FEB- 2022

AGRISAKTHI NATURE

Monthly e-Magazine for Innovative Agriculture

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Agrisakthi e-Magazine Editorial Team

From the Chief Editors Desk…

Dear Readers,

Agriculture has been the very important occupation of human beings. Increasing population, climate change, shrinking the resources and increasing disposable incomes have put agriculture worldwide under tremendous pressure. To face the changes we need the basic knowledge with high research potential in agriculture. So we glad to launch our second issue of **"Agrisakthi e-Monthly Magazine for Innovative Agriculture"**. The main aim of this magazine is to explore the novel innovations, modern technologies, scientific information and latest findings in agriculture and allied sectors for upliftment of farming community. Agrisakthi e magazine is an open access peer reviewed English journal which will start publishing from January 2022.The Agrisakthi magazine will offer a platform to all the undergraduate and post graduate students, scholars, researchers and scientists to share their ideas about latest innovative topics. We invite the popular article, review article and short communication from various disciplines like agriculture, horticulture, forestry, animal science, dairy science, fishery, organic farming, medicinal plants, and sericulture. The following points to be considered before submission, an article must be free of plagiarism, author himself/herself is responsible for plagiarism, article must be within magazine article page limit (within 3-4 pages), article should not be sent for publication and published elsewhere and author agrees to guidelines and terms, conditions of our magazine.

We are happy to announce, our team already published **"Agrisakthi"** Magazine for past two years with 58 issues successfully in Tamil language and received huge positive responses from worldwide. We are looking forward for the same responses to this **"Agrisakthi e-Monthly Magazine for Innovative Agriculture".**

Article Number : 01032022-01

01.Environmental communication for education and awareness

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ENVIRONMENTAL COMMUNICATION

Environmental Communication (EnvCom) is the planned and strategic use of communication processes, media products, and other tools to support effective policymaking, public participation, project implementation, and other activities geared toward environmental sustainability. A broad definition of environmental communication would be "the sharing of information, insights, and opinions on environmental issues, trends, conditions, and solutions through any means of communication, ranging from inter-personal methods to mass communication through modern and traditional media."

Why Environmental Communication?

- **The topic of study is multidisciplinary and encompasses both lay and professional activities.**
- **Identifying and promoting excellent practices is a fundamental objective of the area.**
- **Environmental communication is a practical and indispensable instrument for taking action.**

- **Communication has an impact on how we see and evaluate the world.**
- **The effectiveness with which we communicate about nature and environmental issues will impact our ability to solve ecological catastrophes.**

Snippets of Environmental Communication

Communication about environmental issues is called environmental communication. When it comes to environmental concerns, challenges, and our connection to nature, many different types of communication make up the societal discourse. A related interdisciplinary field of study is environmental communication, which looks at the role of communication in environmental affairs and the techniques and effects of communication (Cox 2013).

Fundamentally, it investigates the activity, and in doing so, it draws on theories and methods from various disciplines, including communication, environmental studies, psychology, sociology, and political science. There are university courses and programmes in environmental communication, research centres devoted to the field's investigation, scholarly journals devoted to the subject, and books on various aspects of the field's study (Hansen and Cox 2015). In addition, several interconnected dimensions of communication focus on the research in this field (Meisner 2015; Anon n.d.).

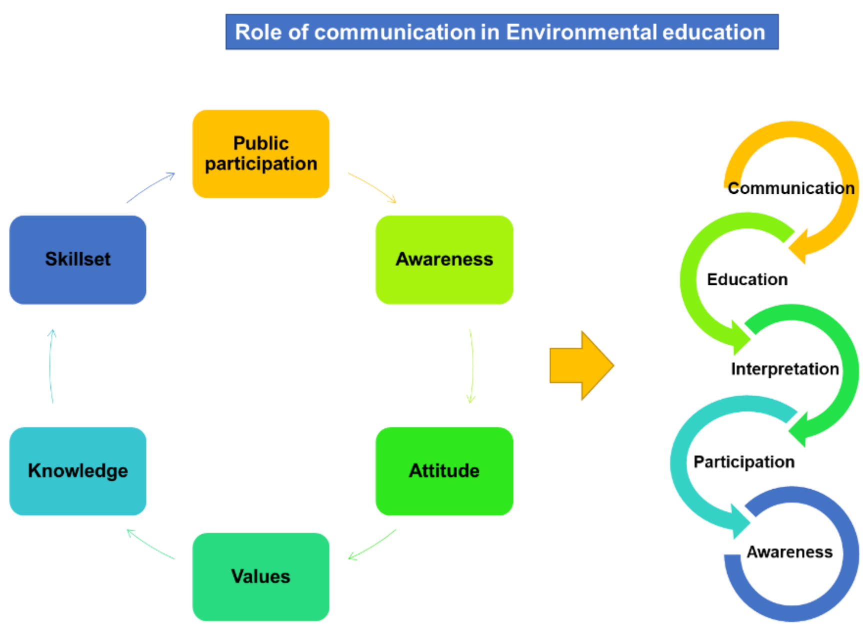

Fig. 1 Role of communication in Environmental Education

The prominence of environmental communication

Environmental communication has two major societal roles. The first is that we communicate. We communicate to inform, convince, educate, and warn others. We utilise communication to organise, dispute, reconcile and negotiate. In this approach, environmental communication is a valuable and necessary instrument. So it warrants close examination. Whether you are trying to promote a policy, increase awareness, modify behaviour, sway public opinion, resolve disputes, pass legislation, or question preconceptions, how you communicate matters. To flourish in any of these areas, efficient communication is required. Communication also plays a part in the creation of meaning. Communication impacts our perception and value of objects, events, situations, and ideas. Communication informs our knowledge of environmental concerns, challenges, individuals and organisations engaged, possible solutions, futures, and most crucially, the natural world itself. Many in this sector appreciate the importance of meanings and values in directing anything from technology development to policy support to daily personal decisions. However, meanings and values do not dictate how individuals behave.

Role of mass media in environmental communication

Mass communication is vital in modern human culture. Various interest groups share information and perspectives to understand one another better. The mass media contribute significantly to global communication. The mass media are significant information sources for public opinion development (Krott 2005). Thus, in modern democracies, environmental communication through mass media is vital (Bennett and Entman 2000). Various stakeholders, including the government, businesses, NGOs, and people, express their views on critical public topics via media discourses. Since the 1992 UN Conference on Environment and Development, forest protection has become a major national and worldwide environmental concern. The importance of forest conservation is growing as it represents sustainability and harmony between economic, ecological, and social components. Forest conservation has recently gained prominence in relation to two global issues: climate change and biodiversity (Park 2013). Hence, environmental communication is mandatory and essential to address the burning issues of the environment. The media is critical in educating the public on climate change and prioritising climate information above other matters (Swain, 2014).

Conclusion

Better legislation, better energy, new technology, carbon levies, and other creative environmental solutions can only get us so far. Human culture must evolve to ensure long-term ecological sustainability (particularly in wasteful Western cultures). This will need fundamental changes in our attitudes toward nature, ourselves, and others. Communicating effectively about nature and environmental issues will influence how fast and deeply societies change, eventually addressing the ecological catastrophe. The importance of the mainstream media in sharing knowledge about the negative consequences of climate change cannot be overstated. According to all available evidence, the media has a critical role in forming human beliefs, cognition and behaviour in relation to particular societal concerns. The major constraint in environmental communication is its complexity; hence it needs to be addressed more scientifically and statistically. However, the receiver is common people; hence, the environmental communication needs to be simpler and easily understandable. So, environmental communication needs to seek the solution for the burning environmental issues by increasing awareness.

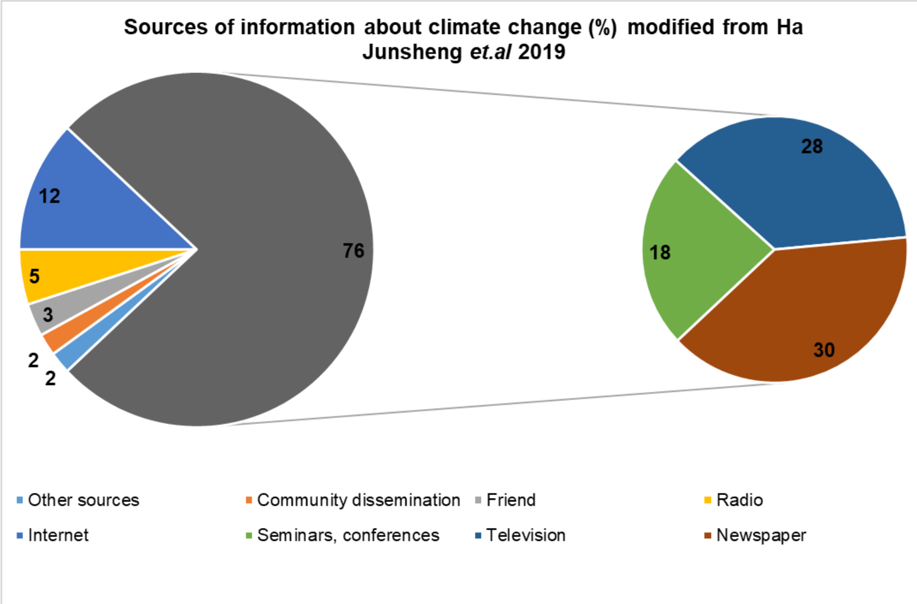

Fig. 2 Sources of information about climate change

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Article Number 010322-02

02.CELLULAR AGRICULTURE

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Cellular agriculture focuses on the production of agriculture products from cell cultures using a combination of biotechnology, tissue engineering, molecular biology, and synthetic biology to create and design new methods of producing proteins, fats, and tissues that would otherwise come from traditional agriculture. Most of the industry is focused on animal products such as meat, milk, and eggs, produced in cell culture rather than raising and slaughtering farmed livestock which is associated with substantial global problems of detrimental environmental impacts (e.g. of meat production), animal welfare, food security and human health .Cellular agriculture is field of the biobased economy

Why do we need cellular agriculture?

