted into cut and fill level adjustment and the corresponding changes in scraper level are carried out automatically by a hydraulic control system. The scraper management is fully automatic; the elements of operative error are removed allowing consistently correct land levelling. The set-up comprises of two units. It quickly rotates, transfer the laser light in a circle like a lighthouse excepting that light is a laser, so it remainders in a very thin beam. A laser-controlled land levelling system consists of the following five major components:

(i) Drag bucket

The drag bucket can be moreover three-point linkage mounted or pulled by a tractor. This system is preferred as it is easier to attach the tractor's hydraulic system to an outside hydraulic ram than to attach the inside control system used by the three-point-linkage system. Bucket dimensions and capacity will vary according to the obtainable power source and field situations.

(ii) Laser transmitter

The laser transmitter mounts on a tripod which permits the laser beam to sweep overhead the field. Approximately tractors through laser unit and strain bucket can work from one transmitter with control from laser receiver.

(iii) Laser receiver

The laser receiver is a multi-directional receiver that detects the situation of the laser reference plane and spreads this signal to the control box. The receiver is mounted on a manual or electric mast involved to the drag bucket. It is mounted on the scraper. A set of controls permit the laser receiver to control the height of the bucket on the scraper. The worker can adjust the settings on the receiver, and he can override the receiver when his requirements to pick up a bucketful of soil and transport it to another section of the field.

(iv) Control box

The control box receives and processes signal from the engine mounted receiver. This displays these signals to indicate the drag buckets situation relative to the finished grade. When the control box is set to automatic, it delivers electrical output for driving the hydraulic valve. The controller box mounts on the tractor within easy reach of the operative.

(v) Hydraulic control system

The hydraulic system of the tractor is used to source oil to increase and lower the levelling bucket. The oils supplied by the tractor hydraulic pump is normally distributed at 2000-3000 psi. The hydraulic pump on the positive displacement pump and continuously pumps more oil than essential, a pressure relief valve is needed in the system to return the excess oil to the tractor reservoir.

Tillage practices to maintain the level of field after levelling

Traditional tillage practices often move the soil in one direction-outward from the centre of the field. Over time, such soil movement creates an uneven soil surface resulting in a low spot in the centre of the field. The centre of the field often remains wetter and tillage operations will often be delayed with high incidence of weeds. After levelling, the field should be ploughed beginning from the centre and working out toward the field boundary. Primarily, a single pass should be made in the centre of the field to change the soil to the right. The tractor is then repositioned at the end of the

primary run so as to plough the another run outwards from the furrow formed. The third plough run then changes the previous ploughed soil back into the depression in the centre of the field.

Experiences with the laser land levelling technology

The laser land levelling was announced in western Uttar Pradesh during 2002 by provided that a laser leveller unit procured from Pakistan to a farmer of Ghaziabad (U.P.). It was used to demonstrate benefits of land levelling to farmers where participating research trials on resource keeping technologies were in improvement. To accelerate the pace of adoption of laser levelling technology, several in field training programmes, demonstrations, farmers' meets and traveling seminars were organized by RWC-CIMMYTPDCSR under the aegis of USAID project. With growing awareness about laser levelling, some farmers bought their own laser systems and turned into custom service businesses in 2003. This proved as a milestone in adoption of this technology. As of February 2006, 37 farmers own laser leveller's units only in western Uttar Pradesh. Within three-years of introduction of laser levelling technology, the acreage has gone up to 10,000 acres spread over 10 districts of western Uttar Pradesh and one district each in Haryana and Uttaranchal.

The benefits of laser land levelling

The benefits of laser land levelling over other land levelling methods include the following:

- Precise level and smoother soil surface
- Decrease in time and water essential to irrigate the field
- Uniform distribution of water in the field
- Uniform moisture environment for crops
- Good germination and growth of crops
- A reduced amount of seed rate, fertilizer, chemicals and fuel requirements
- Improved field traffic ability (for subsequent operations).

Cost of laser land levelling

The time essential for precision land levelling depends upon the area, length and slope in the field and the volume of earthwork. The cost of land levelling mainly depends on the length and slope of the field. Precision levelling of the fields with larger length and slope are more costly per unit of earthwork. The time and rate for one acre land levelling are determined on the base of elevations recorded at each grid point in the field using the laser, and the desired elevation of the field is worked out by averaging all the grid points. The values of the grid points above and lower the desired elevation are averaged.

