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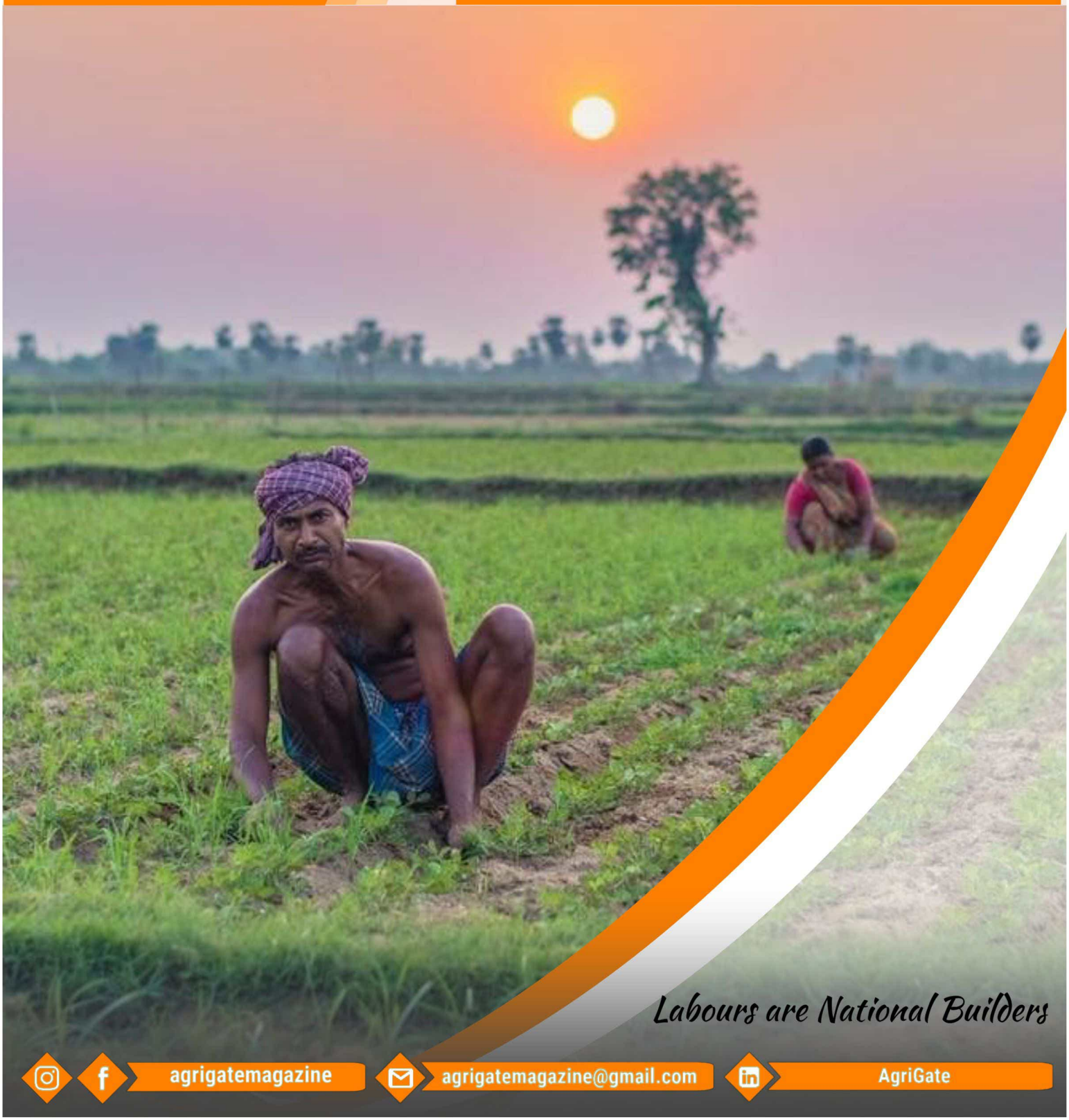

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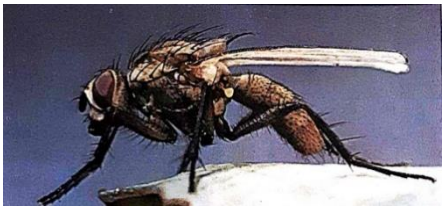


From the Desk of Editor-in-chief

May 2022 | Volume 02 | Issue No. 05

I would like to introduce the launch of **"AgriGate - An International Multidisciplinary Monthly e-Magazine Volume 02 Issue No. 05 – May 2022"** with immense pleasure. Our team is privileged to dedicate this issue to the agricultural labours because, they are the main pillars of agricultural sector development in each country.

The main objective of the magazine is to provide a publishing platform to young researchers and scientists as well as an information hub for the enthusiast, progressive farmer and also common readers. We envisage providing an online platform that appreciates illuminating articles on various topics related to agriculture and allied sciences monthly that will appraise and update the students, farming community and the whole society at large on the updates in agriculture.

Last but not the least, I wholeheartedly thank the editorial team, authors as well as anonymous reviewers for contributing to the release of this issue.

Our team welcomes your constructive feedback and suggestions to improve delivering fruitful content to hungry minds.

Dr R Shiv Ramakrishnan
Editor-in-chief
AgriGate Magazine

Volume: 02 Issue No: 05

3-D PRINTING IN FOOD PRODUCT DEVELOPMENT

Article ID: AG-V02-I05-01

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Abstract

3D printing, also referred as additive manufacturing is an innovative process, 3D food printing may induce a revolution in certain areas of food manufacturing. This technology offers a wide range of new processing possibilities to the food industry which allows us to print food layer by layer (bottom to top) so as to create desired objects. 3D printing allows rapid manufacturing of complex objects, which are unhindered by design complexity, without human intervention, thus providing feasibility to create new and untested geometric shapes. In terms of food manufacturing, the potential that 3D food printing technologies can bring may revolutionize in certain aspects of food manufacturing, providing the convenience of low-cost customized food fabrication and even personalize nutrition control. The most common materials suitable for 3D food printing are carbohydrate, fat, protein, fiber and functional components. three-dimensional (3D) food printing integrates 3D printing to revolutionize food manufacturing with customized shape, color, flavor, texture, and even nutrition. Hence, food products can be designed and fabricated to meet individual needs through controlling the amount of printing material and nutrition content.

Keywords: Geometric shape, customized food, additive, three dimensional

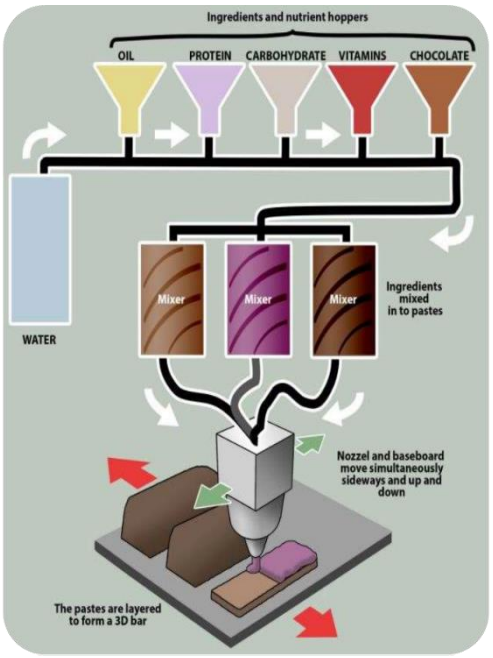
Introduction

This cutting-edge technology has applications that include rapid prototyping, process design, packaging, and at-home food preparation. 3-D printing is a much talked about technology that promises to revolutionize the way we currently make things. Sometimes also referred to as additive manufacturing, it is a process where a material is deposited layer by layer in a specific pattern to make a three-dimensional object. The process is electronically controlled and can technically make any design that can be drawn by the software.

There are several different methods and technologies, such as stereolithography, which is laser sintering or fused deposition. Most of the processes involve either depositing or fusing materials in a desired shape, typically melting and solidifying the material used. The kind of technology used determines the type of material and its properties that can be used for printing. A significant amount of work has been done in broadening the range of materials, which were initially limited to plastics. Metal and even wood has been successfully used to create 3-D printed objects. Some of the materials used in 3-D printers have been edible, giving rise to the idea of 3-D printing food. One of the first such materials was chocolate for the obvious reasons that it is easy to deposit in a melt form and then set by simply cooling it down. But recently other materials such as sugar and even dough have been used, and in some applications, a post-cooking step is required.

Working principle of a 3D printer

The current food printing process starts with a 3 D modeling of food using software such as AD, Solid Works etc, these 3D model is then sent to a special software called the slicer (KISSLICER, BLINDER), that Slices the 3D image into servers slices of printable 2D images and also generates G codes or M codes (G,M codes - Machine Codes). When these codes reaches the print head of the printer the food products are layered according to the codes fed.



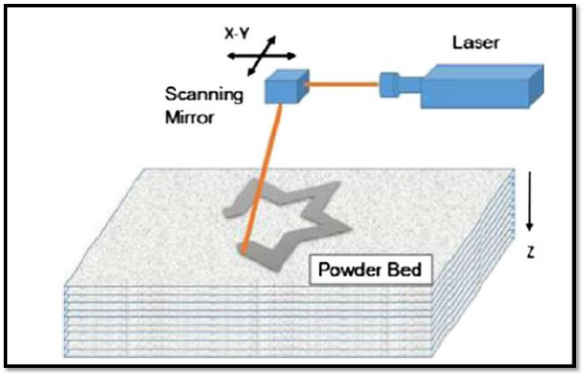
Working of 3 D Printer

3 D FOOD PRINTING TECHNOLOGIES

Selective Laser Sintering/Hot Air Sintering:

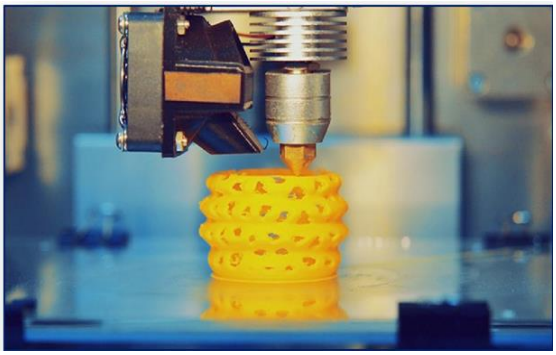
Laser and hot air both can be utilized as a sintering source to fuse powder particles and form a solid layer. The sintered material formed the

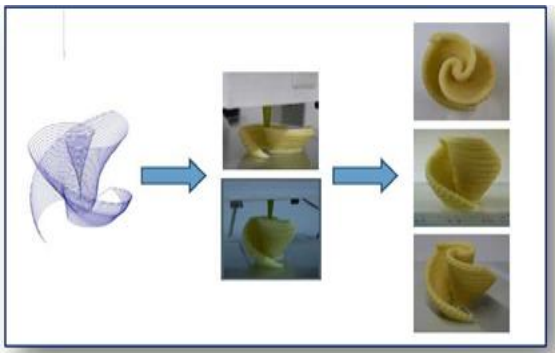
product part while the un sintered powder remained in place to support the structure. The fabrication powder bed is heated to just below the material's melting point to minimize thermal distortion and facilitate fusion to the previous layer. The two sintering processes offer the freedom to quickly build complex food items in a short time without post-curing. However, they are only suitable for sugar and fat-based materials with relatively low melting point.