Cellular agriculture would eliminate the need to kill over a trillion animals annually for food, as is done today. Without the need to raise living animals, cellular agriculture would significantly reduce animal suffering by providing an alternative to factory farming..

Types

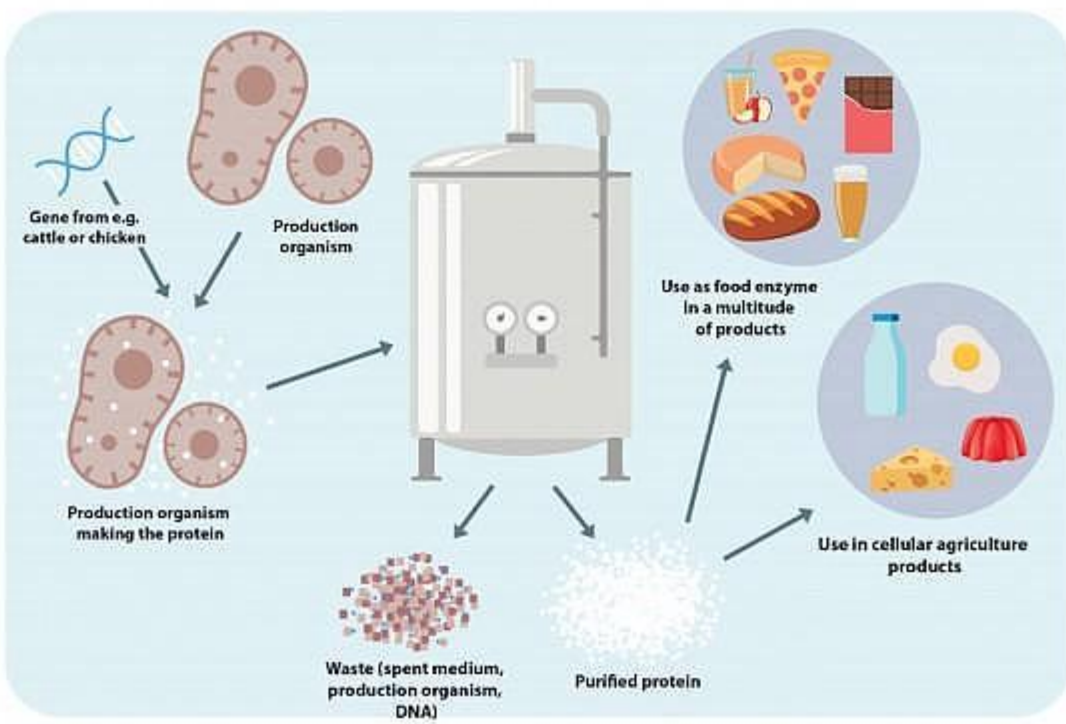
There are two kinds of agricultural products derived from cell culture: a cellular products and cellular products.

- A cellular products are made of organic molecules like proteins and fats and contain no cellular or living material in the final product.
- Cellular products are made of living or once-living cells.

Uses of Cellular agriculture

The main use of this technology has been for food applications, particularly in vitro or cultured meat, called 'clean meat', cellular agriculture can be used to create any kind of agricultural product, including those that never involved animals, to begin with, eggs, leather, milk, fragrances, gelatin and silk

Cell-based meat, also called clean meat or cultured meat, is nutritionally equivalent to conventional animal meat, and tastes, smells, looks and feels exactly the same. Its only difference lies in the method of production.



Future directions for cellular agriculture research

Improvements and changes in food production are the need of the hour owing to the exponentially growing population. Cellular agriculture and cultured meat are promising technologies that could resolve the food security problems to a certain extent. However, the acceptance of the end products of cellular agriculture is still moderate.

The personal health benefits and the environmental sustainability associated with these products are yet to be popularized. Though cellular agricultural products are associated with positive impacts on various areas like global food security, sustainability, environmental improvements, they should not be considered as a definite solution to these problems. Cellular food processing in small quantities is achieved at present but the challenge of large-scale and cost-efficient production is less determinate. Another challenge is the price competition and taste difference of the products when compared to their real counterparts. The day when cellular agricultural production leaves a significant mark on the global climate and food security improvement is still far.

Some key aspects that should be addressed by future research are as follows:

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- How can the production process be made more efficient to make cellular products more cost-effective compared to conventional meat
- What is the consumer acceptance level of cellular products among different age groups and geographical areas and how it can be improved?
- What are the food safety challenges that can arise due to bacterial growth in the bioreactors during the cellular agriculture production process?
- How can the texture, chewiness, and taste of meat analogues be enhanced so that the pessimism towards these products is alleviated?
- What policies and governmental interventions are to be taken to develop cellular agriculture especially in developing countries?

Article Number 010322-03

03.Ecological Engineering for Pest Management

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Introduction

Ecological engineering for pest management is an emerging as a paradigm of ecologically based approach aimed at favoring natural enemies and enhancing biological control in agricultural systems. The aim of ecological engineering is developed suitable ecological infrastructure within the agricultural landscape to provide sufficient resources such as food for adult natural enemies, alternative prey or hosts, and shelter from adverse conditions. Manipulation of the environment to enhance the survival, fecundity, longevity, and behavior of natural enemies to increase their conservation efforts. Natural enemies may require food in the form of pollen and nectar for adult natural enemies, shelters such as overwintering sites, moderate microclimate and alternate hosts when primary hosts are not present.

Habitat manipulation

Habitat manipulation aims to provide Natural enemies with resources such as nectar (Baggen and Gurr, 1998), pollen (Hickman and Wratten ,1996), physical refugia (Halaji et al., 2000), alternative prey (Abou-Awad, 1998), alternative hosts (Viggiani, 2003) and lekking sites (Sutherland et al., 2001). Habitat manipulation approaches, provide these resources and operate to reduce pest densities via an enhancement of natural enemies. Beetle banks are raised earth ridges that typically run through the centre of arable fields and are sown to perennial tussock-forming grasses. During the winter, far higher densities of predatory arthropods shelter on the well-drained, insulated sites than in the open field. In the spring, beetles and other natural enemies emerge from the beetle bank to colonise the growing crop and prevent pest aphid outbreaks (Thomas et al., 1991).

When herbivores (the second trophic level) are suppressed by natural enemies (third trophic level) is the top-down control this type of approach is seen in augmentive biological control. Root (1973) referred to pest suppression resulting from this effect as supporting the enemies hypotheses. Importantly, however, within-crop habitat manipulation strategies such as cover crops and green mulches (components of the first trophic level, as is the crop) can also act on pests directly, providing bottom-up control, this type of approach is seen in habitat manipulation of conservation biological control. Root (1973) termed pest suppression resulting from such non-natural enemy effects as the resource concentration hypothesis, reflecting the fact that the resource (crop) was effectively diluted by cues from other plant species. Thus, habitat manipulation, though it makes a major contribution to Conservation Biological Control, includes a wider series of approaches that may operate independently of natural enemies.

Ecological engineering for pest management – Above ground

- Raise the flowering plants / compatible cash crops along the orchard border by arranging shorter plants towards main crop and taller plants towards the border to attract natural enemies as well as to avoid immigrating pest population
- Grow flowering plants on the internal bunds inside the orchard
- Not to uproot weed plants those are growing naturally like *Tridax procumbens*, *Ageratum* sp, *Alternanthera* sp etc. which act as nectar source for natural enemies
- Not to apply broad spectrum chemical pesticides, when the P: D ratio is favourable. The plant compensation ability should also be considered before applying chemical pesticides

Ecological engineering for pest management – Below ground

- Keep soils covered year-round with living vegetation and/or crop residue.
- Add organic matter in the form of farm yard manure (FYM), Vermicompost, crop residue which enhance below ground biodiversity.
- Reduce tillage intensity so that hibernating natural enemies can be saved.
- Apply balanced dose of nutrients using biofertilizers.
- Apply mycorrhiza and plant growth promoting rhizobacteria (PGPR)

Conclusion

Habitat manipulation is another form of augmentation and conservation of natural enemies in which cropping system altered successfully to augment and enhance the effectiveness of the natural enemies. Adult parasitoids and predators significantly benefited from source of nectar and the protection provided by refuge (hedge rows, cover crops and weedy borders). Mixed planting increases the diversity of habitats and provide more effective shelter and alternative food source to predators and parasites.