Environmental benefits of laser land levelling

Laser land levelling can certainly minimize yield variability on the farm level, optimize input output relative and excluding resources like soil, water and energy. If accepted on a huge scale, the laser levelling would help in improving the amount and excellence of ground water because of improved water productivity and less accretion and deep percolation of water-soluble insecticides and chemicals, especially nitrate.

Conclusions and recommendations

Laser levelling of agricultural land is a recent resource-conservation technology initiative in India. The results are quite encouraging. It has the potential to alteration the way food is produced by enhancing resource-use efficiency of dangerous inputs without any disturbing and injurious effects on the productive resilience of the ecosystem. Popularization of this technology among farmers in a participating mode on a complete scale, therefore, requirements appropriately focused attention on priority basis along with requisite support from researchers and planners. The variation in our image of future agriculture in relation to food and nutritional security, environmental safety and globalisation of markets demands improving resource-use efficiency considerably to reach the wanted growth levels on the food production and agricultural productivity.

*****

COMMERCIAL USE OF PLANT GROWTH REGULATORS IN VEGETABLE PRODUCTION

Ashutosh Upadhyay
Research Scholar (Veg. Sci.)
CSAUAT, Kanpur

Pranjal Singh
Research Scholar (Veg. Sci.)
CSAUAT, Kanpur

Vikash Singh
Research Scholar (Veg. Sci.)
A.N.D.U.A.T., Ayodhya

Pratyksh Pandey
Research Scholar (Veg. Sci.)
CSAUAT, Kanpur

Plant growth regulators (PGRs) are organic compounds, aside from nutrients, that modify plant physiological processes. PGRs, act as bio stimulants or bio inhibitors, PGR act within plant cells to stimulate or inhibit specific enzymes or enzyme systems and help administrate plant metabolism. They are usually active in plants at very low concentrations. The significance of PGRs was first recognized in the 1930s. Since that time, natural and synthetic compounds that revise function, shape, and size of crop plants have been discovered. "Hormone" is Greek word derived from "*hormao*", which means to stimulate. Thimone (1948) propounded the term phytohormones as the organic substance, which are produced naturally in plants, synthesized in one part and typically translocated to other part where in very small quantity affect the growth and other physiological function of the plants. To differentiate them from the animal hormones they are termed as phytohormones. Auxin was the first hormone to be discovered in plants and at one time considered to be solely present plant growth hormone today, specific PGRs are accustomed to modify crop growth rate and growth pattern during the various stages of development, from germination through harvest and post-harvest preservation.

Although, photosynthesis provides the carbon and respiration supplies the energy for plant growth, a group of chemicals produced by plants referred to as plant growth regulators control the growth and development of trees. These chemicals act on plant processes at very low concentrations. Often they are produced at one location and transported to another, where they exert their influence; however, they may also act on the same tissue in which they are produced. Plant growth regulators are organic chemical substance, other than nutrients and vitamins that can regulate the growth of plant when applied in small quantities. PGR are utilized in different forms like powder, paste, liquid etc.

Table-1 Plant Growth Regulators and their classes

Plant growth regulators	Classes
Auxins	Indole-3-acetic acid (IAA), 1-Naphthalene acetic acid (NAA), Indole-3-butyric acid (IBA), 2,4-Dichlorophenoxyacetic acid (2-4D), 4-Chlorophenoxyacetic acid (4-CPA).
Gibberellins	Gibberellic acid (GA3)
Cytokinin	Kinetin, Zeatin
Ethylene	Etherel
Abscisic acid	Dormins, Phaseic Acid

Jatinder Singh (2014)

Table.2 Various Plant Growth Regulators and their Functions

Name of the plant growth regulators	Functions
Auxins	(a) Apical dominance

	(b) Cell division and enlargement (c) Shoot and root growth (d) Plant growth movement (e) Parthenocarpy (d)Abscission
Gibberellins	(a) Prevent genetical dwarfism (b) Regulation in bolting and flowering (c) Production of parthenocarpic fruit (d) Germination.
Cytokinin	(a) Cell and organ enlargement (b) Seed germination (c) Development of bud and shoot growth
Ethylene	(a) Ripening of fruit (b) Seedling growth and emergence (c) Abscission of leaf.
Abscisic acid	(a) Abscission (b) Dormancy (c) Inhibit seed development and germination of seed (d)Stomatal closing (e) Helps during water stress

Jatinder Singh (2014) and P. Hazra and M.G. Som, (2006).