Fused Deposition Modeling (FDM) / Hot-Melt Extrusion:

In Fused Deposition Modeling melted semisolid food polymer is extruded from a movable FDM head that solidifies almost immediately after extrusion and welds to the previous layers. Hot-melt extrusion has been applied to create customized 3D chocolate products. Some natively printable materials like cheese, frosting, can be extruded smoothly at room temperature. These material flow rate can be adjusted by controlling solenoid valves, and this setup was tested using creamy peanut butter and jelly. This extrusion method can fabricate complex confections using a single material with high repeatability, which were difficult to make by hand. The food printers designed based on the extrusion method usually have a compact size and low maintenance cost but are greatly limited by material choices, long fabrication time and delamination (breakdown of materials layer by layer) caused by temperature fluctuation.

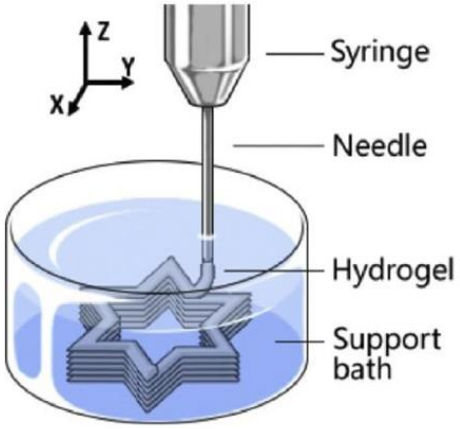




Hydrogel-forming extrusion (HFE):

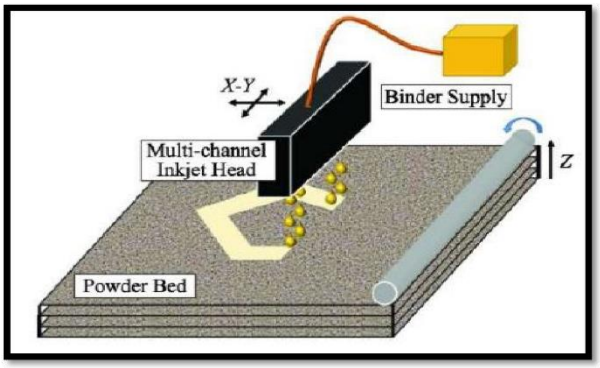
HFE is the extrusion of hydrocolloid solutions or dispersion into a polymer/hardening/gel setting bath using syringe pipette, jet cutter, vibrating nozzle and similar apparatus.

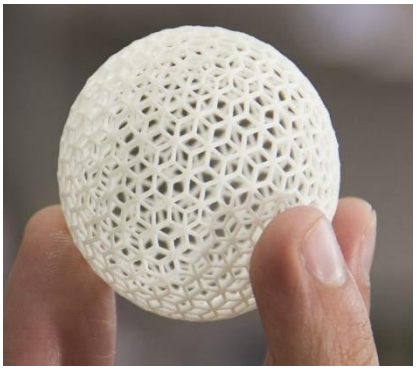
This extrusion is critically dependent on the rheological properties of polymer and the mechanism of gel formation. In other words, the food material should present visco elastic characteristic first, and then turn into self-supporting gels prior to the deposition as consequent layer. 3D edible gel printer using a syringe pump and dispenser was developed to produce soft foods for elderly people with swallowing problems.



Binder Jetting:

In binder jetting each powder layer is distributed evenly across the fabrication platform, and a liquid binder sprays to bind two consecutive powder layers. This method is similar to that of Selective-sintering method, but instead of heat to bind each layer a binder is used to fuse the consequent layers together. The binders are agar, xanthum agar, hydro colloids etc. Before printing a layer of water is sprayed to stabilize the powder and to minimize disturbances from dispersing of powder from the print head. This method offers fast fabrication and low material cost but the product finished have rough surface finish with as to be post processed to have some smooth surface characteristics.



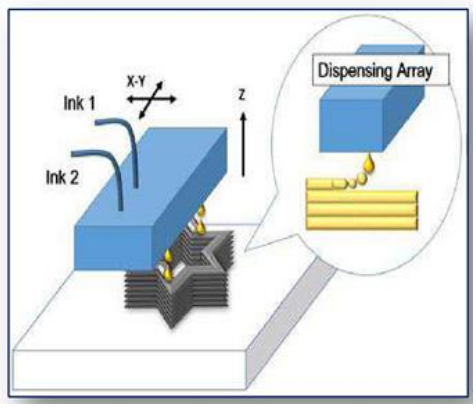


BINDER JETTING- SCULPTURED SUGAR CANDY

Inkjet Printing:

Inject food printer works as that of an ordinary inject printer, instead of printing ink food material that is ground into paste or in form of a powder is used as the ink. Inkjet food printing dispenses a stream of droplets from a syringe-type print head in a drop-on-demand way for cookie, cake, or pastry fabrication. The drops fallen under gravity and forms a two and a half- dimensional digital image

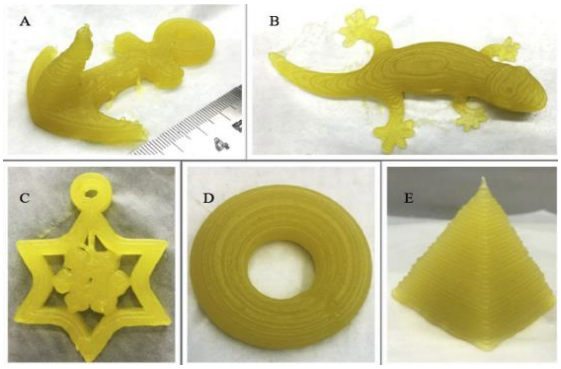
as decoration. Inject food printer is most effective during multi-layer and multi-material printings.



3D PRINTED PIZZA USING INKJET PRINTER

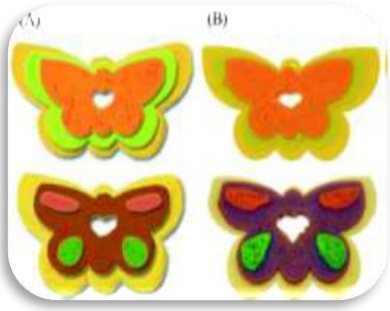
Applications of 3-D Printing in food

3-D printing has been used in several areas where its unique benefits provide an advantage for both traditional and food applications. It can create complex shapes that may not be cost-effective or even be possible using other technologies. Additional complexity may not even impact the cost and time of producing the object beyond the effort of creating the drawing. In applications such as aerospace, complex shapes can be fabricated feasibly, which can save additional weight. Artists and designers have used 3-D printing in art and fashion. Similarly, food 3-D printers have been used to create unique edible shapes, primarily as novelties.



3-D printing makes customization much more affordable. Products can feasibly be made in smaller numbers instead of mass production. For example, it can be used to create shoes that fit perfectly for each individual athlete or prosthetics customized for each individual. In food applications, customization can be used not just for shapes; a food printer loaded with multiple ingredients can also formulate products based on individual nutritional needs. While it is slower than mass production, 3-D printing can be much faster than other methods in prototyping. Subsequently, one of the most established applications of 3-D printing has been in rapid prototyping where several iterations of a design can be quickly produced during the development phase to better optimize the final product that needs to be

manufactured employing user feedback. This has been applied successfully in several industries such as automotive and architecture. One of the largest impacts of 3-D printers has been in convenience. Desktop-size 3-D printers are affordable for use at home where anyone can create solid objects using a variety of different materials. This has been a huge benefit in fields such as research or robotics and has fueled the "maker" movement of consumers making their own products (Matias and Rao 2015). Similarly, a long-term promise of food 3-D printers is to be able to put a vast range of culinary dishes at our fingertips with the press of a button. Consumer Insights and Prototyping. During the early stages, R&D teams work closely with consumer insights to gather consumer information to define what the consumer is looking for and translate that into the product attributes that can address those needs. It can be an iterative process where prototypes need to be reviewed with consumers for feedback to ensure it is optimized for the concept. This is a slow process since prototyping typically requires significant time and resources.



Innovative Food Products

One of the key attributes of a product is appearance, which includes shape and size. Rapid prototyping using 3-D printing has been used to create models of the product in order to get consumer feedback. This is much more impactful compared with using images that cannot simulate a consumer's experience of being able to hold the product in his or her hands. The models also need not be edible to generate useful data, which allows us to use plastics, which are well established in 3-D printing technology. This can significantly minimize the time

and resources typically required, and since a large number of options can be quickly tested with consumers, it can also ensure that an optimal shape and size is identified.

Current Limitations

While the impact of 3-D printing has already been significant in multiple industries, a lot of work is still being done to further broaden its application. It still requires specific properties, which limits the range of material that can be used. The same is true for food applications. Most of the current machines are extrusion-based and use materials such as chocolate that can be easily extruded and change states. Dough has been used to make 3-D shapes, which can be subsequently cooked. Other technologies such as sintering have also been used with sugar since it can be easily melted. However, ingredients such as meats and vegetables, which cannot be extruded or melted, can only be used in complex formulations to make them usable in 3-D printing (Sun *et al*. 2015). There have been significant strides made in the speed and cost of 3-D printers, which has made the overall cost of fabrication come down rapidly. However, it is still not as cheap as mass production of everyday objects that are simple to make. Beyond shape and appearance, our perception of food consists of flavor and texture.