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Article Number 01032022-04

04.GROW MILKY MUSHROOM FOR MORE PROFIT

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Introduction

Cultivation of milky mushroom was developed by Dr. RP Tiwari. This is the first indigenous mushroom to be commercialized in the country. Milky mushroom (*Calocybe indica)* is second tropical mushroom after paddy straw mushroom and 4th popular mushroom in India. Milky white mushrooms thrive in humid tropical and subtropical climates, making them ideal for commercial cultivation. Extracts from milky mushrooms have been shown to have anti-hyperglycemic and anti-lipid peroxidation properties. It can be successfully cultivated during summer and hence they are called as summer mushroom.

Merits of growing Milky Mushroom

- It has high biological efficiency (80-100%) and simple cultivation process
- It has better keeping quality (3-4 days) and cultivated in different agro wastes
- It can be cultivated March-October in India
- It can tolerate high temperature in which straw mushroom fails

Health benefits of milky mushroom

- ✓ Milky mushrooms are an excellent source of vitamins B2, E, and A, phosphorus, potassium, selenium, and also contain calcium, vitamin C, iron and zinc.
- ✓ It strengthens and regulates the immune system and act as powerful defense against infections.

- ✓ It is also said to have antibiotic, anti-tumor, and anti-cancer properties, and to help in regulating diabetes, lowering bad cholesterol levels, and to have strong antioxidant properties.

Climatic requirement:

- ✓ Temperature-25-38 °C
- ✓ Humidity- More than 80%
- ✓ Light- 200 lux
- ✓ Substrate moistuer- 65-70%

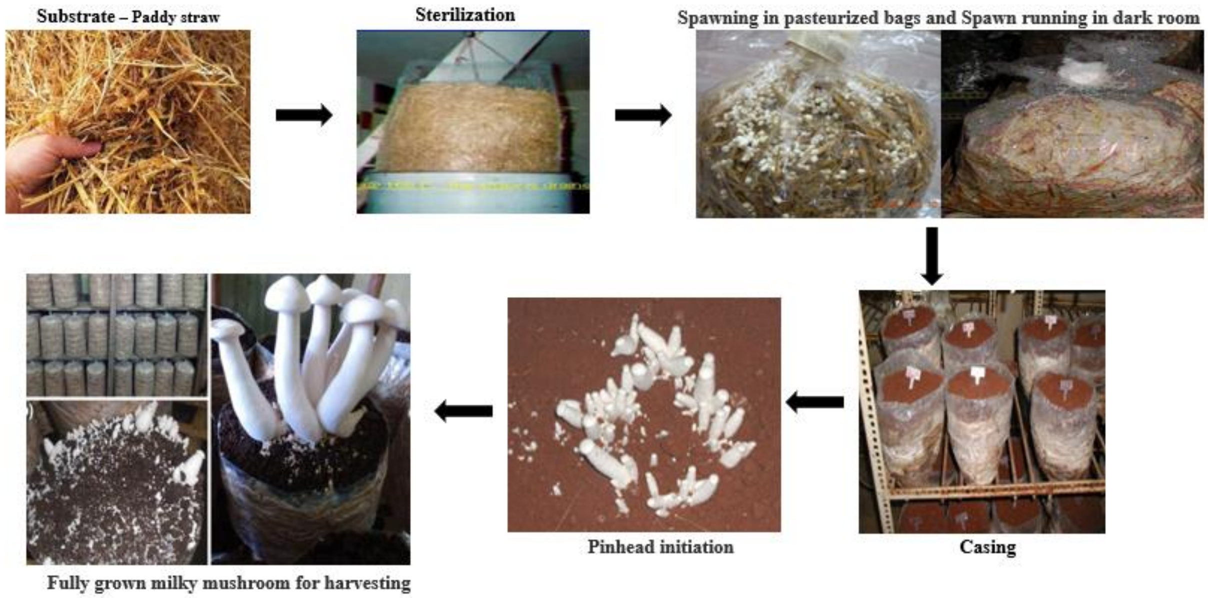
Materials required

- ✓ Straw-1.5kg
- ✓ Spawn-200g
- ✓ Polythene bag-1 (60x40cm)
- ✓ Suppliments-200g (boiled wheat, pulse powder, maize mill, wheat bran, rice bran,
  vermicompost etc.)

Mushroom Crop	**Crop duration (days)**	**Crop cycle (days)**
Milky Mushroom	**40**	**60**

Substrate preparation

As with oyster mushrooms, milky mushrooms (*Calocybe indica*) can be cultivated on a variety of substrates including paddy straw, maize stalk, sorghum stalk, pearl millet stalk, palmorosa stalk, vetiver grass, sugarcane bagasse, soyabean hay, and others, however paddy straw is the best and cheapest form of substrate for this mushroom. Paddy straw can be chopped into small (1-2cm pieces), soaked in water for 2-3 hours. The substrate can be pasteurised in hot water 60°C for 4 hours (no prior soaking necessary), making it ideal for small-scale production (or) Steam pasteurisation (in autoclave or special steam chambers) at 80°C for 2 hours, appropriate for semi-commercial manufacturing (or) Sterilized in an autoclave at 121°C, 15 lb pressure for 15 minutes (after filling in PP bags, blocked with cotton) (best method for commercial production). After pasteurization/sterilization, straw-filled bags are moved to the spawning chamber for cooling, bag filling, and spawning.



2. Spawning and spawn running:

The moisture content of the substrate should be 62-65 percent at the time of spawning, and a larger spawn dose (4-5 percent) of wet substrate should be used. After spawning, the bags are moved to the spawn running room and kept in the dark, where the temperature is controlled between 25 to 35 °Celsius and the relative humidity is kept over 80%. It takes about 20 days when substrate is fully colonized and bags are ready for casing.

3. Casing

After the spawn run, sterilised casing material in a thickness of around 3-4 cm is applied to the upper surface of the bags. Casing mixture (soil 75 % + sand 25%) with its pH adjusted to 7.8-7.9 is pasteurized in an autoclave at 15 lbsp.s.i for one hour or chemically treated with formaldehyde solution (4%) about one week before casing. Casing soil so treated should be covered with polythene sheet for about a week for proper fumigation and to avoid escape of chemical. The sheet is removed after a week, and the mixture is changed every two days until the mixture is free of formalin smells at the time of casing. The casing mixture is distributed in a homogeneous layer of 2-3 cm thickness on the straw surface, with a bed temperature of 30-35°C and a relative humidity of 80-90 percent maintained.

4. Cropping

When the cropping room is kept at 30-35°Celsius, with a RH of 80-90 % and enough light during the day (10 to 12 hours each day), as a result commencement of fruiting bodies or pinhead initiation about 7-10 days after casing which mature in about a week. Twisted mushrooms with a cap diameter of 7-8 cm are collected, cleaned and packaged in polythene bags for marketing.

5. Yield

Milky Mushrooms are 40-45-day crop with a yield of 12-15 kg/100 kg compost. The mushrooms are either sold fresh in the market or canned for long time preservation.

Major insect pest and diseases of mushrooms and their management

- ✓ Phorid fly, Sciarid fly and Cecids - Nimbidiseen (0.03%) 100 ml/ lit. is be added in 13-14 liter of water to mix with 100 kg compost. *Bacillus thuriengiensis var. israelensis*, and methoprene are effective in controlling.

- ✓ Mites - Diacophal 50 EC 2ml/lit (or) Kelthane at 10 lit sprayed from time to time in the compost and on the wall of mushroom house.

- ✓ Springtails - Diazinon 30 ppm in compost at the time of filling and spray of insecticides like Dichlorovos at 0.025–0.05 % conc. (spawn run and cropping period)

- ✓ Nematodes - Nematode trapping fungi like *Arthrobotrysoligospora, A. superba, A. robusta* and several species of *Pleurotuscan* be used as bio-control agents against mushroom nematodes. Mixing of plant extracts of neem, castor, groundnut, karanj etc. in compost at the time of spawning or cropping.

- ✓ Major diseases of mushroom - Fungal diseases dry bubble, *Verticillium fungicola* (Use of sterilized casing material and steam the compost with 71 º C for 8-10 hours and Wet bubble, *Mycogone perniciosa* (live steam at 71º C for 10 – 12 hours copping beds / bags; fumigation of the cropping room with formaldehyde and spray of fungicides like Bavistin (0.5%) immediately after casing.

- ✓ Bacterial spot / Brown blotch: *Pseudomonas tolaasii* (Vector: Tryoglyphid mite)- Watering with 150-ppm chlorine solution.
- ✓ Viral diseases of mushrooms are also know as la france, die back disease and mummy disease- Complete hygiene, use of disease free spawn, frequent disinfection with formaldehyde, cook out of exhausted compost at the end of the crop with live steam at 70-71 º C for 10-12 hours.