Commercial Utility of Plant Growth Regulator in Vegetable Crops

Tomato-

- Enhance the fruit set at high temperature apply Tomatotene or tomatolan (4-CPA)
- Increase the fruit set, earliness and parthenocarpy used 2-4 D@2-5ppm as seed treatment.
- PCPA@50-100 ppm used in tomato for fruit set under high and low temperatures conditions.

Brinjal-

- Plant spray of 2-4, D (2 ppm) at an interval of one week from 60 -70 days after planting from commencement of flowering increase fruit set, early yield and total yield in brinjal.

Chilli

- Growth regulator is used to control fruit drop in chilli is "Tricontinol' & 'Planofix' (NAA).
- Spraying of Planofix (NAA) 10 ppm at flower initiation stage reduces flower drop and increases the fruit set.

Potato-

- In potato GA_3 @ 10-15 PPM for 10-20 minutes for breaking the tuber dormancy and inhances the sprouting.
- Thiourea @ 1% used for breaking the tuber dormancy.
- Malic Hydrazide (MH) and Chloropropham (CIPC) @ 25 mg/tones of tubers used as sprout inhibitors.

Okra

- Plant growth regulators affect okra in many ways, such as seed treatment by GA (400ppm), IAA (20ppm) or NAA (20ppm) enhanced germination; Ethephon (100-500ppm) reduced vegetative growth and weakened apical dominance; cycocel (1,000-1,500ppm) reduced plant height.
- Pod yield in okra is improved by soaking of seeds in GA3 (50-100 ppm) or IAA (100 ppm).
- Foliar spray of Ethephon (250 ppm) or CCC (25 ppm) or NAA (15 ppm) at pre-anthesis also enhances pod yield.
- Post-harvest treatment with cycocel (100ppm) enhanced shelf-life of fruits, and with ascorbic acid (250ppm) retention of chlorophyll was the best with minimum fruit weight loss after 8-9 days of storage at room temperature.
- Cycocel at 500 ppm improve the salt tolerance and fruit yield in okra upto EC 6 mmhos/cm; however seed treatment with 100 ppm cycocel for 8 hrs is found more effective than foliar spray with 500 ppm.

Cauliflower

- Treatment of cauliflower seedling with NAA 10ppm as starter solution has been found effective in respect of plant stand in the field and the vegetative growth.

- Application of GA4+GA7 @ 80mg/liter of water shortened the period from transplanting to the harvest.
- Dipping seedlings roots in IBA (0.1 ppm) improves seedling establishment, induces earliness by 10-15 days and increases curd yield.
- Application of 2, 4-D in combination with BA retards yellowing of curds.
- Spray of 2, 4-D (100-500 ppm) at 1-7 days before harvest reduces the leaf abscission and weight loss in cauliflower.

Cabbage

- In cabbage, vegetative yield is increased by soaking of seeds in 0.1% boric acid before sowing whereas spraying 50ppm boric acid at flowering enhances the seed yield.
- Seedling root dip in GA3 at 5-10 ppm improves seedling establishment.
- A spray of CCC or SADH (2,500- 5,000ppm) increases the low temperature resistance in cabbage. Seed treatment/foliar spray of NAA 0.1% or IBA 0.4% or GA3 5-10ppm improves head size and yield of cabbage.
- Spray of 2, 4-D (100-500 ppm) at 1-7 days before harvest reduces the leaf abscission and weight loss in cabbage.

Garlic

- Foliar spray of Ethephon 500ppm or Alar 500ppm at 20-25 days after sowing increases clove size and yield.
- Foliar application of NAA 50ppm at 60 and 90 days after planting increases bulb yield.
- A foliar spray of GA_3 200-400ppm for stimulated formation of lateral buds.
- Foliar spray of MH 2500ppm on foliage at fortnight before harvesting to control sprouting during storage.