Conclusion

3D food printing has demonstrated its capability of making personalized chocolates or producing simple homogenous snacks. Currently, these applications are still primitive with limited internal structures and monotonous textures. It is necessary to develop a systematic way to investigate recipes, platform design, printing technologies, and their influences on food fabrication. Meanwhile, the food design process should be structured to promote user's creativity, the fabrication process should be quantified to achieve consistent fabrication results, and a simulation model should be developed to link design and fabrication with nutrient control. Food printing technologies apply digital technologies to manipulate food forms and materials. This versatility, applied to domestic cooking or catering service, will allow efficient delivery of high-quality, freshly prepared food items to consumers. It can also deliver personalized nutrition, new flavors, textures, and shapes of food products. With the development of an open web-based media interface, food printers may form an ecology of networked machines that can order new

ingredients, prepare favorite food on demand, and even collaborate with doctors to develop healthier diets.

References

- Anukiruthika T., J. A. Moses and C. Anandharamakrishnan. 2020. "3D printing of egg yolk and white with rice flour blends. Journal of Food Engineering. 265: 109691.
- Matias, E. and B. Rao. 2015. 3D Printing: On Its Historical Evolution and the Implications for Business, Proceedings of PICMET '15: Management of the Technology Age. IEEE. doi:10.1109/PICMET.2015.7273052.
- Sun, J., W. Zhou, D. Huang, J. Fuh, and G. Hong. 2015. An overview of 3D printing technologies for food fabrication. Food and bioprocess technology. 8(8):1605-1615.
- Xu, Q., H. Qin and Z.Yin. 2013. Coaxial electrohydrodynamic atomization process for production of polymeric composite microspheres. Chemical Engineering Science. 104: 330–346.
- Yu, Y. Z., L. L. Zheng, and H. P. Chen. 2014. Fabrication of hierarchical polycaprolactone/gel scaffolds via combined 3D bioprinting and electrospinning for tissue engineering. Advances in Manufacturing. 2(3): 231–238.

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ANDROGENESIS: A FASCINATING PHENOMENON FOR HAPLOID BREEDING IN COCONUT

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Abstract

Doubled haploid production is a rapid method to development of homozygous parental lines in coconut which is a perennial plantation crop. Androgenesis which involves culturing of anthers is one of the techniques for producing haploid plants through doubled haploid production. However, androgenesis in coconut is affected by various factors and the protocol for producing haploid plants through anther culture needs to be standardised. This involves optimizing the age of explants, culture conditions, induction of somatic embryogenesis and regeneration. The effect of imposing heat or cold stress treatments in inducing an androgenic response needs to be studied in coconut. Evaluating and optimising different media compositions with supplemented nutrients is essential to standardize the embryogenic callus induction protocol, followed by subculturing and regeneration. Once produced the haploid plants can be subjected to artificial diploidization resulting in homozygous plants. Development of doubled haploids will have a quick and significant impact in the hybridization and molecular breeding programs in coconut, besides adding value to the germplasm collection.

Keywords: Coconut, anther culture, microspores, doubled haploids

Introduction

Cocos nucifera, (2n=2x=32) commonly called coconut palm belongs to the palm family Arecaceae and is the only species in the genus *Cocos*. It is widely grown throughout the tropical countries for its wide use in food, industries and decoration. Virtually every part of the coconut palm has some human use and hence it is popularly known as “Karpaga Viruksha”. India ranks third among the coconut producing countries in the globe after Phillipines and Indonesia. In India, coconut is grown in an area of about 1.90 million hectares, producing 14,744 million nuts with a productivity of 7,747 nuts per hectare. Among the four major

coconut growing states, Tamil Nadu has the highest productivity (13,133 nuts/ha), followed by Andhra Pradesh (8,577 nuts/ha), Kerala (7,046 nuts/ha) and Karnataka (3,139 nuts/ha).

Coconut is an economically important perennial crop. It comprises of two forms: tall (*Cocos nucifera* var *typica*) and dwarf (*Cocos nucifera* var *nana*). The tall types are generally outcrossing, while dwarfs are mostly self-fertilized. Due to the differences in the breeding behaviour, there is a high degree of variation among the tall forms of coconut. Hybrid vigour in coconut has been established as early as 1937. The present day hybrids in coconut are produced by crossing the heterozygous tall forms with the homozygous dwarf types and the demand for good quality hybrid seedlings is increasing due to their increased yield over the parents. However to exploit the full heterotic vigour and to produce more uniform hybrids from a specific cross, there is a need to develop inbreds in coconut.

For enriching its genetic base, efforts have been made on exploration, collection, conservation and enhancement of coconut germplasm in India. (Ratnambal and Nair, 1994). More than 350 accessions are available in the germplasm centre at Kidu. Germplasm conservation, evaluation and utilization including local ecotypes has been a continuous process in coconut breeding programmes, resulting in the release of several varieties for cultivation in the farmers field. Further establishment of mother palm gardens of potentially proven tall and dwarf varieties to supply quality seedlings to farmers is also being taken up at several AICRP centres. In addition, there is a growing demand from farmers for coconut hybrids due to their heterotic vigour for high yield. Currently coconut hybrids are synthesised from crosses between heterozygous tall and homozygous dwarf parents. However, progeny performance for uniformity may not be to the expected level due to the inherent heterozygosity present in the tall parents. Hence there is a need to develop homozygous parental lines to exploit maximum hybrid vigour. Further, progenies developed from selected homozygous mother palms would have high level of predictable performance coupled with uniformity that would have more farmers' preference.

When hybrids are developed using an open pollinated heterozygous male with dwarf female, the genetic gain in terms of yield and oil content are not predictable and it is a time consuming

process to identify better cross combinations. Developing homozygous lines in coconuts through doubled haploidy can be a potential option to speed up the crop improvement programmes in coconut to attain increased yield through development of stable hybrids.

Development of homozygous lines in coconut and its implications

Homozygosity is being obtained by continuous selfing or inbreeding in crop plants by following conventional approaches which take several years. Tall types of coconuts are highly heterozygous due to cross pollinated nature. Androgenesis a phenomenon of plant regeneration from haploid anther cells give raise to haploid plants and later doubling of chromosomes of haploids will lead to homozygosity (Asif, 2013). Standardization of embryogenic callus induction from selected tall varieties such as west coast tall by culturing anthers and induction of plant regeneration from somatic embryos will lead to production of haploids. Doubling of chromosomes of haploids will result in di-haploids which will be completely homozygous and homogenous. By doubled haploid technique, it is possible to develop inbreds within a span of two to three years and the inbreds can be evaluated within a span of 10 years where as in conventional inbreeding method, it may take 60 years to develop complete homozygosity. Haploid production in coconut is still a challenge as it is one of the most recalcitrant species to regenerate *in vitro* and only limited studies are available on the efforts put forth towards development of development of anther culture plantlets in coconut (Than Tyuen and De Guzman, 1983; Monfort, 1985; Perera *et al*., 2008; Perera *et al*., 2009; Perera *et al*., 2011). There are several factors affecting the androgenesis induction and the effect of these factors has been studied by the above authors, since decades. Amidst these challenges the, attempts to standardise the protocol for development of doubled haploids has been progressing in coconut due to its potential to speed up the breeding process. The requirements and challenges for androgenesis in coconut are discussed below.

Standardization of protocol for development of doubled haploids in coconut

Standardisation of embryogenic callus induction protocol

Identifying the stage of anthers used for culturing is a crucial step in *invitro* culture. Anthers need to be collected

from inflorescences at different stages such as three weeks before splitting (WBS), two WBS and one WBS. However excising the spike at this stage can even be destructive to the palm. Further cytological observations are essential to identify the stages of meiosis to culture the permeable haploid cells into the medium. The developmental stage of the microspores is a critical factor that determines the success of anther culture. Use of anthers at first pollen mitosis and tetrad stage induced callus formation at a low frequency (Monfort *et al*., 1985). Use of uninucleate microspores resulted in many celled anther derived proembryos that failed to develop further. Anthers bearing late uninucleate microspores have been reported to be optimal for induction of androgenesis in coconut (Perera, 2003; Thanh-Tyuen and de Guzman, 1983). However the frequency of development of embryos from pollen in cultured anthers was less than 1%. Further these embryos showed no further development (Thanh-Tyuen and de Guzman,1983). Perera *et al*., 2008 had reported the favourable role of heat pretreatment at 38°C for 6 days or cold treatment at 4°C for 6 days in invidual spikes, before excising the anthers. The excised anthers have to sterilized with disinfectants such as 2% sodium hypochlorite and cultured in liquid or solid callus induction medium. Evaluation of different media composition and standardisation of the media conditions can increase the frequency of obtaining somatic embryos. The general incubation period is 25 $\pm$ 2ºC at a relative humidity of 60-70 per cent under darkness.

Induction of somatic embryogenesis from embryogenic calli obtained from cultured anthers/microspores

Once proliferated, the embryogenic callus needs to be subjected to somatic embryogenesis by transferring it to a solid medium such as M72 medium. The impact of varying concentrations of chemicals known to induce somatic embryogenesis such as 2,4-D, BAP and TDZ in the medium can be evaluated for their efficiency to produce somatic embryogenesis and can be standardised for this crop.

Induction of regeneration from somatic embryos

Calli bearing embryogenic structures once produced have to be transferred to germination medium once in every three months and shoots emerging from germinating embryos can be excised for development into individual plantlets. The regeneration

potential also has to be well studied to increase the frequency of obtaining plantlets. Confirmation of haploidy can be done by cytological techniques.

Standardization of the hardening technique

Pechyake *et al.,* (2007) has reported a standardized hardening technique, wherein the plantlets are transferred to a greenhouse and planted in black polyethylene bags containing a mixture of peatmoss and soil (1:1) and covered with transparent polyethylene bags with 1.5 cm slits on each side to increase the atmospheric exchange. After one week, the transparent covers can be removed and plantlets can be left uncovered for a further three week period in the greenhouse conditions before being transferred to shaded nursery.

With long concerted efforts put into standardisation of double haploid production in coconut, recently Perera *et al*., (2021), have been successful in developing a stepwise protocol for doubled haploid induction including palm selection, anther isolation, pretreatment, culture initiation, plant regeneration and thereafter acclimatization of the regenerated plants. This standardised protocol is now available for testing and validation by coconut research groups.