Economics of milky mushroom production

(25 kg / day in 300 working days in a year)

Sl. No	Particulars	25 kg / day	
		Quantity and rate	Amount (Rs)
A. Capital Investment			
1.	Construction of mushroom shed @ Rs. 12,000	4 Nos x 20,000	80,000
2.	Straw cutter	1 No x 8,000	8,000
3.	Boiler–100 lit / 250 lit capacity (G.I.drum)	2 No x 4,000	8,000
4.	Vessel for boiling casing soil	2 No x 4,000	8,000
4.	Cement tub	2 Nos x 2,000	4,000
5.	Sprayer	1 No x 2,500	2,500
6.	Heat efficient chullah	2 No x 1,000	2,000
	Total		1,12,500
B. Fixed cost or overhead cost			
1.	Interest on capital investment @ 15% p.a.	1,12,500 x 15/100	16,875
2.	Depreciation for capital investment @ 10 %	1,12,500 x 10/100	11,250
	Total		28,125

C. Working expenditure			
1.	Paddy straw @ Rs. 1,000 / t	10 t x 1,500	10,000
2.	Spawn bags @ Rs.15 / bag (20 % more than the required to compensate contaminated bags)	9,000 x 15	1,35,000
3.	Polythene bags for bed preparation and polythene bags for packing mushroom @ Rs. 60 per kg	300 x Rs. 60	18,000
4.	Casing soil preparation		15,000
5.	Fungicides, insecticides, fumigants, etc.		5,000
6.	Women labour @ Rs. 40/day	900 x 40	36,000
7.	Electricity charges and fuel		10,000
8.	Miscellaneous including jute thread		5,000
	Total		2,34,000
D. Total cost of production			
1.	Working expenditure		2,34,000
2.	Fixed cost		28,125
	Total		2,62,125
	Cost of production / kg of mushroom		**34.95**
E. Income			
1.	Value of mushroom (25 kg per day in 300 days @ Rs.60 / kg)	7,500 x 60	4,50,000
2.	Total cost		2,62,125
	Net income / year		**1,87,875**
	Net income / month		**15,656**

CONCLUSION:

Mushrooms can serve as food, as tonic, and as medicine. A regular intake of mushrooms can make you healthier, fitter, and happier. They can make you live longer, and always look younger. It has been observed that over 70% of agricultural and forest products have not been put to total productivity, and have been discarded as waste. Using these agricultural wastes to get money from mushroom gardening is a good idea. Mushroom cultivation not only can convert these huge lignocellulosic biomass wastes into human food, but also can produce notable nutriceutical products, have many health benefits and creating a pollution-free and beneficial environment.

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Article Number 05

05. HYDROPONICS-AN ALTERNATIVE TECHNOLOGY

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INTRODUCTION

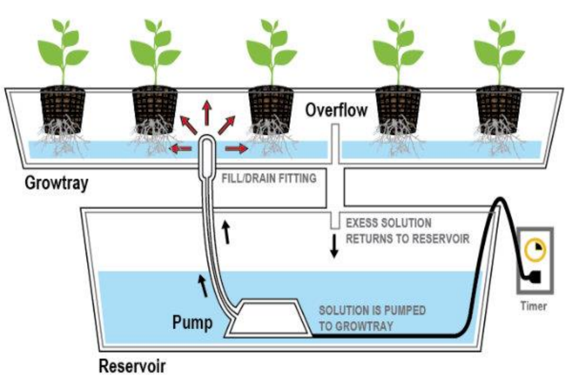
Due to several man-made factors such as industrialization and urbanization, soil-based agriculture is currently facing difficulties. Soil fertility and quality are also depleted as a result of natural disasters, climate change, and the unregulated use of pesticides in agriculture. As a result, scientists have devised a novel alternative cultivation technology known as soilless cultivation or hydroponics (Greek word: hydro-water, ponics-labour).It is the method of growing plants in different types of substrates (chemically inert), gravel, or liquid (water), in which nutrients are added, but no soil is used. The word first appeared in a scientific magazine article (Science, 178:1) published in February 1937 and was authored by W. F. Gericke. Initially only three crops were grown under hydroponics, now wide range of crops are successfully grown like pepper, strawberry, cucumber, potatoes, roses etc.

MAJOR TYPES OF HYDROPONIC SYSTEMS

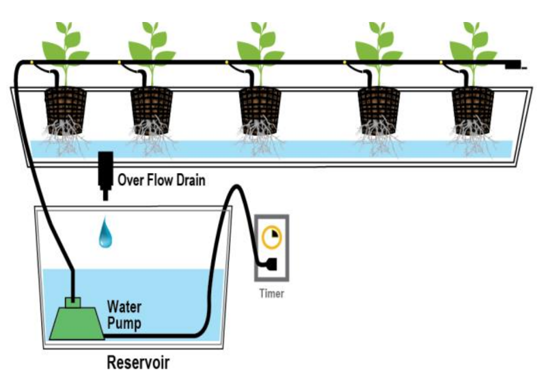
Types	**Description**
Deepwater culture (DWC)	The roots of the plants are suspended directly into the nutrient solution in the deep water culture system of hydroponics, and an air stone is utilised to deliver air to the roots. The roots of the plants are suspended in nutrient-rich water and are grown in net pots (Sharma *et.al*, 2018). Deep water culture is the main hydroponic production system of cherry tomato
Drip system	The nutrient solution is kept separate in a reservoir, and the plants are cultivated in a soilless medium separately. With the help of a pump, water or nutrient solution from the reservoir is delivered to individual plant roots in an appropriate proportion. (Raphael and Colla, 2005). Advantage: Able to withstand short-term power or equipment failure
Ebb and flow	This is the first commercial hydroponic system that works on the flood and drain method. A grow tray and a reservoir filled with nutritional solution are used in this method. A pump floods the grow tray with fertiliser solution on a regular basis, which then gently drains away. It is possible to cultivate a variety of crops, although root rot, algae, and mould are all prevalent problems (Nielsen *et al*., 2006)
Nutrient film technique (NFT)	Dr. Alen Cooper created NFT in the mid-

	1960s in England. It is one of the most popular hydroponic system. A fertiliser solution is continuously pumped through ducts in which plants are inserted (Domingues *et al*., 2012). The nutrient solutions are returned to the beginning of the system when they reach the end of the channel. This creates a recirculating system, but unlike DWC, the roots of the plants are not entirely buried, which is why this method is called NFT. It is most commonly used for growing smaller and quick growing plants like lettuce
Wick system	This is the most basic hydroponic system, as it does not require electricity, a pump, or aerators (Shrestha and Dunn, 2013). Plants are planted in an absorbent media such as coco coir, vermiculite, or perlite, with a nylon wick going from the roots to a nutritional solution reservoir. Water or fertiliser solution to plants deliver through capillary action

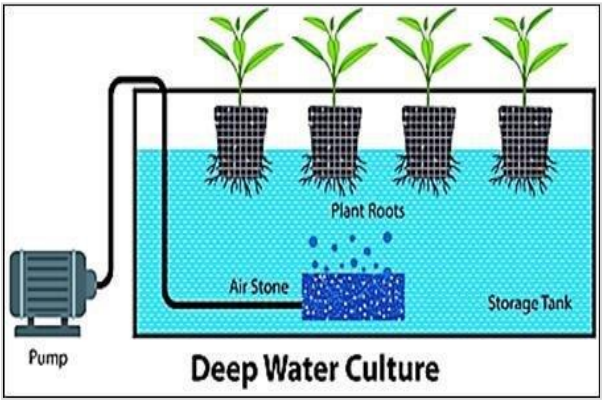
Ebb and flow system

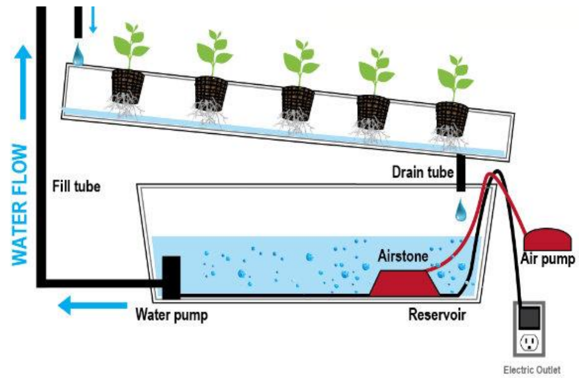


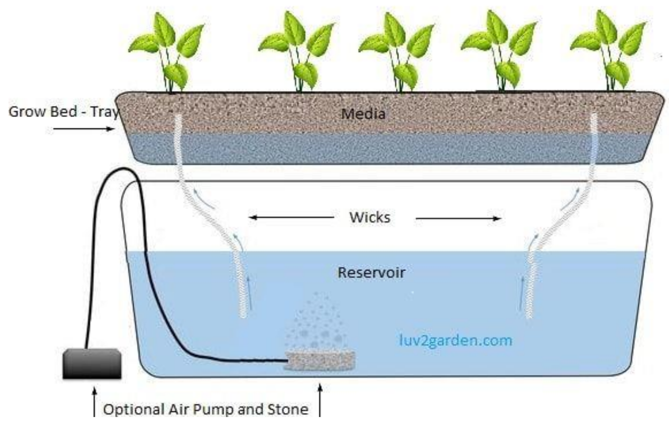
Drip system



Nutrient Flim System







Wick system

Sharma *et al.*, 2018

ADVANTAGES

- **Surplus and scarcity**: Gap between supply of food and demand becomes more now a day. In such cases, geoponics seems difficult. Thus people shift to hydroponics with advantage of growing crops in small space
- **Farming at heights**: It is less space is used to generate a high amount of outputs. It also extended vertically in even places such as marginal lands, inside warehouses, water scarce areas.
- **Pesticide free**: There is no need for the farmer to add any kind of fertilizer to the nutrient-rich water the crop extracts the required minerals, also it has been proven that hydroponically greens are better to taste
- **Better growth rate**: Artificial environment with the addition of a light or air conditioning created will be suited best according to the different plant's

needs, results in terms of turning out to be fresher, greener and tastier to eat

- **Conservation of water**: it requires just 2- 3 litres of water to produce one kg of lush green fodder, as compared to 60-80 litres to conventional system of fodder production.
- **Reduced labour requirement**: Continuous intense labour for cultivation of fodder is required in conventional fodder production, but in hydroponics labour required is 2- 3 hours / day only

DISADVANTAGES

- High initial investment cost
- Technical skill and knowledge are necessary for operating the system
- Requires strict sanitation to avoid pest and disease incidence
- Daily monitoring is necessary

CONCLUSION

Finally, hydroponics is becoming more popular around the world, and these systems provide many new chances for producers and consumers to obtain high-quality produce, including veggies boosted with bioactive components. Farmers should be given training on how to produce plants utilizing a hydroponics system in the future. Universities and research institutions in agriculture should be provided cash to conduct surveys and strive to create innovative, cost-effective procedures.