Onion

- Seed treatment with NAA 100-200ppm or IAA 10ppm improves bulb growth and yield.
- Seedling treatment with GA 40ppm for improved bulb growth and yield.
- Foliar spray of MH 2500ppm at one week before bulb digging to check the sprouting during storage.

Cucumber

- Application of Ethrel (150-200 ppm) increases the number of female flowers, fruit set and in turn increases the fruit yield.
- NAA' and 'Ethephon' promote pistillate flowers.
- GA (1500-2000 ppm), AgNoz (200-300 ppm) and AVG induces male flowers on gynoecious Cucumber.
- MH (100 ppm), NAA (100 ppm), Ethrel (150-200 ppm) and Boron (3 ppm) increase number of female flowers, fruit set and in turn increases the fruit yield.

Muskmelon

- Soaking of seeds in ethephon at 480mg/liter of water for 24 hours improves germination in muskmelon at low temperature.
- Application of Ethrel (250ppm) increases the fruiting and in turns the yield.
- Exogenous application of silver thiosulphate (300-400ppm) induces the male flower in gynoecious muskmelon. These chemicals/plant growth regulators should be applied twice at 2-true-leaf stage and secondly at 4-true-leaf stage.

Watermelon

- In watermelon to increases the fruiting and the fruit yield exogenous application of chemicals such as TIBA (25-50ppm), boron (3-4ppm), molybdenum (3-4ppm) and calcium (20-25ppm) are recommended.
- Fruit yield can also be increased by foliar spray of GA3 (25-50ppm), ethrel (500ppm), MH (100ppm) and NAA (200ppm). GA3 (25 ppm) are found most effective in increasing number of female flowers and yield. These chemicals/plant growth regulators must be applied at two-true-leaf stage. Repeat the spray at 4-true-leaf stage.

Bottle Gourd

- Fruit set in bottle gourd can be increased by spraying the plant twice at 2 and 4-true-leaf stage with ethrel (100- 150ppm), Maleic hydrazide (MH) @ 400ppm, Triodobenzoic acid (TIBA) @ 50ppm, boron (3-4ppm) and calcium (20ppm).
- Maleic hydrazide at 400ppm promotes the female flower production and increases fruit set and in turn the yield.

Bitter gourd-

- MH @ 50-150ppm and CCC @ 50-100ppm increase female: male ratio and at a high concentration of 200ppm CCC it is reduced.
- Ethrel @ 25ppm increases female flowers and GA @60ppm reduces the ratio of male: female Flowers.
- Seed treatment with B-Nine @3-4ppm for 20 hours gave the highest number of female flower per plant.
- For induction of hermaphrodite flower: AgNo3 @ 400ppm at pre-flowering stage.
- Seed germination enhanced by GA3 @ 25-50ppm.

Pumpkin

- A growth regulator, Ethrel 250ppm can be applied to increase the female flower production which helps to increase the yield.

Pea

- Spraying 15ml of 10 M solution of the growth regulator CCC at the five node stage of development has favorable effect on the growth and yield of crop.
- Soaking of pea seeds in GA3 (10ppm) for 12 hours give the highest germination.
- Foliar application of MH (25 ppm) or CCC (500 ppm) before flowering increases pod yield.

French bean

- Growth regulators like PCPA at 2ppm, L-naphthlyacetamide or B-naphthal acetic acid at 5-25ppm have shown favorable effect on fruit set when sprayed at prevailing temperature when pod set is impaired.
- GA_3 sprayed at 50-200ppm is effective in improving the crop growth.