Conclusion

Establishment of a reliable and validated regeneration protocol would help to reduce the breeding cycle in coconut for production of homozygous lines in the form of doubled haploids. These lines add to the germplasm resources, and could serve as potential parents for varietal improvement and hybrid production to meet farmers' demands. In addition, they serve as an immortal mapping population for molecular breeding programs to tag important genes associated with agronomic and biotic/abiotic stress tolerant traits. Production of homozygous genotypes through another culture will have a direct implication in conventional/molecular breeding programs for development of improved varieties/ hybrids. Heterotic vigour of hybrids can be successfully exploited if the parents will be completely homozygous for all the loci. Further the DH population could serve as a suitable mapping population to identify genes/QTLs associated with stress resistance and economic traits of coconut where in developing mapping population by backcrossing or RILs is practically impossible. The known

genetic architecture of inbreds lines derived from the double haploidy processes can be exploited for hybrids or population development.

References

- Perera P.I.P., Vidhanaarachchi V.R.M. (2021). Anther Culture in Coconut (*Cocos nucifera* L.). In: Segui-Simarro J.M. (eds) Doubled Haploid Technology. Methods in Molecular Biology, vol 2289. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-1331-3_11
- Asif, M. (2013) Androgenesis: a fascinating doubled haploid production process. In: Progress and opportunities of doubled haploid production. Springer, Heidelberg, pp 7–44
- Thanh-Tuyen N.T., De Guzman E,V. (1983). Formation of pollen embryos in cultured anthers of coconut (*Cocos nucifera* L.). Plant Sci Lett 29:81–88
- Monfort, S. (1985) Androgenesis of coconut: embryos from anther culture. Zeitschr Pflanzen 94:251–254
- Perera P.I.P, Hocher V, Verdeil J-L, Bandupriya H.D.D, Yakandawala D.M.D, Weerakoon L.K (2008) Androgenic potential in coconut (*Cocos nucifera* L.). Plant Cell Tissue Organ Cult 92:293–302
- Perera P.I.P, Yakandawala D.M.D, Hocher V, Verdeil J-L, Weerakoon L.K (2009) Effect of growth regulators on microspore embryogenesis in coconut anthers. Plant Cell Tissue Organ Cult 96:171–180
- Perera P.I.P, Kularatne J.D.J.S, Weerakoon L.K (2011) Effect of gelling agent and selective sub-culturing on hyperhydricity in anther-derived coconut embryos. CORD Int J Coconut Res Dev 27:26–37

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ANTIDOTES FOR SPECIFIC POISONING AND ITS MECHANISM OF ACTION

Article ID: AG-V02-I05-03

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Introduction

Poisoning happens when a hazardous material comes into contact with the skin, eyes, or mucous membranes and is swallowed, inhaled, or absorbed. Toxicosis or intoxication are other terms for poisoning. They are frequently poisoned after consuming a harmful substance such as antifreeze or a deadly plant. They can also be poisoned by a venomous insect or snake sting or bite, or by a well-intentioned owner administering human pharmaceuticals that are toxic to animals.

A poison can poison an animal after a single exposure (with the effects being most obvious during the first 24 hours) or after repeated or protracted exposure. The dose, the amount of poison presentas well as the species have an impact on the harmful effects. A tiny amount may go undetected and cause no harm, whereas a big dose can be lethal.

Initially, life-saving interventions may be required. Treatment consists of limiting further toxin absorption, providing supportive treatment and if available, delivering specialised antidotes. The next sections go over the precise antidotes for some of the most prevalent poisonings in domestic animals.

1. Urea Poisoning

Urea isused as a source of non-protein nitrogen (NPN) in feed supplements. In ruminants, nitrogen from urea is released in the rumen as ammonia and can be used by rumen microflora to synthesise protein. This protein then becomes available to the animal through the normal processes of digestion and absorption. However, if more urea is consumed than the rumen organisms can metabolise, the ammonia is absorbed from the rumen into the blood. The ammonia is then converted back to urea in the liver and is then

excreted by the kidneys. It is a common poisoning which occurs due to excess feeding of molasses (silage, hay, straw). These excess fermentable carbohydrates will be converted to ammonia by urease produced by rumen microbes. This increases the rumen pH and enter in circulation leading to toxicity.

Treatment

- Vinegar (5% acetic acid) - 2 to 8 liters via stomach tube in cattle,0.5 to 2 liter in sheep and goat.
- It decreases the rumen pH, prevents further absorption of ammonia and inactivates ammonia by forming ammonium acetate, which can be utilized by microbes.
- Cold water/ice water (0-4^{o}C) upto 40L in cattle.

2.Cyanide Poisoning

A number of common plants may accumulate large quantities of cyanogenic compounds. Sorghums and related species readily accumulate these compounds. These cyanogenic compounds are in epidermal cells (outer tissue) of the plant, while the enzymes that enable cyanide production are in the mesophyll cells (leaf tissue). Once plants containing cyanide have been consumed, the toxin rapidly enters the blood stream and is transported throughout the body of the animal. Cyanide inhibits oxygen utilization by the cells in the animal's body. In essence, the animal suffocates. Ruminant animals (cattle and sheep) are more susceptible to cyanide poisoning than nonruminant animals because the ruminal microorganisms have enzymes that will release cyanide in the animal's digestive tract. It is mainly present in immature sorghum as cyanogenic glycoside along with beta glycosidase enzyme.This HCN will bind with cytochrome oxidase enzyme and forms cyan cytochrome oxidase complex. So that the cells can't utilize oxygen leads to tissue anoxia.

Treatment

- Sodium nitrite-20mg/kg, as 1% solution, slow IV
- Sodium thiosulfate-500mg/kg, as 25% solution, slow IV
- Cold water and vinegar (to prevent further release of HCN from cyanogenic glycoside)

3. Nitrate and Nitrite Poisoning

Nitrate poisoning (toxicosis) in animals (especially ruminants) results from excess consumption of nitrates from plants or water or via ingestion of nitrate-containing fertilizers. The nitrate

ion (NO3–) is reduced to nitrite ion (NO2–), which is rapidly absorbed and leads to the formation of methaemoglobin, which inhibits oxygen transport. Toxicosis most often occurs in naive domestic species, most commonly due to ingestion of plants containing excess nitrates; particularly by hungry animals engorging themselves, thus ingesting an enormous volume of nitrate. Confounding metabolic interactions with nonprotein nitrogen, monensin, and other feed components may exacerbate effects of excessive nitrate content in animal diets, especially when coupled with management errors. Nitrate source: sorghum, oats, rye, millets, wheat, barley, maize, Amaranthus (Mulaikeerai), Chenopodium (Paruppukeerai).

Treatment

- Methylene blue 1% solution in drinking water/NS, very slow IV – 4 to 22 mg/kg repeated every 6 to 8 hrs
- Plenty of cold water
- Saline purgative (to empty GI tract)
- Oxygen therapy

4. Lead Poisoning

Lead competes with or replace calcium, zinc and iron. It inhibits - SH groups of essential enzymes.it interferes with sodium potassium ATPase and alters cellular and mitochondrial membranes.

Treatment

- $CaNa_2$-EDTA-calcium disodium ethylene diamine tetra acetate (edentate calcium disodium) as a chelating agent
- Dose in cattle & horse – 110 mg/kg/d (1-2% solution in 5% dextrose), IM or IV, BID for 4-5 days
- Dog and cat – 25 mg/kg, SC, 4 times daily for 5 days
- Here, Na_2EDTA should not be used as it causes fatal hypocalcemia
- D-penicillamine – 110 mg/kg, PO
- Dimercaprol/British anti-lewisite (BAL), it can cross BBB

5. OPC Poisoning

This OPC compounds will bind with esteratic site of AChE leads to enzyme-OP complex formation. So, the acetylcholine gets accumulated and this cause excess muscarinic signs.

Treatment

- Atropine sulphate (to counter act muscarinic signs)
- Dose - dog and cat - 0.2 to 2 mg/kg, 1/4 IV and ¾ IM or SC,4 to 6 hrs interval

- Cattle, horse, swine - 0.2 to 0.5 mg/kg, 1/4 IV and ¾ IM or SC
- ChE reactivators/oximes like pyridine-2-aldoxime(2-PAM) – 25 to 50 mg/kg, slow IV, followed by IM at 8 to 12 hrs interval

6. Carbamate Poisoning

Carbamates will bind with both anionic and esteratic sites at AChE enzyme.

Treatment

- Similar to OPC poisoning, atropine sulphate - 0.2 to 0.5 mg/kg.
- Here, AChE reactivators (2-PAM) are contraindicated as it aggravates the signs.

(Because the carbamate doesn't have site for binding, so it will bind with other free AChE enzymes found in the site).

7. Snake Poisoning

- Administration of the specific anti-venom if the species of the snake is known, administration of polyvalent anti-venom if the species of snake is not known
- Total dose: 100ml - 5to 10 ml at the site of bite and remaining through IV

8. Anticoagulant Rodenticide Poisoning

- By warfarin, dicoumarol, brodifacoum, bromadiolone, diphacinone
- They will inhibit vitamin-k epoxide reductase, so the bleeding disorder will occur

Treatment

- Specific antidote-phytomenadione (vitamin-k) - 1 week therapy for 1st generation rodenticides
- Dog and cat-2.5to5mg/kg, IM/SC for 1 to 3 days
- Cattle - 0.5 to1mg/kg/day, IM/SC

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AQUARICULTURE FOR NOVICES

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Abstract

Freshwater ornamental Fish culture is one of the favourite aquacultural areas in tropical and sub-tropical areas. People in the developing countries like India are very fond of ornamental fish culture, but somewhere they lack idea in technical wise at the beginning. This article will remove that kind of hesitation among farmers by explaining the basics about ornamental fishes and their management techniques.

Key words: Guppy, Molly, Goldfish, Fighter fish, Aquariculture, Water quality management.

Introduction

Aquariculture – ornamental fish culture - is the culture of charming, mesmerizing and colourful fish in a confined aquatic system. It is a multibillion-dollar industry and second most hobby after photography. Those who wants to start a business it is a great opportunity for peaceful, happiness and income generation on entrepreneurship development. The successful ornamental fish culture depends on the location, layout of unit, proper management protocols in breeding and rearing. The present popular article narrates about unit setup, commercially important fish varieties, water quality management, feeding management, breeding and health management.