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Article Number 010322-05

06.LATE BLIGHT OF POTATO - A THREAT

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INTRODUCTION:

The Potato is a starchy tuber of the plant *Solanum tuberosum* and is a root vegetable native to the Americas. The plant is a perennial in the nightshade family Solanaceae. Potato plants are herbaceous perennials that grow about 60 cm (24 in) high, depending on variety, with the leaves dying back after flowering, fruiting and tuber formation. They bear white, pink, red, blue, or purple flowers with yellow stamens. Potatoes are mostly cross-pollinated by insects such as bumblebees, which carry pollen from other potato plants, though a substantial amount of self-fertilizing occurs as well. Tubers form in response to decreasing day length, although this tendency has been minimized in commercial varieties.

Late blight is one of the most dangerous disease in Potato. It is caused by the fungus like oomycete pathogen *Phytophthora infestans*. This potentially devastating disease can infect potato foliage and tubers at any stage of crop development. Ist reported in 1845 at Irish. It causes the Irish famine. Nearly 4 million peoples were died. 8 million peoples were migrated in other countries. It's called Pandemic Disease. In india it was 1st reported in 1870 at Nilgris. If the disease will occur it causes 100% yield loss.

Six theories involved for this disease occurrence as yearly manner

1) The persistence of mycelium in soil.

2) A perennial mycelium in the affected tubers

3) The production of oospore or resting spore which over winter or over summer in the soil

4) The presence of latent mycelium with in the potato tissues

5) The fruiting of the fungus of the parent tubers left in the soil

6) The development of sclerotial like bodies on chlamydospores. Primary spread through soil, Secondary spread through Zoospores.

Pathogen Characters:

It is a facultative saprophyte, mostly terrestrial and less development on free water for reproduction. Morphologically, members of both genera are very similar in having coenocytic, hyaline and freely branching mycelium although the hyphae of *Phytophthora* species are usually wider in diameter (5-7µm) and slow growing with approximately right angle branching whereas the hyphae of *Pythium* species are fast growing in general, narrower (4-6µm) wide, with the hyphae more flexuous or meandering in nature.

Symptoms:

- Water soaked spots appear on leaves, increase in size, turn purple brown colour & finally black colour.
- It affects leaves, stems and tubers.
- White growth develops on under surface of leaves.
- This spreads to petioles, rachis& stems.
- Stem breaks at these points and the plant topples over. In tubers, purplish brown spots and spread to the entire surface on cutting, the affected tuber show rusty brown necrosis spreading from surface to the center.

Mode of spread and survival:

- The primary infection was due to infected tubers and the infected soil.
- The diseased tubers are mainly responsible for persistence of the disease from crop to crop.
- The sporangia act as a source air borne infection is caused.

Epidemiology:

- Relative Humidity - >90%, Temp.-10-25°C and Night temperature:10°C.

Cloudiness before rainfall and Rainfall at least 0.1mm and subsequent days after rainfall.

Management:

- Sanitation
- Advance spraying with mancozeb or zineb 0.2 % should be done to prevent infection of tubers.
- Spraying Metalaxyl or Fosetyl – Al @ 0.02 % is effective.
- Tuber contamination is minimized if injuries are avoided at harvest time and storing of visibly infected tubers before storage.
- The resistant varities recommended for cultivation are Kufri Naveen, Kufri Jeevan, Kufri Alenkar, Kufri Khasi Garo and Kufri Moti.

Water soaked lessions on the leaf

Destruction of the foliage few days before harvest is beneficial and this is accomplished by spraying with suitable herbicide

Article Number 07

07.Effect of Natural fertilizers on blooming quality of Rose

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Rose (*Rosa spp*.) is universally acclaimed as a 'Queen of Flowers'. Cultivation of beautiful roses needs a care and lots of nutrients. You can grow your roses best with a food balance that's high in nitrogen, phosphorus, and potassium, as well as some secondary nutrients and minerals. Natural fertilizers provide steady nutrients to the soil long-term, and there are many types to choose from. Chemical fertilizers are fast-acting and need only 1-3 applications for the year. Many rose gardeners prefer to combine the two types of fertilizer for the best results.

Use natural fertilizers before planting and before your rose's first bloom:

For new and small rose plants, it's best to use organic fertilizers to avoid burning their delicate roots. Add nutrients to the soil before planting your rose bush, and after you first plant them, with natural fertilizers. Wait until after they bloom the first time before using any chemical fertilizers

- During early spring, the roses start to bloom and comes out of dormancy, The perfect way to get roses accustomed to the soil contains new nutrients can be achieved by using the natural fertilizers.
- Before going to fertilizer application, check the organic label present in the fertilizer pack or go with the organic homemade fertilizers.

Use natural fertilizers for every 4 weeks at high growth season:

During early spring use natural fertilizers with constant supply of nutrients flow into the soil on which the roses are cultivated. Until 3-4 weeks before they enter dormancy, regular supply must be given for every 4 weeks. You can go with any of the natural fertilizer into the upper soil levels (Figure 1.)

Spread granular or solid natural fertilizers in a circle around the top of the soil surface and about 15 cm from the base of the bush and further work it into the top 5.1 cm of soil with small cultivator. In addition to that liquid natural fertilizers poured in a circle about 15 cm from the base of the bush. Fertilization were stopped 35-40 days before the first frost date.

Figure 1. Natural fertilizer application on rose

Potassium acquired by burying the banana peel

Before use of banana peel for rose cultivation as potassium source, it was well composted and used. The banana peel compost was applied at 15 cm deep under the outer perimeter of rose bush. It provided new sources of potassium. It was used in conjunction with natural method like coffee ground and alfalfa pellets. Banana compost was well decomposed by blending and chopped into fine pieces before application.

Effect of natural fertilizers on growth and yield of rose:

Now-a-days vermicompost is being used as media for growth of plants and as soil amendments. It contains 1.9 %N, 2.0 % P, and 0.8% K, 100 ppm Cu and 500 ppm Mn. Nutrient source should be applied to soils for high production of crops which should be cheap and eco-friendly. The nutrients present in vermicompost are readily available for plant uptake and in addition to that it also acts as excellent soil conditioning agent. It enhances the growth and yield of ornamental flowering plants (Arancon *et al.,* 2002). Senthilkumar *et al*. 2004 investigated that application of recommended doses of NPK fertilizers along with vermicompost increased the blooming quality and yield of rose. Since, it increased the mineral contents in soil in more available form. Further, it led to improvements in both growth and flowering of crossandra compared to control plots. Natural fertilizers are helpful in minimizing the environment degradation and thereby increase the soil fertility.

Natural fertilizers like vermicompost and FYM play an important role in soil by improving plant growth since these manures participates in major constituents in chlorophyll, protein and amino acids which resulted in increased production of green leaves. Choudhari *et al.* 2009 observed that on application of Azotobacter, Azospirillum and 50g N /plant increased the diameter of flower, weight of flower, number of petals, yield of flowers and shelf life. Maximum initiation of first rose flower was produced by combined use of biofertilizers and fertilizers compared to control.

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Article Number 01032022-08

08.SYMPTOMOLOGY AND MANAGEMENT OF HORSE GRAM

(*Macrotyloma uniflorum*) POWDERY MILDEW CAUSED BY *Erysiphe polygoni*

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Horse gram is a Leguminosae crop grown in various tropical and subtropical areas. It is native to tropical southern Asia. The horse gram is named for the fact that it is often used for horse feed and human consumption. Horse gram, Kulthi, Hurali gram, Madras gram, Kannam, and Kollu are some of the names given to it. Horse gram is grown extensively throughout India, including Tamil Nadu. In Tamil Nadu, production and protectivity are moderately high compared with other states in India. Particularly southern Indian peoples continuously cultivated for consumption purposes. Cultivated in intercropping as well as slow cropping system. The mature plants, empty pods are used for animal feed and also used for green manure/fodder crops for tropical countries. It's a highly drought-tolerant (20 to 30 °C (68 to 86 °F) crop so perfectly suitable for rain field conditions. In horse gram there are several benefits are there as an antioxidant, complex nutrient, ayurvedic and medicinal uses. Different factors are highly interrupted horse gram cultivation. Among them, the biotic (living organisms) factor most serious problem for all the Leguminosae crops, Powdery is one of the most devastating fungal diseases in horse gram at an early stage to harvesting. The only one Powderly mildew fungal genera are causing that disease namely *Erysiphe polygoni*. That is a newly associated disease, particularly in the warm and cool climatic areas of Tamil Nadu.