PGR application methods

1. **Application in Powder form:** PGR powders dissolved in organic solvent mixed with moistened charcoal powder, soybean flour or wheat flour and prepare a uniform paste. The paste is allowed to stand until the solvent evaporates.
2. **Application in Lanoline paste:** Most of the roots promoting PGR are readily soluble in lanoline; a lanoline paste which promotes advantageous roots in plant is made by mixing PGR in lanoline and allowing it to cool.
3. **Soaking Method:** Measured quantity of PGR is dissolved in alcohol then dilute with distilled water to make required quantity and concentration of solution (20-2000 ppm), Cuttings are soaked in solution for 24 hours before planting.
4. **Aerosol Method:** This method is popular in green houses, where the PGR solution is released through a small aerosol bottle / cylinder. Liquid gases soon evaporate leaving the PGR chemical in the air.
5. **Spraying method.**
6. **Root feeding method.**
7. **Injection of solution into internal tissues.**

Constraints in the Use of Growth Regulators

- Sensitivity of each plant species or cultivars to a given chemical treatment prevents easy predication of the biological effects.
- Screening for PGR activities entails high costs and much difficult. Some synthetic plant growth regulators causes human health hazards.
- The cost of developing new PGR is very high due to which they are very much costly.
- It's difficult in identification of proper stage of crop at which the growth regulators should be applied.
- Lack of support from agricultural researchers in public and private sectors.
- Lack of basic knowledge of toxicity and mechanism of action.

*****

REARING OF SILKWORM FOR SILK PRODUCTION

Shani Kumar, Hem Singh
Department of Entomology, SVPUAT, Modipuram, Meerut, UP

Pradeep Kumar Verma
Avinash Varma
Department of Agriculture, Quantum University, Roorkee, UK

Sericulture is the art and science of rearing silkworms for getting raw silk from them at cocoon stage, silkworm species are domesticated and semi domesticated, highly sensitive to environment change, fluctuation in temperature, relative humidity and wind velocity is also affects the growth and development of silkworms.

It is a labour intensive agro industry and is well suited to the developing countries like India, where unemployment is a serious problem. This industry has vast scope to earn foreign exchange through marketing of silk goods. The major activities of sericulture comprise of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for value added benefits such as processing and weaving.

In India, Sericulture is ideally suited for improving the rural economy of the country, as it is practiced as a subsidiary industry to agriculture. 25% share as state government, 50% share as central silk board, 25% share will be borne by beneficiaries.

Species of Silkworm: -

India is the only country in the world where all 5 types of silkworm species are cultivated due to variability in biodiversity and environment namely: -

Sr No.	Name	Scientific name	Host plant	States (India)	Characteristics
1	Mulberry Silkworm	*Bombyx mori*	*Morus alba* (mulberry)	Karnataka, AP, TN, WB, UP	Top quality fibre, shining and creamy white
2	Tasar Silkworm	*Antheraea mylitta*	Arjun plant	West Bengal	Copper brown in colour, lowest quality of silk
3	Muga Silkworm	*Antheraea assamensis*	Soalu and Som plant	Assam,	Light yellowish, slightly tough, moderate quality
4	Eri Silkworm	*SaimaCynthia*	*Ricinus communis* (castor)	Assam, Meghalaya	moderate quality, creamy white but less shining
5	Oak tasar Silkworm	Antheraea *protyle*	Oak plant	West Bengal	Gray in colour

Mulberry silk worm is dominated in the term of 93% production and 95% in export.

Silkworm races: Mulberry silkworm is divided into three type races like univoltine, bi voltine and multivoltine.

Univoltine:

Univoltine races produce only one generation per year. The eggs laid remain in a diapausing condition till the next spring. Larvae of univoltine races of silkworm are very sensitive to temperature and other environmental conditions. They are unsuitable for summer and autumn rearing by artificial breaking of egg diapause.

e.g.: - E16

Bivoltine: -

Silkworms are complete two generations in year. The worms are highly sensitive to environment changes (change in humidity, temperature, air etc.),

results crop losses are high. Cocoon production is less than 50kg/100DFL. **e.g.,** the improved bivoltine hybrids namely, CSR2 x CSR4, CC1 x NB4D2, CA2 x NB4D6, CSR12 x CSR6, SR3 x CSR6, CSR16 x CSR17, CSR18 x CSR19, CSR48 x CSR4, CSR50 x CSR51, PM x CSR8, GEN3 x GEN2, Double hybrid (Krishnaraja),

Multi-voltine: -

Silkworms are complete 5 -6 generations in a year. The worms are hardy and have high survival rates and can produce more than 50 to 70 kg/100DFL. The quality of silk is slightly inferior to that of bi-voltine races. e.g. MY1 x NB18, P2D1 x NB18, RD1 x NB18, BL23 x NB4D2, BL24 x NB4D2, Kapila-BL43 xNB4D2, Cauvery-BL67 x CSR19, Varuna-BL24 x C. Nichi, Jayalakshmi, ND7 x CSR2, L14 x CSR2.