Unit setup

Glass tanks, cement cisterns and FRP tanks can be used for the culture of ornamental fishes. Cement tanks are mostly preferred because it is easy to maintain and durable. For instance, three to four cement cisterns (3*2*1 meters) is sufficient for small scale unit (500 sq.ft land). Glass and FRP tanks are suitable for breeding. Aerator is a fundamental for effective culture of ornamental fishes. Heaters needed for temperature maintenance in the culture unit. Shade facility and antibird nets needed for effective culture practice. Sufficient

water supply at breeding and rearing unit is essential. Quarantine tanks used to keep the new fish stocks before it added to the existing stocks. Size of tank varies according to space, number and type of fish cultured.

Commercially Important Ornamental Fishes

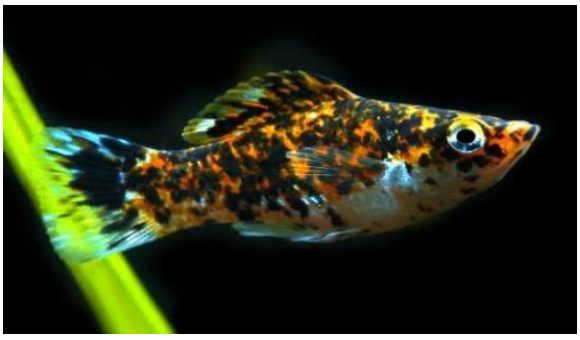
Live Bearers	Egg Layers
Guppy (*Poecilia reticulata*)	Gold fish (*Carassius auratus*)
Molly (*Poecilia sphenops*)	Koi carp (*Cyprinus rubrofuscus*)
Platy (*Xiphophorus maculatus*)	Zebra fish (*Danio rerio*)
Sword tail (*Xiphophorus helleri*)	Neon tetra (*Paracheirodon innesi*)

Guppy Fish

Platy Fish

Sword Tail

Live Bearers



Molly Fish

Egg Layers

Fighter fish

Angel fish

Koi Carp

Neon tetra

Gold Fish

External fertilization occurs in egg layers. Based on spawning behaviour the egg layers are further classified into

1. Egg scatters (adhesive eggs)
2. Egg scatters (non-adhesive eggs)
3. Egg burrier
4. Mouth brooder
5. Nest builder

It is always advised to the farmer to be master on single species than venturing into many species. One species can be stocked in one tank. In case of the compatible nature, two to three species are also reared in same tank.

Water quality management

Water source from bore, wells, rivers used. In case of municipal water, it should be dechlorinated by aeration before used for culture. Most of the ornamental species cultured require soft to medium hard water. Bio-filter essential for proper water quality management. Standard water exchange with appropriate aeration paves way for effective culture. Aeration is done by blower pump with network of tubes.

S. No	Parameters	Level to be maintained
1	Temperature	24-28^0 C
2	PH	7-8
3	Hardness	150-200 ppm
4	Dissolved oxygen	5 ppm
5	Carbon dioxide	< 1 ppm

6	Phosphate	< 0.5 ppm
7	Nitrite	0 ppm
8	Nitrate	< 50 ppm
9	Ammonia	0 ppm

The only safe level of ammonia is zero. Ammonia is more toxic at high temperature and high PH. Beginners should aware of "New tank syndrome condition". Adding more number of fish in small tank, overfeeding a new culture tank rises nitrite and ammonia to unsafe level. This leads to loss of fish.

Feeding Management

First food of fish larvae is vital for achieving good survival rates and immunity. Live feeds are mostly preferred because of its nutritive value, easy digestion and available at all the space of water. Commercially available brine shrimp (*Artemia salina*) or else readymade pellet feed are can be used. The major problem on artificial feeds is high cost. Low-cost alternative live feeds are green algae, water fleas, sludge worm (tubifex worm), copepod, earthworm are fed. Different homemade feed like whole wheat breads, vegetable peelings are also fed. Most farms rely on Daphnia, tubifex worms, Mosquito larvae, Infusoria, Artemia nauplii and Rotifer fed for early stages of life. Live feed production is essential for effective maintenance of unit. Generally feeding once a day at morning is sufficient. Over feeding harmful than under feeding as excess feed destroys the water quality. Type and quantity of feed depends on the size of fish.

Breeding

Beginners should always start work on breeding the live bearers (molly, guppy, platy, sword tail, etc.) as they breed easily. Breeding of gold fish and other egg layers preferred after success breeding of live bearers. The success of breeding based on the compatibility of pairs. Glass tanks are preferred for breeding purpose of most of the species. Sex identification of ornamental fishes is essential for breeding.

Identifying Characters	**Male**	**Female**
Colour	Bright	Dull
Size	Small	Large
Fin	Longer dorsal and caudal fin	Shorter fins
Belly	Normal	Bulged

Matured Male: Anal fin pointed, straightened to rigid tube (Gonopodium).

Matured Female: Appearance of dark crescent shaped area close to vent (gravid spot).

Live bearers are notorious cannibals, they devour their young ones. It is prevented by using breeding hapa. Conditioning of parent fish should be done prior to breeding. It is done by feeding brooder fish with protein rich feeds like brine shrimp, Insect larvae and blood worms etc. Brooder male and female should be separated during conditioning.

Special consideration on egg layers that egg scatters like barbs and tetras require plants and substrates. Angel fish is an egg depositor which deposits larger eggs require substrates. Some fishes carry their eggs and larvae in mouth, such as cichlids termed as mouth brooders. Nest builders are type of egg layers which builds nest with floating plants/fine leaves. Fighter fish, kissing gourami, Dwarf gourami are some examples for nest builders.

Health management

Water quality control is primary preventive measure. The most common disease that affect ornamental fishes are white spot, tail and fin rot, dropsy. CIFACURE (developed by CIFA) medicine for controlling various bacterial and fungal disease. The used nets disinfected with methylene blue. Rough handling and sudden changing in tank condition avoided. Chloromycetin and tetracycline 10mg/litres used for treatment of dropsy, tail and fin rot. Acriflavine used against velvet disease and costiasis. Methylene blue is effective against the fungal disease Saprolegnia. Potassium permanganate used for treatment of anchor worm (lernaea), fish louse and fluke.

Chemical	Method of use	Purpose
Common salt (15-30 g/litres)	Bath treatment for 30 minutes	Disinfectant
Methylene blue (2.5 g/litres)	Added in aquarium water	Water purification
Copper sulphate (1 g/litres)	Bath treatment for 1 hour	Disinfectant

Tips for success

1. Plenty of water.
2. Try to be a master in single species.
3. Construct a culture unit near Market and transport facilities.
4. Knowledge of market demand (Customer preference).

Conclusion

The fishes reach marketable size in 3-5 months. Aquariculture requires less space and less capital investment than other types of aquaculture practices. Ornamental fish breeding easily adoptable by rural people. It may be practised even in urban areas by little alteration of backyard or roof of the house. Culture of ornamental fishes is profitable technique, creates alternative source of income among elders, unemployed youths and women.

References

- Jagdish Reddy- Ornamental fish farming for beginners (Agri farming).
- Dr. P. Jayasankar- Ornamental fish culture (ICAR- CIFA).
- Bijay Kali Mahapatra - Ornamental fish farming-Successful Aqua business in India.
- TNAU Agritech portal.

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AGRICULTURAL CO-OPERATIVE SOCIETIES: A BOON FOR FARMERS

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Introduction

Growth of Indian economy is not possible without the progress of its rural areas. Slogan like "Jai Jawan - Jai Kisan" raised from these regions only. For fulfilment of needs and development of these rural areas, government as well as private organizations play their part. Government and private banks, charitable trust companies, non-government organization, joint firms and co-operative societies are to name the few. Co-operatives originated in the West during the middle of the last century and were introduced to India in 1904 with the promulgation of the 'Indian Co-operative Societies Act'. Rural indebtedness was the key trigger behind the formation of co-operatives in India. Initially these were just to provide credits to the farmers. Non-credit societies came in 1912. With the formation of the Reserve Bank of India (RBI) in 1935, the development of more co-operative societies was prioritized.

Main aim of the co-operative was to get the poor and indebted farmers out of poverty and out from the clutches of money lenders. Within short span of time, role of co-operatives extended beyond agricultural credit. It started covering activities such as production, farming, marketing and processing. Co-operatives are now playing a very significant role in the socio-economic development of our country especially the rural India. Co-operatives cover more than 97 per cent of Indian villages. These societies are autonomous societies which work on their own where farmers work together to achieve their economic, social, and cultural needs. These societies are the organizations in which its members have the ownership and control to utilise the facilities/services of the society. The main function of these societies is to help its members in the form of kind or cash. People come forward in group in these

societies and utilise the resources in the best possible way to gain maximum profit

Types of co-operative societies

Apart from agriculture, co-operative societies work in other areas where instead of working alone, resources and services can be utilised efficiently by working together.

1. **Co-operative Credit Society:** These kinds of societies provide financial help to the members in the time of need. This society keep the deposits of members money and provide credit on reasonable interest rates whenever it is required by the members. For example, village level or primary co-operative society and urban co-operative banks.
2. **Housing Co-operative Society:** These societies provide residential plots, houses or flats to their members. These societies provide loan on lesser interest rate for construction of the house. For example, Employee's Housing Society, Metropolitan Housing Co-operative Societies, etc.
3. **Consumer Co-operative Societies:** By providing daily needs products on affordable and reasonable prices, these societies protect the rights of common consumers.
4. **Producer Co-operative Society:** This society provides raw material inputs implements. Machinery, etc. To small farmers to safeguard their interest.
5. **Co-operative Marketing Society:** These societies are made by those small producers and manufacturers who face difficulty in serving their produce.
6. **Co-operative Agriculture Society:** The main objective to build these societies is to work in collaboration with farmers so that they can get maximum gain from agriculture.
7. **Co-operative Training Societies:** These societies impart training to different co-operative employees under corporation.
8. **Co-operative Societies for Women:** In these societies, women work together on different fields like stitching, pickle making, etc.

In Punjab state, total number of co-operative societies are 18948, out of which 3961 societies are Primary Agricultural Co-operative/Credit

Societies (PACS). The co-operative societies include Joint Collective Farming Societies, Primary Marketing and Processing Societies, Milkfed, Markfed, Poultry Cooperation Society and Sugarcane Supply Co-operative Societies. Besides, State Agricultural Development Bank (SADB) and Primary Agricultural Development Banks (PADB) are also there to help farmers. District Ludhiana has the highest number of PACS (387) in the state followed by Hoshiarpur (305) and Sangrur (286). PADBs are highest in Ludhiana (8), Sangrur (8) and Patiala (7) districts. It is important to mention that nearly 52 per cent PACS are running in profit and about 37 per cent in loss. The remaining ones are running in almost no profit no loss condition. There is a dire need for improvement in the condition of these societies.