Symptomology:

The Powdery mildew fungus produces an abended white mycelial growth on both surfaces of the leaves. Initially, it causes the circular round powdery patches, but later it covers the entire leaves and also highly infects the older leaves. In the later stage, infected plant leaves get defoliated due to more powdery growth that affects photosynthesis, leading to loss of chlorophyll and drying of the infected leaves. In severely infected plants, they are completely wilting. Infected plants have reduced flower and seed production.

Fig.1. WHITE SUPERFICIAL MYCELIAL GROWTH ON AFFECTED PLANTS

SEVERELY INFECTED PLANT

Pathogen:

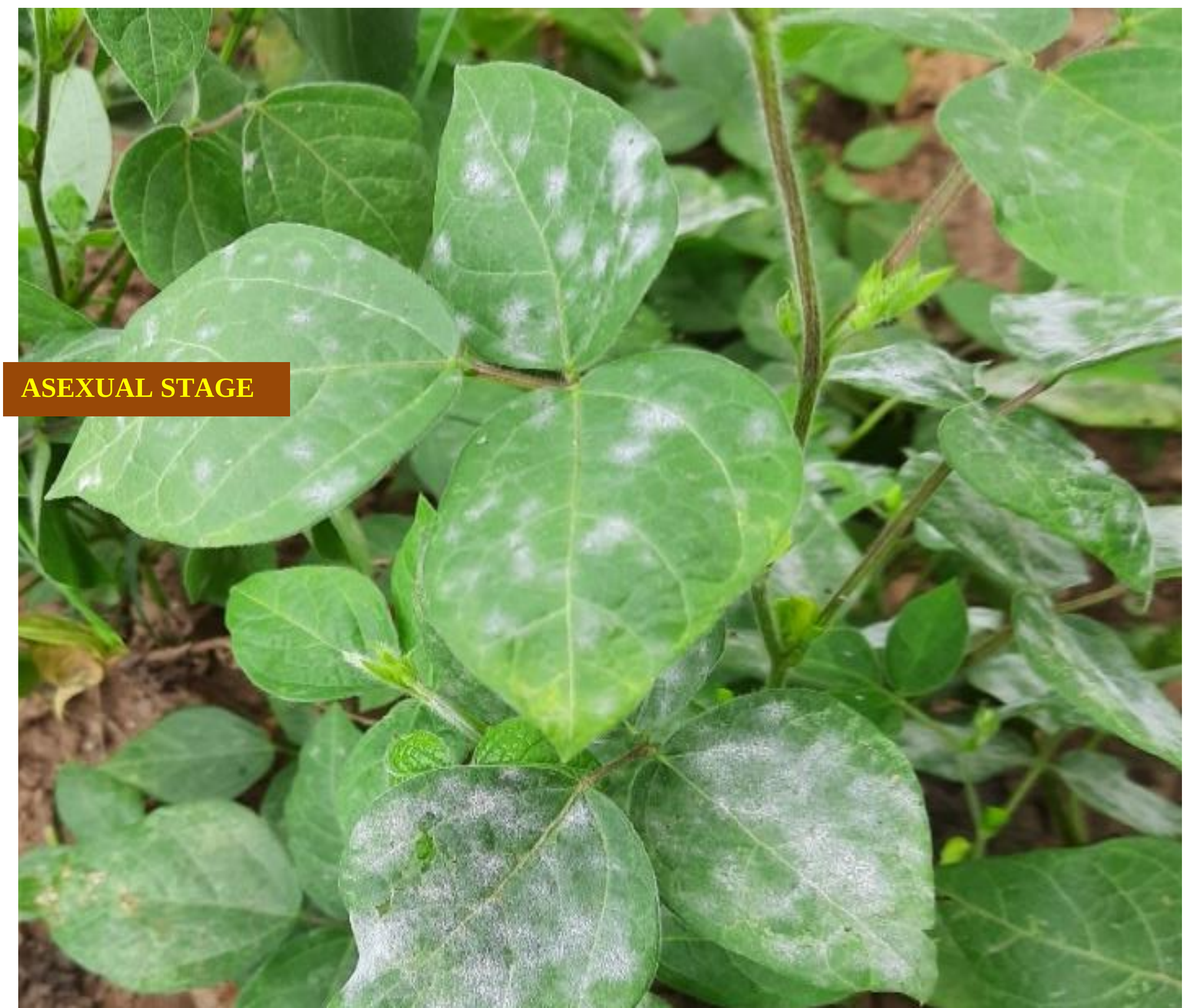
The fungus is an obligate parasite, producing white mycelium with septate. The fungus produces the asexual spores through a chain of conidiophores with single-celled hyaline conidia. As the conidial population grows, the infected plant parts develop white powdery patches. In the sexual stage, the fungus produces a closed sexual fruiting body, namely Cleistothecium (Many asci). At the time of mature cleistothecium, five or eight ascospores (single-celled) are released. Both conidia and ascospores infect the host plant. The conidia mostly cause high damage. Both conidia and ascospore transmit the wind and rain flash, which causes the primary infection. Ascospores also survive in the soil, causing secondary infections.

Phenotypical characteristics of pathogen:

Conidiophore

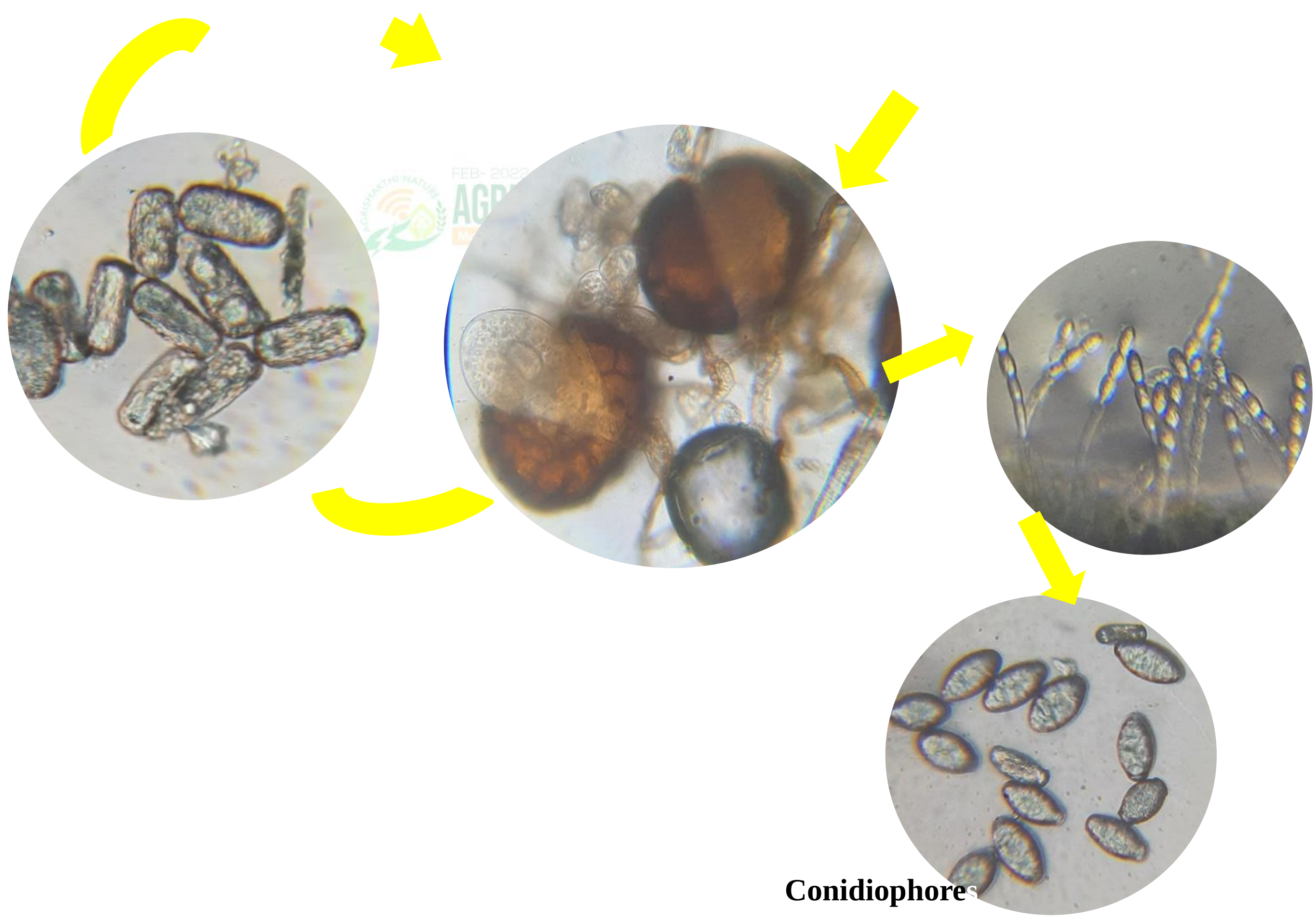
Single celled-conidia

Cleistothecium-myceloid appendage



Conidia

SEXUAL STAGE



Management:

- At the time of initial infection, spray both Neem seed kernel extract @ 5% and Neem seed oil @ 3% twice, spraying at 10-day intervals.
- After the initial infection, spray fresh leaves with an extract of *Eucalyptus globulus* at a concentration of 10%. It helps to reduce the pathogens' infectivity assay.
- In chemical, spray Wettable sulphur @ 1500ml/ha or Propiconazole 500ml/ha at the initial stage and ten days after infection. Completely reduced the pathogen infection compared with the above-mentioned botanicals.