Crossbred: -

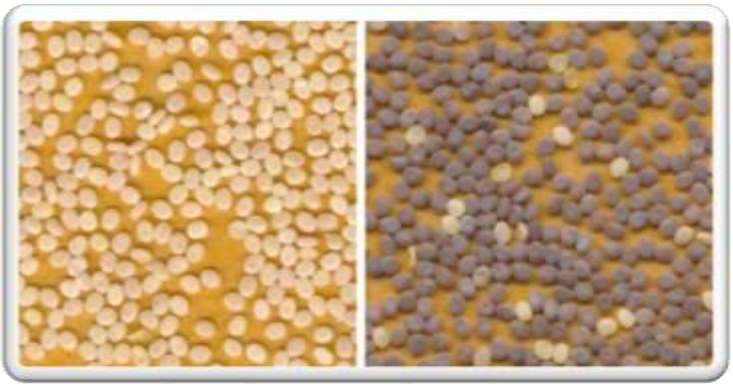
A cross of multi-voltine female with bi-voltine male (BAIF I; Y/'-WG XCSR2, BAIF II; WBC1 X CSR2). These crosses perform better in Maharashtra than the previous two and are therefore being promoted. Average cocoon production ranges from 50 to 100kg/100DFL. It is the 'race' preferred by farmers due to its combination of hardiness and higher production.

Life Cycle of mulberry silkworm (Bombyx*mori*):

The silk moth is dioecious, i.e., the sexes are separate. Fertilization is internal, preceded by copulation. The mulberry silkworm completes life cycle through complete metamorphosis in 40-45 days, consists of stages egg, larva, pupa and adult (moth). Egg stage is taking for 8-9 days, larval stage which is 22-27 days, pupal stage 8-9 days and moth stages 3-5 days.

Egg:

After fertilization, each female moth lays about 300 to 400 eggs. These eggs are placed in clusters. eggs are small, hemispherical and grayish in colour. Silkworm eggs are very tiny, size ranges from 1-1.3mm in length, 0.9- 1.2 mm in width. The size of egg will not be uniform in all races. That is depends on genes of silkworm races and nutritive value.



Caterpillar (larva):

The early hatched larva is dark black in colour covered with bristles around 3-5mm long, and later stage turn into white in colour. It will become a longer about 4-10 cm. The silkworm larva is a long ant like structure having head, thorax, and abdomen. During development stage the silkworm larvae under goes moulting depending upon the type of race. During each moult the cuticle stretches due to its elasticity and allow the body to develop, in view of elasticity, the larval body becomes smoother and lighter in colour due to stretching of cuticular skin.

Young worms can only feed on tender chopped mulberry leaves. And later age it become feed all type mulberry leaves except over matured and diseased leaves. At the time of maturity larva shows light yellow in colour and secrete fine thread from mouth. Then mature larva transferred into montage cage for cocoon formation.



Pupa: -

Mature larvae of mulberry silkworms are spine and constructed a protective shell around his body then pupate inside the shell. the cocoon is constructed from one continuous thread of silk having 800 -900 m long. The silk cocoon serves as protection for the pupa. The colour of Cocoons is white, creamy and yellow in colour depending on race of silkworm. After a final moult inside the cocoon, the larva develops into the brownish red, chitin covered structure called the pupa.

If the silkworms are allowed to mature and break through the cocoon, the silk would be rendered useless for commercial purposes. So, the encased insect is plunged into boiling water to kill the inhabitant and dissolve the glue holding the cocoon together. The end of the silk is then located and the cocoon unwound onto a spindle to be made into thread.

Cocoon:

Cocoon is the stage in which the larva spins silk threads around it, to protect itself from its predators. The larva traps itself inside the cocoon in order to pupate. The colour of the cocoon varies, depending upon race of silkworm and its food material. It can range from white to golden yellow. The second moulting occurs inside the cocoon, when the larva turns into a brown pupa. It takes about 2-3 weeks for the pupa to metamorphose into an adult moth.