Table: Agricultural Co-operative/Credit Societies and Banks in Punjab

S. No.	Particulars	Number
1.	Total co-operative societies of all type	18948
2.	Primary Agricultural Co-operative/ Credit Societies	3961
3.	Primary Agricultural Development Banks (PADB)	89
4.	State Agricultural Development Bank (SADB)	1
5.	Punjab State Co-operative Bank (PSCB)	1
6.	Joint Collective Farming Societies	83
7.	Primary Marketing-cum-Processing Societies	82
8.	Apex Marketing Federation, Punjab (Markfed)	1
9.	Primary Co-operative Milk Producers' Societies (Milkfed)	6521

10.	Poultry Co-operative Societies	91
11.	Sugarcane Supply Co-operative Societies	7

Conclusion

Co-operative societies can help in improvement of farmers' economic and domestic conditions if they work independently. It is difficult for small farmers to survive in present days' expensive agriculture. Co-operative societies can purchase farm inputs in bulk at comparatively low prices which can help reduce cost of cultivation. In Punjab, there are many co-operative societies which not only provide farm inputs but also other services like agriculture credit, agri machinery, implements and create employment to agricultural labour. The interference by politicians and other influential persons may cause loss to the societies as well as its member farmers. In Punjab, 3961 co-operative societies are working, out of which, the societies which are running autonomously showed an exemplary progress and they have their own petrol/diesel pumps and agro-processing complexes. These also take land on lease by which they create employment to other fellow farmers. To improve the financial condition of farmers, only co-operative societies are the hope. These may be proved successful if these are allowed to work autonomously and independently. The marginal (up to 2.5 acre) and small (2.5 to 5 acres) farmers constitute 33 per cent of total operational holdings in the state which have only 9.7 per cent of total agricultural land. They are unable to bear huge farm expenses on purchase of modern machinery and implements. So, in such a situation, with the help of co-operatives using agricultural machinery and implements collectively is the only best option. Co-operative societies may help in eradicating poverty, enhancing food security and creating new job opportunities. Where public and private sector fails, co-operative societies become a saviour. This is our uttermost responsibility to look after our village societies and make these successful and profitable organization because profit to co-operative is profit to farmers.

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AWARENESS AND DEMONSTRATION OF THE SOIL HEALTH CARDSCHEME BENEFITS FOR RURAL DEVELOPMENT

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ABSTRACT

Soil is the most basic component of agriculture, as it holds nutrients and allows plants to grow properly. Soil health has deteriorated in recent years as a result of indiscriminate fertiliser usage and unbalanced use of other techniques. In light of these facts, India's government has developed a flagship programme to provide information on available nutrient status for crop production. The findings revealed that the vast majority of farmers were aware of the Soil Health Card's use and usefulness. The considerable time gap between soil samples obtained and issuing cards, as well as the difficulty in understanding all of the information presented in the soil health card and estimating fertiliser dose based on soil nutrient status, were major constraints in utilising information.

Keywords: Soil, nutrients, health card, samples and constraints

INTRODUCTION

"Swasth Dharaa. Khet Haraa." -
Healthy Earth. Green Farm.

Soil Health Card Scheme is a scheme launched by the Government of India on 19 February 2015. Under the scheme, the government plans to issue soil cards to farmers which will carry crop-wise recommendations of nutrients and fertilisers required for the individual farms to help farmers to improve productivity through judicious use of inputs. The result and suggestion will be displayed in the cards. The government plans to issue the cards to 14 crore farmers.

What is a Soil Health Card?

SHC is a printed report that a farmer will be handed over for each of his holdings. It will contain the status of his soil with respect to 12 parameters, namely N, P, K (Macro-nutrients); S (Secondary nutrient); Zn, Fe, Cu, Mn, Bo (Micro – nutrients); and pH, EC, OC (Physical

parameters). Based on this, the SHC will also indicate fertilizer recommendations and soil amendment required for the farm.

How can a farmer use a SHC?

The card will contain an advisory based on the soil nutrient status of a farmer's holding. It will show recommendations on dosage of different nutrients needed. Further, it will advise the farmer on the fertilizers and their quantities he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields.

DEMONSTRATION PERFORMED TO SHOW THE BENEFIT OF SCHEME IN VILLAGE DHARAMPURA

1. Data was collected to determine whether or not farmers are aware of the soil health card scheme, as well as the constraints experienced by the farmer who tested the soil.

For analysis 60 farmers were selected and asked question about some point which are discussed below

Awareness about soil health card	YES	NO
Soil health card provides information regarding the status of available nutrients (Macro & Micro) in the soil	57 (95%)	03 (05%)
Soil health card provide corrective measures a farmer should take for improved soil health and for better yield	49 (82%)	11 (18%)
Soil health card helps farmers in reducing extra expenditure by supplying required nutrients in the soil	53 (88%)	07 (12%)
The soil health card helps the farmers to get an idea on the crop wise recommendation of nutrients and fertilizers required in each type of soil	48 (80%)	12 (20%)
Soil health card can be helpful and effective only if the recommendations are followed by farmers on regular basis	43 (72%)	17 (28%)
The technical information provided in soil health card has been made available in local language.	47 (78%)	13 (22%)
Soil health card helps to check the excessive use of fertilizer	45 (75%)	10 (17%)

Soil health cards provides clue to health of farm and its strength and weakness in terms of different nutrients and organic carbon ingredients.	55 (92%)	15 (25%)
Expenditure of crop production decreases after soil testing	52 (87%)	08 (13%)

It was found that majority of farmers (95%) were aware about the soil health card that it provides information about the status of available nutrients (Macro & Micro) in the soil, which provide corrective measure for improving soil health and for getting better yield (82%).

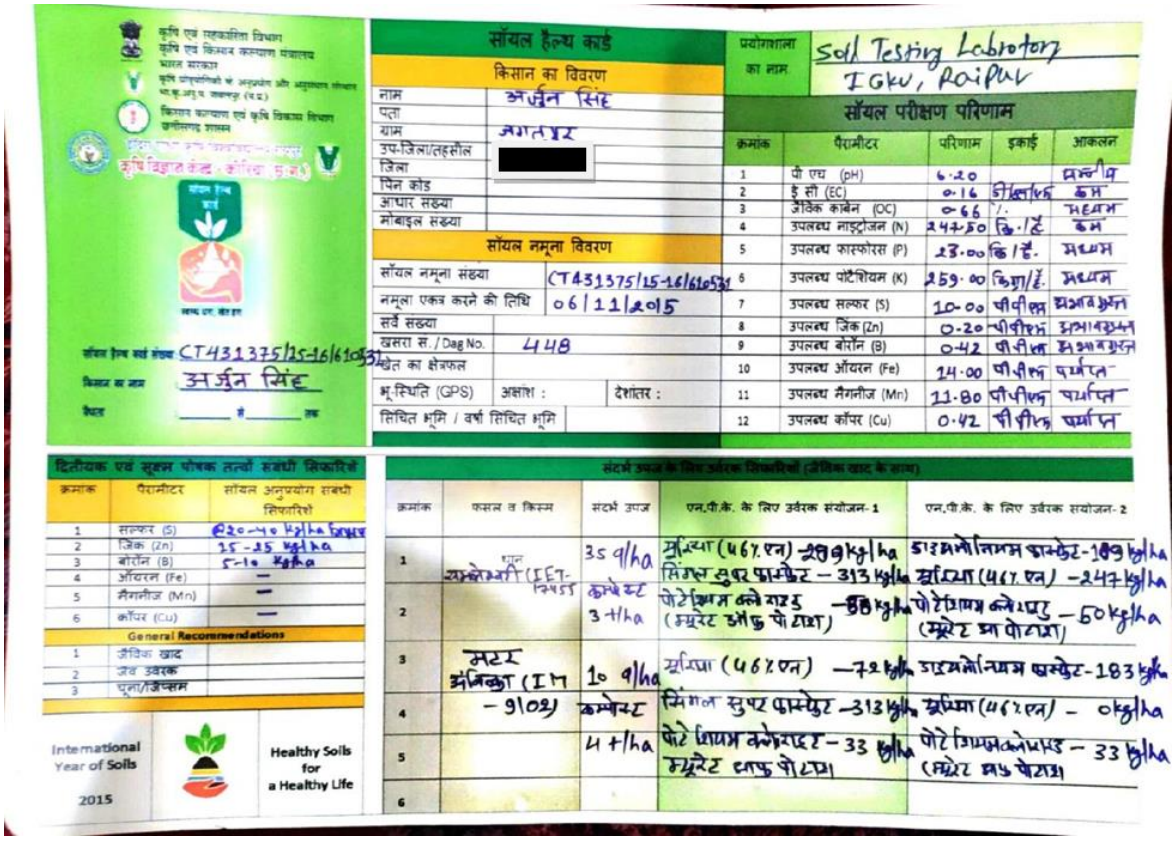
CONSTRAINTS FACED BY THE FARMER ABOUT SOIL HEALTH CARD

1. Time gap between soil samples taken and issuing cards was too high
2. Difficulty in understanding all the information given in the soil health card
3. Difficulty in calculating fertilizer dose on the basis of nutrient status of soil
4. High price of fertilizers
5. Lack of knowledge about method of collecting ideal soil sample
6. No subsidy on inputs required by the government for improving the soil quality
7. Soil testing laboratories are located far away
8. Result of soil testing is reliable

Fig: Collecting soil sample

livelihood. Due to excessive use of fertilizer soil become pollute so govt. starts some programme to aware about soil.