JPG PHOTO:

Life cycle of *Erysiphe polygoni* on *Macrotyloma uniflorum*

Article Number 01032022-09

09.ROLE OF SILICON IN IMPROVEMENT OF PLANT RESISTANCE

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Silicon is the second most prevalent element in the soil. Soils generally contain from 50 to 400 g Si kg^{-1}. The silicon content in the soil depends on the soil type and varies from 200 to 350 g of Si kg^{-1} of soil in clay soils while in the sandy soil from 450 to 480 g Si kg^{-1} of soil. The inert quartz or crystalline silicates are the main Si-rich compounds forming the skeleton of the soil.

The physically and chemically active Si substances in the soil are represented by soluble monosilicic acids, polysilicic acids, and organosilicon compounds. The soluble monosilicic acids are absorbed by plants and microorganisms. They also control chemical and biological properties of the soil P, Al, Fe, Mn and heavy metal mobility, microbial activity, stability of soil organic matter and formation of polysilicic acids and secondary minerals in the soil. Plants and microorganisms can absorb only monosilicic acid.

Polysilicic acid has a significant effect on soil texture, water holding capacity, adsorption capacity, and stability of soil erosion. Plants can absorb enough Si, which can determine silicon effect on the soil fertility and plants.

Silicon uptake and accumulation in plants

Although abundant, silicon is never found in a plant available form and is always combined with other elements, usually forming oxides or silicates. Silicon is absorbed by plants in the form of uncharged silicic acid, $Si(OH)_4$, and is ultimately irreversibly precipitated throughout the plant as amorphous silica. Therefore, silicon is plentiful, most sources of silicon are insoluble and in a plant-unavailable form.

Typical concentrations of silicic acid in soil solution range from 0.1 to 0.6 mM. Plant silicon concentrations vary greatly in the aboveground parts, ranging from 1.0 to 100.0 g Si kg^{-1} of dry weight. In a study of more than 500 plant species, divisions were formed to group the high, intermediate, and nonsilicon accumulators. The groupings were based upon measurements (on a dry weight basis) of silicon and the silicon-to-calcium ratio in plant tissues. The wide variation in Si concentration in plant species is attributed mainly to differences in the characteristics of Si-uptake and transport. Active Si-uptake has been demonstrated in Graminaceous species such as rice, wheat, ryegrass, and barley. However, some Gramineae plants such as oats take up Si passively. Passive Si-uptake has been demonstrated in some dicots such as cucumber, melon, strawberry and soyabean. Unfortunately, molecular mechanisms underlying Si uptake in these plants are unknown.

Investigations of the mechanisms by which silicon is absorbed into the plants showed that silicon interacted with polyphenols in xylem cell walls and affected lignin deposition and biosynthesis. In rice, under water deficit induced by polyethylene glycerol, addition of silicon decreased the transpiration rate and membrane permeability. In sorghum, application of silicon increased the relative water content and dry mass of plants. It was suggested that the improvement of drought tolerance in sorghum achieved by adding silicon might be associated with enhancement of water uptake ability. Addition of silicon also improved water status and increased dry mass of wheat plants in pots under drought.

Protective role of silicon

Silicon is not traditionally considered as an essential element in plants, numerous studies have shown that it can influence positively plant growth and yield. Silicon is applied to improve plant growth and yield, in particular, under stress conditions. Several functions have been attributed to silicon. Those are improvement of nutrient imbalance, reduction of mineral toxicities, improvement of mechanical properties of plant tissues and enhancement of resistance to other various abiotic (salt, metal toxicity, nu-trient imbalance, lodging, drought, radiation, high temperature, freezing, UV) and biotic stresses. The protective role of silicon in plants may be connected with accumulation of polysilicic acids inside cells. This opinion found indirect support in the fact of increased stress-tolerance accompanying an increase in the concentration of polysilicic acid in plant tissues.

Salinity

High salt concentrations normally impair the cellular electron transport within the different subcellular compartments and lead to generation of ROS, which triggers phytotoxic reactions such as lipid peroxidation, protein degradation and DNA mutation. Addition of Si decreased permeability of the plasma membrane of leaf cells, and significantly improved the ultra structure of chloroplasts, which were badly damaged by NaCl addition with the double membranes disappearing and the grannae being disintegrated in the absence of Si. Silicate partially offsets the negative impact of NaCl stress, which increases tolerance of tomato plants to NaCl salinity by raising superoxide dismutase and catalase activities. Also exogenous Si significantly enhanced the activities of SOD, CAT, and GR in roots of salt-stressed plants. Addition of Si increased the activities of SOD, GPX, and APX of salt-stressed plants.

Metal toxicity

Heavy metal stress negatively affects processes associated with biomass production and grain yield in almost all major field grown crops. Every metal and plant interact in a specific way, which depends on several factors such as the type of soil, growth conditions, and the presence of other ions. Silicon treatments gave significant alleviation of the toxic effect of Al in barley plants. Aluminium uptake by roots was significantly diminished in the presence of Si. Silicon mediated alleviation of (heavy) metal toxicity in higher plants is widely accepted. The alleviation of Mn toxicity by Si in plants was attributed to a significant reduction in lipid peroxidation (LPO) intensity caused by excess Mn and to a significant increase in enzymatic *eg.* SOD, APX, and GR, and non-enzymatic antioxidants *eg.* ascorbate and glutathione). The activities of SOD and CAT in boron stressed plants obviously increased, whereas that of APX was decreased.

Drought

Drought, one of the environmental stresses, is the most significant factor restricting plant growth and crop productivity in a majority of agricultural fields of the world. Numerous studies demonstrate that the antioxidant defence system improves the relationship between enhanced or constitutive antioxidant enzyme activities and increased resistance to drought stress. Compared with the non-silicon treatment, application of silicon under drought increased the activities of some antioxidant enzymes: SOD, CAT, and GR as well as the fatty acid unsaturation of lipids and the content of photosynthetic pigments, whereas the content of H_2O_2 was decreased and the activities of GPX and AsP showed no significant difference. The improvement of drought tolerance provided by silicon in plants is associated with an increase in antioxidant defence abilities, thereby alleviating oxidative damage of cellular functional molecules induced by over production of ROS under drought and maintaining many physiological processes of stressed plants. Silicon alleviated the physiological response of peroxidase (POD) to drought stress, maintained the SOD normal adaptation and increased the activity of CAT. Under severe stress, these physiological biochemical reactions showed positive correlations with the amount of silicon supply.

UV radiation

Ultraviolet-B (UV-B) radiation negatively affects plant cells, causing generation of ROS such as superoxide anions (O_2^-), hydrogen peroxide (H_2O_2), hydroxyl radicals (OH) and singlet oxygen (O2). Si increases plant tolerance to UV-B radiation. The CAT and SOD activities increased under the effect of UV-B radiation and significantly decreased at Si application. The UV-B light had more adverse effects on growth than drought, the data also showed that Si could alleviate seedling damage under these stress conditions.

Environmental stress causes huge losses in agriculture productivity worldwide. Si has certain physiological functions in plants. Its role becomes more important under adverse environmental conditions. Increasing of the content of silicon in plant tissues enhances their resistance to various stresses. The presence of silicon in the cell walls of plants increases their strength, as silicon increases resistance to salinity, drought tolerance, and photosynthetic activity, and promotes active growth of roots and foliage. The entry of silicon to plant tissues leads to inhibition of the oxidative destruction processes that is accompanied with increasing activity of some antioxidant enzymes that neutralize ROS induced by drought, salinity, toxic metals, and UV-B radiation, they also suggest that Si could be used as a potential growth regulator to improve plant growth and resistance under stress conditions. This may be a promising new strategy for improvement of soil properties in agriculture.

Article Number 010322-10

10.Seed quality – importance, characteristics and their attributes

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Introduction

Seed quality can be defined as those attributes of seed that provides for varietal purity, higher field emergence, increased yield leading to the uplift of farmer. Since most of the Indian farmers are naïve, it is left to the government to regulate the quality of seeds. The importance of quality seeds has been recognized from the time immemorial. The old scripture, Manu Smriti says "*Subeejam Sukshetre Jayate Sampadyathe*" i.e., Good seed in good soil yields abundantly. Seed quality has been treated as sacred, being an important factor in the improvement of agriculture and agrarian societies. Although the importance of seed was recognized in ancient agriculture, the need for organized seed production was identified only at the beginning of 20th century when Royal commission of Agriculture (1925) recommended spread of improved varieties and seed distribution.

Objectives of seed quality

- Ensure sale of quality seeds.
- Ensure testing for seed quality before sale and during sales (seed inspection)
- Increase agricultural productivity
- Ensure seeds are treated before sale
- Ensure seeds of right size, shape, weight are sold

- Ensure seeds of right germination potential alone as sold.