Adult:

The adult moth is whitish dustyin colour, 25 mm long with 40 to 50 mm wing span. The female is larger than the male. The body has three divisions- head with a pair of eyes and a pair of antennae, thorax with three pairs of legs and two pairs of wings, and one large abdomen containing genital organs, they are not feed any food material due to vestigial mouth part.

Rearing of mulberry silkworm (*Bombyx mori* L.):

For rearing of silkworm, availability of food is must be needed, and environmental conditions like temperature, humidity, wind velocity, day length is also affecting the growth and development of worms.

Practices before rearing of silkworm

Before raising silkworm, these are following practices should be done-

i. Reconstruct the rearing house and repair door, window and closed with net to avoid the enemies of the silkworm, like bird, rats, ants, spiders and reptiles etc.

ii. Rearing house, all material like- rearing stand, rearing tray, feeding stand, chopping board, chop knife, baskets, table, stool, buckets, feathers, and mountages, are should be cleaned. Then rearing house, all material should be sterilized with 2% formaldehyde solution or bleaching powder, para formaldehyde and lime are also used and closed the rearing house for 20-24 houses.

iii. Maintain proper hygienic condition in rearing house to avoid the contamination and spread of disease.

iv. Avoid the unwanted entry in the rearing house which are not required.

v. Egg should be purchased from authorized agency or authorized institution.

Silk seed:

Silk seed is always available in the form of eggs in packets (dfls). One dfl contains 300-400 eggs. Silkworm seeds the backbone of silk industry. Healthy egg production is needed for much growth of the entire silk industry. Timely supply of superior quality of silkworm seed can alone sustain sericulture as a commercial crop in competition with other cash crops.

Incubation of egg:

The eggs should be kept in cooler place at a 25°C temperature and 80-85 % relative Humidity. Less humidity, decrease hatching percentage and more temperature cause weak larva and poor hatching percentage. For uniform hatching egg card should be kept in dark and cooler atmosphere. On the day of pin head or blue egg stage all the eggs are covered with a black sheet or kept in black box and known as black boxing. This facilitates faster development of embryo which are lagging behind and arrest the hatching of fully developed embryo. On the day of hatching all the eggs are suddenly exposed to bright light in the early morning at 8 A.M so that 95% hatching can be achieved.

Brushing:

The newly hatched larvae after one hour of hatching get ready to feed on mulberry leaf. Newly hatched larvae can be covered with a net with small hole that are almost similar to mosquito net and chopped leaves can be sprinkled over the net. These larvae slowly crawl on to the net and start feed on the mulberry leaves. Then transfer in to rearing tray by gently topping the net. Further, in case of egg cards, the egg cards are placed in the rearing trays and chopped mulberry leaf is sprinkle over the newly hatched larvae, the larvae crawl on to the mulberry leaf later on the cards are removed Transferring of newly hatched larva into rearing trays is defined as brushing.

Food requirements:

The young worms are fed with tender, succulent leaves, which contain sugar, less amount of fibre, starch but high moisture and proteins that are suitable of silkworm. Hence top tender leaves of mulberry plants are used to feed the young age worm. 1st and 2nd instar caterpillars are feeds on fresh tender chopped leaves because small size and very less food requirements and 2nd to 5th instar larvae feed gradually and need much leaves because, the caterpillar are gradually increase body size and develop silk glands for secretion silk thread are used as a material for making cocoon. Daily 3 feeds (6 AM, 2 PM and 10 PM) schedule should be followed. Avoid feeding of solid, over matured leaves. Distribute the larvae uniformly in the bed during every feeding. The bed space required for the worms of 100 dfls at the end of the fifth stage is 600^2fits. Remove the under sized and all suspected diseased worms carefully with chopsticks before every cleaning / feeding to avoid the contamination. The picked larvae should be put into 2% bleaching powder in 0.3% slaked lime solution.

Bed cleaning

- Remove the dried leaves, rejected leaves in the bed, silkworm excreta, dead worm,
- Don't spill the bed refuse on the floor of the rearing room while cleaning the bed.