One of the programmes is soil health card. Soil sample taken in farmers field are analysed and the recommendation given in soil health card are followed by farmer. Farmers take note of and apply the limiting nutrient specified on the card, which is accountable for



सॉयल हैल्थ कार्ड

किसान का विवरण

नाम	अर्जुन सिंह
पता	
ग्राम	जगतार
उप-जिलातहसील	[redacted]
जिला	
पिन कोड	
आधार संख्या	
मोबाइल संख्या	

सॉयल नमूना विवरण

सॉयल नमूना संख्या	CT431375/15-16/16053
नमूना एकत्र करने की तिथि	06/11/2015
सर्वे संख्या	
खसरा सं./Dag No.	448
खेत का क्षेत्रफल	
भू-स्थिति (GPS)	अक्षांश : देशांतर :
सिंचित भूमि / वर्षा सिंचित भूमि	

प्रयोगशाला का नाम: Soil Testing Laboratory IGKV, Raipur

सॉयल परीक्षण परिणाम

क्रमांक	पैरामीटर	परिणाम	इकाई	आकलन
1	पी एच (pH)	6.20		प्रबल
2	ई सी (EC)	0.16	डेसीसिमेंस	कम
3	जैविक कार्बन (OC)	0.66	%	मध्यम
4	उपलब्ध नाइट्रोजन (N)	242.50	कि.ग्रा/हे.	कम
5	उपलब्ध फास्फोरस (P)	23.00	कि.ग्रा/हे.	मध्यम
6	उपलब्ध पोटैशियम (K)	259.00	कि.ग्रा/हे.	मध्यम
7	उपलब्ध सल्फर (S)	10.00	पीपीएम	प्रभावकमी
8	उपलब्ध जिंक (Zn)	0.20	पीपीएम	प्रभावकमी
9	उपलब्ध बोरॉन (B)	0.42	पीपीएम	प्रभावकमी
10	उपलब्ध ऑयरन (Fe)	14.00	पीपीएम	पर्याप्त
11	उपलब्ध मैंगनीज़ (Mn)	11.80	पीपीएम	पर्याप्त
12	उपलब्ध कॉपर (Cu)	0.42	पीपीएम	पर्याप्त

द्वितीयक एवं सूक्ष्म पोषक तत्वों संबंधी सिफारिशें

क्रमांक	पैरामीटर	सॉयल अनुप्रयोग संबंधी सिफारिशें
1	सल्फर (S)	20-40 kg/ha जिप्सम
2	जिंक (Zn)	25-25 kg/ha
3	बोरॉन (B)	5-10 kg/ha
4	ऑयरन (Fe)	—
5	मैंगनीज़ (Mn)	—
6	कॉपर (Cu)	—

General Recommendations

1	जैविक खाद
2	जव उवरक
3	चूना/जिप्सम

क्रमांक	फसल व किस्म	संभावित उपज	एन.पी.के. के लिए उर्वरक संयोजन-1	एन.पी.के. के लिए उर्वरक संयोजन-2
1	धान सलेक्शन (IET-19455)	35 q/ha कम्पोस्ट 3 t/ha	यूरिया (46% एन) 299 kg/ha सिंगल सुपर फास्फेट – 313 kg/ha पोटेशियम क्लोराइड (म्यूरेट ऑफ पोटाश) – 88 kg/ha	डाइअमोनियम फास्फेट-183 kg/ha यूरिया (46% एन) -247 kg/ha पोटेशियम क्लोराइड (म्यूरेट ऑफ पोटाश) – 50 kg/ha
2	मटर अंजिका (IM-9102)	10 q/ha कम्पोस्ट 4 t/ha	यूरिया (46% एन) – 72 kg/ha सिंगल सुपर फास्फेट – 313 kg/ha पोटेशियम क्लोराइड – 33 kg/ha म्यूरेट ऑफ पोटाश	डाइअमोनियम फास्फेट-183 kg/ha यूरिया (46% एन) – 0 kg/ha पोटेशियम क्लोराइड – 33 kg/ha (म्यूरेट ऑफ पोटाश)
3				
4				
5				
6				

International Year of Soils 2015

Healthy Soils for a Healthy Life

Fig: Report of soil sample by giving recommendation of accurate amount of nutrient

CONCLUSION

Soil is a sole to farmer because major of the population in Chhattisgarh are dependent on farming for their production limitation. Because of the application of the needed amount of fertiliser, the farmer claims that their production has increased and their

input costs have decreased.

Due to benefit of farmer seen in demonstration other farmers are also excited to test the soil sothat they also get more yield and less input cost.

Fig: Awareness about the scheme

REFERENCES

- Doran, J.W., Jones, A.J., (1996). Methods for Assessing Soil Quality, SSSA Special Publication. vol. 49 Soil Science Society of America, Madison, WI.FAO, (2015). Healthy Soils Are the Basis for Healthy Food Production.
- Hartmann, M., Frey, B., Mayer, J., Mäder, P., &Widmer,F. (2015). Distinct soil microbial diversity under long- term organic and conventional farming.*The ISME journal,* 9(5), 1177.
- Jaiswal, M., and Singh, A., (2018) Study on awareness & perception regarding soil health card. *Journal of Pharmacognosy and Phytochemistry;* SP4: 395-400.
- Kibblewhite, M. G., Ritz, K., & Swift, M. J. (2007). Soil health in agricultural systems. Philosophical Transactions of the Royal Society B: Biological Sciences, 363(1492), 685-701.
- Kumar, S., Sangeetha, V., Singh, P., Burman, R. R., Bhowmik, A., & Kumar, S. A. (2017). Constraints Faced by Farmers in Utilizing Rice Related Information through Rice Knowledge Management Portal (RKMP). *Indian Journal of Extension Education,* 53(1), 84-89.

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BREEDING OF ORGANIC RESPONSIVE RICE VARIETIES TOWARDS SUSTAINABILITY AND NUTRITIONAL SECURITY

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Abstract

Organic responsive breeding of rice is necessary and foremost important task to the rice breeders across the rice growing regions of India. It is a multi-disciplinary approach to combine various traits viz., nutrient mobilization ability, root exudations, microbial colonization ability, photo synthetic efficiency, low input responsiveness, tolerance to biotic and abiotic stresses and quality traits. Optimization of selection platform by normalizing the soil factors is the first and foremost step followed by screening and development of magic populations and selecting superior lines under organic input conditions. Development of organic responsive rice varieties and growing them under organic conditions will lead to yield stabilization. But modern high input response varieties growing under organic conditions will drastically reduce the yield and it will cause imbalances nutritional securities and huge cost of organic rice produces.

Keywords: low input responses, nutrient mobilization, root exudations, rhizosphere colonizations

Introduction

Rice is the staple food crop for more than 50% of the world population. It is cultivated mainly in subtropical and tropical regions and a few parts of temperate regions. It is grown in different eco systems viz., dry, semi dry and wetlands with different levels of water requirements. Evolutionarily rice was self-sown and grown in natural habitats without inputs requirements and primitive selection process leading to formation of low input response varieties which were adapted to higher water regimes and continuous water inundations. They depended upon organic inputs and other management practices for production of rice. Mainly transplanting was evolved to overcome weed menace in water logged conditions. The average productivity remained less than 1000 kgs per hectare and rice was

always respectful crop as it was consumed regularly only by elites. But due to increase in population during 1940s, the production levels were not sufficient to meet the population in the country. Great Bengal famine occurred in 1942, caused starvation and mortality of people. It necessitated the introduction of high yielding varieties in rice in 1960s. Desi (indica) rice varieties belonged to indica group mainly and fewer aromatic varieties belonged to japonica were tall, lodging, photo sensitive, fertilizer non responsive, shattering and longer durations. They were inherently poor yielders. Rice cultivation by big farmers with more than 25 acres with cheaper labor force supposed to be profitable. It had been non economical for the small farmers, where the bulk of grain produces given as wages. Rice symbolized both for poverty and wealth simultaneously. Wonder rice IR 8 which was hybrid derivative of TN-1 x Peta having short plant stature (semi dwarf), high tillering, nitrogen responsive, short duration and with higher levels of yields. IR 8 revolutionized the rice cultivation in the world which is popularly termed as "Green Revolution ". IR 8 served as donor for most of the indica rice varieties across the rice growing regions of the world. Various high yielding rice varieties from IRRI were developed and popularized for cultivation viz., IR 20, IR 36, IR 50, IR 64. India initiated the high yielding varieties programme (HYV) using IRRI rice lines as donors and several high yielding varieties were developed viz., Jaya, ADT36, ADT 39, ADT43, BPT5204, Pusa Basmati 1, CO43, Jyothi, ASD16, TKM9, and popularized in farmers field for cultivation. Narrow genetic base of sd1 background of IR8 lead to susceptibility to pests' diseases and eventually the high yielding varieties lacked the ability to withstand abiotic stresses and nutrient mobilization capabilities.

They are dependent on application of chemical fertilizers for growth and development to produce higher yields, also 2-3 rounds of sprays of chemical fungicides and pesticides for the control of pests and diseases.

Due to sort of organic manures and manual labors for rice cultivation, rice farmers solely dependent upon chemical inputs for rice cultivation. They are potential pollutants of water, soil and rice products creating health hazards on a long-term basis. Prices of chemical inputs are increasing every year which makes rice cultivation not a profitable venture.

Due to continuous applications of chemical fertilizers, soil fertility is greatly affected in rice ecosystems viz., excess phosphatic fertilizers application led to aggravation of zinc deficiency in wetland rice cultivation system, drastic reduction of microbial populations in rice ecosystem, eutrophication of water bodies, change in physico, chemical and biological properties of soil. Over all the rice productivity per unit area is being reduced due to altering soil conditions. These issues necessitate development of organic responsive rice varieties through breeding for stabilizing the yield by utilizing natural inputs from soil and free from chemical inputs.

Present status of organic farming initiatives in rice cultivation

There are no organic responsive varieties evolved recently. Modern varieties which are developed under high fertilizer application and responsive conditions have very slow response to organic cultivation methods. There is a severe yield reduction and maximum yield attainment under organic farming is not possible due to lack of organic responsiveness. The most popular variety which is cultivated throughout the country, BPT5204 is showing drastic yield reduction under organic cultivation methods.

Most of the organic initiatives involve cultivation of local landraces and traditional varieties across the nation viz., Kavuni, Basmati, Mappillai samba, Seeraga samba, Kalanamak, and many other varieties which are low yielding also have long duration, photosensitivity and lodging tendencies. However, these following modern varieties under Tamil Nadu conditions found to be responsive organic cultivation methods viz., Paiyur-1, Bhavani, Improved White Ponni, IR-36 and TRY 3.

Necessity to develop organic responsive varieties in rice

Modern rice varieties with semi dwarf background fail to respond to organic cultivation methods and record poor yields. Organic responsiveness includes incorporation of necessary traits into semi dwarf genetic background involving in nutrients mobilization (N, P, Zn, Fe), root exudation ability, photosynthetic efficiency, microbial colonizations, release of volatile compounds, nutrients use efficiency and improved qualities.