Role of improved seeds:

1. Carrier of new technology
2. Basic tool for a secure food supply
3. The principle means to obtain crop yields in less favorable production area
4. Medium for rapid rehabilitation of agriculture after natural disasters.

Characteristics/Attributes of quality seed, concepts and their components

Seed quality is a concept of providing seeds of high vigor, germination potential, right shape, size, weight and free from pest and disease are sold after seed treatment. The main components are a. genetic purity, b. physical purity c. physiological quality and d. seed health.

1. It must be genetically pure:

It refers to true to type. The genetic purity has direct effect on ultimate yields. Genetical purity ensures varietal purity so that farmer upon purchase of seed gets the desired characteristics. The quality of breeder seed must be the highest so that ensures the genetical quality of foundation seed (99%). Similarly the genetical quality of FS must be higher than CS so that the genetical purity of CS is assured. The TFL seeds should have purity standards equal to that of CS. Genetical purity is ensured by field inspection, rouging at appropriate stages, isolation, inspection during processing, seed testing for genetic purity in lab especially Other Distinct Variety (ODV) and Grow Out test. The Seeds Act, and Plant Variety Protection and Farmer Rights Act ensures that varieties are registered only when they quality for DUSN (Distinct, Uniformity, Stable and Novelty).

The minimum standards for genetic purity are as follows: Breeder/nucleus; 100 %; Foundation seeds: 99.5%; Certified seeds varieties: 98%; Certified hybrid seeds:95%; Certified hybrid cotton: 90%; Certified hybrid castor: 85%.Care is taken in selection of land for seed production (land requirement) to prevent volunteer plants, isolation – to avoid contamination, seed source verification, sowing the right stage of seed, right plant spacing, rouging (at vegetative, flowering, harvest and post-harvest) to prevent contamination, spread of seed borne disease and during harvest, processing at approved processing unit in presence of seed certification officer, testing at notified seed testing lab, tagging, labeling and sealing. Even after granting certification, seed inspector does a post control check and GOT is must for parents of hybrids and hybrids before tagging them. Thus genetic purity is ensured.

Free from other crop seeds (number/kg): designated inseparable crop seeds are the plants seeds cultivated crops found in the seed fields and whose seeds are so similar to crop seed that is difficult to separate them economically by mechanical means, cause physical admixtures with the crop seeds only when these crop mature approximately at the same time when seed crop matures. Ex. In barley: oats and wheat seeds**.**

Freedom from other distinct varieties (ODV): Seeds of most crops like rice, groundnut, and sunflower are checked for ODV during testing.

2. It should have required level of physical purity and moisture content:

Physical purity refers to physical composition of seed lot. Pure seeds considered together with seed germination determine the planting value of seed. It ensures that no matter other than seeds alone are present in the seed bag. Upon harvest, threshing and processing seeds get contaminated with soil, plant bits, broken seeds etc. Physical purity ensures that the material other than seeds (inert matter) does not exceed the limit. All crops: 98%; Carrot: 95%; Ragi: 97% and groundnut 96%. Along with physical purity, seed moisture content, weed seed content is included. Seed moisture content is important character that determines the viability of seeds. Limiting weed seed content reduces the contamination of land by exotic weeds.

Optimum moisture content: Cereals: 10-12 %; Pulses: 7-9%; Oilseeds:6-7%; Vegetables: 5-6%

Free from objectionable weed seeds: these are seeds of weed species which are harmful in one or more of the following ways;

a. The size and shape of weed seeds are similar to the crop seed and difficult to separate them by mechanical means

b. Weeds growth habit is determinate type and competes with the crop for all resources

c. Weed plant parts are poisonous or injurious to human and animals

d. Weed plants also serves as alternative hosts for pests and diseases

Ex. Bersem: chicory

Paddy: wild paddy (*Oryza sativa* var. *fatua*)

Cucurbits: Wild cucurbits spp.

Lettuce: wild lettuce

Bhendi: wild Abelmoscous spp

Wheat: *Convolvulus arvensis* (Hirankuri)

3. Physiological quality:

High germination and vigour: Physiological quality ensures that seeds germinate evenly, quickly. Famers are more concerned with germination, because if germination is low then seed quantity will have to be increased. Seed Acts ensures that only seeds of minimum germination potential are sold to the public. The germination is tested in STL before being sold. Since seeds are living, the test results are valid for 9 months only and have to tested again and revalidated for another 6 months.

The most important stage in development of quality seed is during breeding and varietal development. Since wild and exotic sources of germplasm are used in breeding, these can exhibit dormancy or other seed related traits that will not be desirable in the final variety. Eliminating those traits by selection early in breeding process is beneficial, but in most cases breeders concentrate on quality like large seed, high protein content, other than such physiological quality. But concentrating on seed quality in terms of germination, vigor, storage potential will become important when the variety enters into commercial stream for seed production and distribution.

4. Seed health quality:

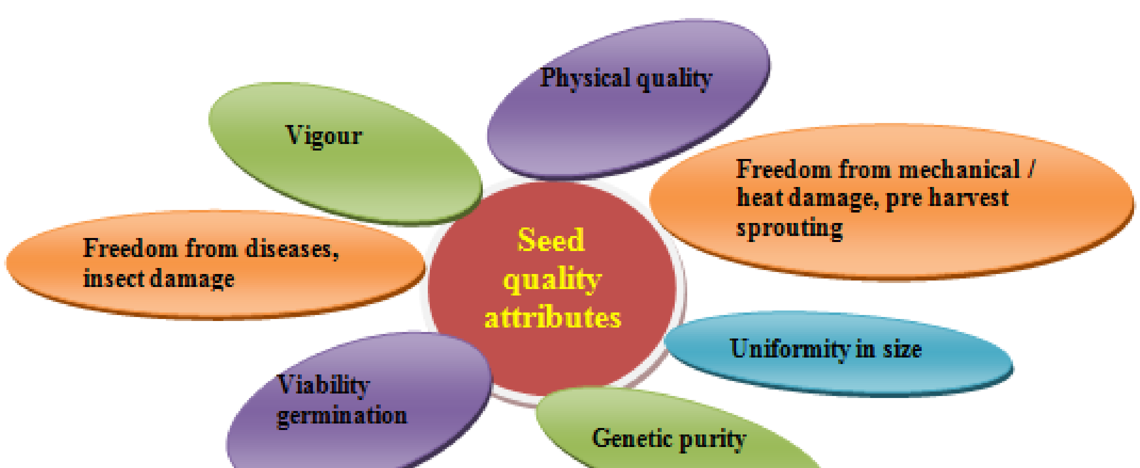
Seed health refers to the presence or absence of disease organisms/ insect pests on seeds. The quality of the seed lot very much depends on health. Seeds must be free from pest and diseases because field carryover of pest and disease is the major cause of spread of disease/pest. Though much emphasis is not given for pest damage except that the damage of seeds by insect is limited to 10% in maize and 5% in case of other crops. In case of disease, field inspection for designated disease and compulsory seed treatment ensures that seed is free of disease. It also refers to the diseases specified for the seed certification which may cause contamination of seed lot

Example;

- loose smut of wheat (*Ustilago tritici*)
- Kernal smut of sorghum (*Sphacelotheca sorghi*)
- Grain smut of pearl millet (*Tolyposporium penicillariae*)
- Ergot of bajra (*Claviceps microcephala*)
- Early blight of tomato (Alternaria solani)
- Little leaf of brinjal (*Datura virus-2*)

Seed quality standards:

The standards are based on market expectation and the limits of biological systems. These are based on critical control points throughout the product life cycle. Therefore the thresholds or tolerances are a component of seed quality standards. Tracking, recordkeeping, testing and appropriate management systems are required before the seed reaches the farmer. In India, the Indian Minimum Seed Certification Standards were brought. They are known minimum standards because the threshold level is kept lower in such a way it is practicable and justifiable in maintaining seed quality.



Factors affecting seed quality:

Seed production technology: Selection of land, isolation, rouging, seed production management practices are critical in maintain seed quality**.**

Post harvest handling of seed crops: Harvesting at physiological maturity, threshing and processing without seed injury, storage in clean containers to avoid physical contamination and protection measures during storage are important

Ecological effects on seed quality: Biotic and abiotic factors alter seed quality. Factors like heat/cold stress, rain, humid weather, soil pH (saline, sodic), micronutrient deficiency, soil borne pest/ diseases alter seed quality.

Quality control

National level: Seed quality is ensued by enacting right laws that provide basis for seeds quality. In India, Seeds Act and Seeds Rule ensure that authority (Central Seed Certification Board) is created to provide guidelines for quality control and appointment of government officials (SCO, SI and STO) are placed to test and provide certificate of quality. Seed Control order brings the person selling the seed to possess seed dealer liscence and Plant Quarantine Rules ensure that only quality inputs are imported or exported and PVPFRA ensures that seed varieties are registered only when they obey DUSN.

State level: Seed Certification agency ensures that seed crop is inspected in field, processed in approved seed processing unit, tagged, labeled and sealed by an authorized officer. The seed testing officer tests the seed for quality while seed inspector does the post quality check.

International level: ISTA is responsible for developing quality control norms at international level while AOSA is responsible for America.

Private seed companies: Private seed companies release their own variety and have seed testing labs that test but the tag is provided by Seed Certification agency only.