Maintenance of temperature and humidity

- The ideal temperature for the late age rearing is 26°C for III instar larvae, 25°C for IV instar and 24° C for V instar larvae. 80% humidity is required for III instar larvae and 70% is required for IV and V instar larvae.
- Adjust the temperature and relative humidity as per requirement by using cooling, heating and humidifying appliances such as air cooler, room heater, charcoal stove, wet gunny cloth or by sprinkling water on the roof or using wet sand.
- Good cross ventilation will help to reduce the body temperature of the silkworm.

Maintenance of hygiene

Wash hands and feet with disinfectant solution before entering in to the rearing house. To begin with, the hands and feet should be washed with alkaline soap and then dipped in disinfectant solution (2.5% sanitech/ serichlor in 0.5% slaked lime solution or 2% bleaching powder in 0.3% slaked lime). Wash hands in disinfectant solution and water after picking of diseased worms, after bed cleaning and before feeding. Pick the diseased worms every day into a basin with lime powder and bleaching powder mixture and dispose of carefully by burning or burying at a distant place. Keep the rearing room clean and well aerated during silkworm rearing

Harvesting of cocoon: -

The silk worms complete spinning in 2-3 days but the cocoons should not be harvested at this time as the worms inside are still in the pre-pupal stage. Harvesting should be done on the 5th day (7th day for bivoltine hybrids) when pupae are fully formed and hard.

****

Subscribe

Times of Agriculture

Monthly e-Magazine

Rs. 0	Rs. 300	Rs. 500
B.Sc. Students	M.Sc.	Scientists
	Ph.D.	Professors
	Students	SMS/RA
		JRF/ SRF

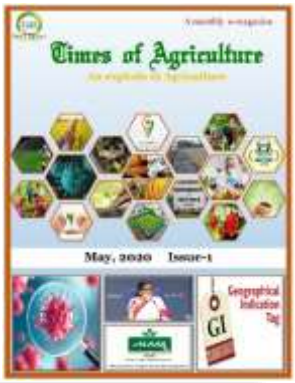
Apply for Membership

Timesofagriculture.in

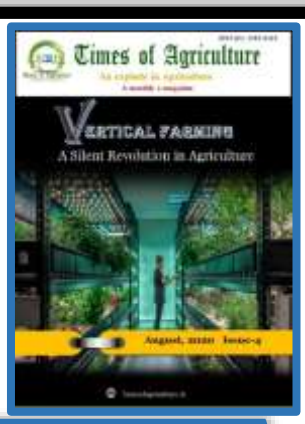
Visit

1-May

2-June

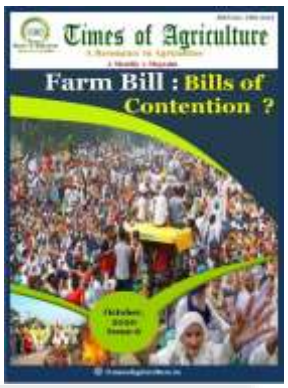


3-July

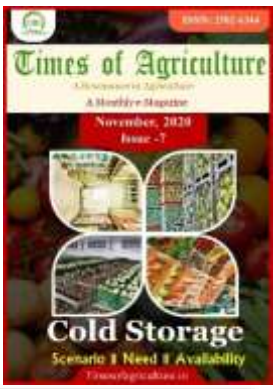


4-August

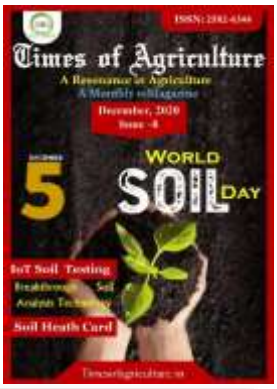
5-September



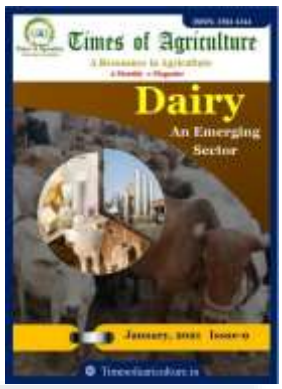
6-October



7-November



8-December



9-January

10-February

11-March

12-April