Steps in breeding of organic responsive rice varieties

1. Conversion of field plots by optimization of soil fertility viz., microbial population, organic

matter content, pH, EC, physical properties and standardization of zero tillage practices, crop rotation practices etc.,

2. Screening of larger number of germplasm lines under no input/ low input conditions for identifying efficient lines
3. Identification of component traits to constitute organic responsiveness viz., nutrients mobilization ability in deficient soils (N, P, Zn, Fe), root exudates (biochemicals diversity and content), microbial colonization in rhizosphere (rhizobiome), tolerance to abiotic and biotic stresses, and quality traits (nutritional cooking taste, mineral nutrients content, protein)
4. Development of magic population by utilizing the key donors identified in the screening processes by crossing them in all possible combinations.
5. Raising the F1s in organic conditions and forwarding the F2.
6. Sowing the seeds in low input conditions and studying the segregation pattern for organic responsiveness
7. Selection of semi dwarf types combined with organic responsiveness.
8. Following the crop rotations with rice fallow pulses/ green manuring and constituting the F3 family and forwarding to F4.
9. Following zero tillage practices in the selection plots and direct sowing the F4 families with space manually and selection of superior families with no input responses.
10. Harvesting the ear heads and allowing the stubbles for decomposition by irrigating with cow dung slurry.
11. Reconstituting F5 lines and selecting superior lines with yield under low/no input responsive conditions.
12. Forwarding selected F5 families using single seed descent method by raising the single ear under low input response conditions.
13. Selection of superior F6 lines under low input response conditions and validating the root exudations, microbial colonization tolerance to biotic and abiotic conditions, and quality traits.

14. Mass multiplication of seeds of superior lines having organic responsiveness validated with component traits.
15. Conducting PYT, AVT, CYT under organic conditions and promotion for organic conditions to particular locality based on MLT results.

Conclusion

Organic responsive rice breeding is an important task to be taken up rice breeders to reduce the chemical inputs dependence, to improve the soil fertility, and quality of produces and reduce the cost of organic produces. Organic responsive varieties with same level yields of conventional farming methods will definitely reduce the cost of produces and affordable to all income group of population. It is a long term and coordinated efforts to identify the traits and bringing them together in favorable genetic background.

References

- Masanobu Fukuoka (1978) One Straw Revolution.
- Berendsen, R.L., Pieterse, C.M and Bakker, P.A. 2012. The rhizosphere microbiome and plant health. Trends Plant Sci. 2012 Aug;17 (8):478-86. doi: 10.1016/j.tplants.2012.04.001.
- Liu, Y., Yang, H., Liu, Q., Zhao, X., Xie, S., Wang, Z. 2020. Effect of two different sugarcane cultivars on rhizosphere bacterial communities of sugarcane and soybean upon intercropping. *Frontiers in Microbiology.* 11:596472.
- Long-Jun Ding, Hui-Ling Cui, San-An Nie, Xi-En Long, Gui-Lan Duan, Yong-Guan Zhu, 2019. Microbiomes inhabiting rice roots and rhizosphere, *FEMS Microbiology Ecology*. 95:5. https://doi.org/10.1093/femsec/fiz040
- Mendes, R., Kruijt, M., De Bruijn, I., Dekkers, E., van der Voort, M., Schneider, J. H. & Raaijmakers, J. M. 2011. Deciphering the rhizosphere microbiome for disease-suppressive bacteria. *Science*, *332*(6033): 1097-1100.
- Prabha R, Singh DP, Gupta S, Gupta VK, El-Enshasy HA, Verma MK. 2019. Rhizosphere Metagenomics of *Paspalum scrobiculatum* L. (Kodo Millet) Reveals Rhizobiome Multifunctionalities.*Microorganisms*. 7:608. https://doi.org/10.3390/microorganisms7120608

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BENEFICIAL HONEY BEES UNDER THREAT BECAUSE OF COLONY COLLAPSE DISORDER

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Abstract

Honeybees are one of the most prominent beneficial insects on the earth. They play a crucial role in pollination as a result it enhances yield, quality of food products. Before chemical usage era due to good environmental conditions and proper usage of organic pesticides, the population of Honeybees was high. In course of time, due to rapid and steadily growth in human population urge to produce more food increased. Man has forgotten the actual role of honeybees and indiscriminate usage of chemical pesticides and erratic climatic conditions had huge impact on decline of honeybees colonies. In this review article, will be discussing about the role of honeybees in pollination, reasons of their decline in their population.

Introduction

"If the bee disappeared from the surface of the earth, man would have no more than 4 years to live." - Einstein.

Honeybees (*Apis* spp, Apidae, Hymenoptera). There are about 25,000 to 35,000 species which acts as efficient pollinator, It pollinates 3/4th of World's angiosperm plants. Beekeeping and hunting practices were begun by human beings around 4500 years ago (FAO, 2009) Honey bee as dominant pollinator of Bee species include *Apis dorsata* (Rock bee or Giant Honey bee), *Apis cerana indica* (Indian bee/Asian bee), *Apis florae* (Little bee), *Apis mellifera* (European bee). These are domesticated Indian bees. An introduced bee species is *Apis mellifera* which is known as Italian bee/European bee. It was first introduced into Punjab by A. S. Atwal *et al* in 1963. European bee has some unique features due to which it attracted the beekeepers to initiate bee keeping such as it produces prolific queen, less prone to swarming and absconding, high honey yield (45-180kg/colony/year) compared to indigenous rock bee(37kg/colony/year). Low honey producing species like little bee (*Apis*

florea), Dammer or Mosquito or Stingless Bee (*Trigona iridipennis*, Meliponidae, Hymenoptera) They are used because they are having good medicinal properties hence used in Ayurvedic. The Wild bees are Himalayan or Cliff bee (*Apis laboriosa*) considered to be biggest bee species. It acts an essential pollinator of Apples in Himachal Pradesh.

Apart from Honey, there are other by products such as Pollen, Royal jelly, Bee Venom, Bee wax, Propolis. The price of Bee wax is much higher compared to Honey as it requires 20 kg of honey to produce 1 kg of Bee wax.

Inspite of all these uses, due to indiscriminate usage of chemical pesticides diminished the population of honey bees especially due to the usage of Neonicotinoids (Imidacloprid) and also due to climatic changes. So, both biotic and abiotic factors led to decline in the population. As a result, due to decrease in bee population it shows a major negative impact on agricultural production (Grossman,2013). Hence Conserving bees without disturbing their original natural habitat is very essential (Murray *et al.,* 2009). Honey bee colony declines could threaten agricultural production and led to food insecurity based on yield data obtained from 60 crop systems in 5 continents (Asia, Europe, Africa, Australia and America) through 1983-2013 (Ghosh and Jung, 2016).

Diversity of honey bees is very crucial for stable plant pollination and yield. The Pollination deficits are main determinant of crop yield over diverse agronomic inputs, fossil fuel energies (Garibaldi *et al*., 2016)

Constraints: Asynchrony in season of flowering (Le Conte and Navajas,2008, Hegland *et al* 2009, Lever *et al*; 2014). One of the major constraints in honeybee population is Colony Collapse disorder. Colony Collapse disorder was discovered by Dr. Ernesto Guznan. It is synonymously known as Disappearing disease, Spring disease, Dwindle disease, May disease, Autumn collapse.

Major causes of Colony collapse disorder:

1. Use of Neo-nicotinoids
2. Poor Nutrition
3. Climatic change
4. Poor management practices
5. Electromagnetic radiations

Kumar V, 2020 conducted an experiment at Belgium with 2 boxes in which they used phones near to one box and without phone in another ones. Due to this phone tower radiations, bee population was drastically reduced.

Usage of Neonicotinoids: Beekeepers reported that damage caused to bees by Neonicotinoids resembled damage of Varroa mites, Virus instead of insecticide poisoning. Due to the damage, Beekeepers reduced the usage of neonicotinoids but losses continued due to usage of Fluvalinate to control Varroa mite in France.7.6 nanograms of Imidacloprid can kill 1 billion bees (Kranthi). At European Bee research Conference in 2004, paper related to hazards of Neonicotinoids was presented by Italian researchers.

Usage of Dimethoate: In United Kingdom & world it is commonly used which reduced the activity of bees.

Other chemicals: Fipronil which acts as toxic at 4 nano grams, Pyrethrins becomes toxic at 50-210 nano gram.

Management of Colony collapse disorder:

1. Use 15ml Polybion SF syrup
2. 75mg Oxytetracycline per colony (Vikas Chandra *et al.*, 2019)
3. Use safer and non-systemic insecticides
4. Maintain hygiene in the bee hives by daily cleaning and discarding the dead and diseased bees
5. Discard all collapsed colonies and don't combine with the healthier ones
6. Use all sterilized and clean equipments
7. Provide abundant bee flora so that they will get enough pollen and nectar

Conclusion:

Bee keepers are in ambiguity regarding the usage of Neonicotinoids as one hand environmentalists suggests usage of such chemicals is harmful but on other hand agronomists suggests that it is safer to use. Bee Connected Scheme, an online system it helps farmers to inform local beekeepers that they are spraying on their crops is to be welcomed. Hence not only bee keepers but also farmers should be trained regarding beekeeping practices in order to enhance their crop yields as well as to keep away harmful usage of chemicals which affects bee activity. Government should bring new innovative schemes, training programmes in order to bring beekeepers, farmers under one umbrella so that bee population is increased in coming years.

References

- AbushadyAZ, Bees and Spraying. Bee wild (1920)
- Carreck NL, Pesticides and honeybees. Br Beekeepers Ass News(2008)

- Carreck NL, Decline of bees and other pollinators in biological and environmental hazards, risks and disasters by Shroder JF and Sivanpillai, Elsevier, Chennai, India ,2016
- Martin SJ Acarides (Pyrethroid) in Varroa destructor. Bee Wild (2004)
- Neumann P and CarreckNL, Honey bee losses (2010)
- Thompson HN, Pesticides and Honeybees, Central Association of Beekeepers, Poole, Dorset, UK (2000)
- Atkins, E.L (1992) Injury to Honeybee poisoning in the hive and the honeybee, Illinois, Dadant and Sons Inc
- Kranthi, CICR, Nagpur
- Francis, R.L., Nielsen, S.L. and Kryger, P. (2013) Varroa -Virus interaction in the collapsing honeybee colonies
- Kumar. S. S (2018) Colony Collapse Disorder in the Honeybees caused by EMF radiation, Bioinformation

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DRONES IN AGRICULTURE

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ABSTRACT

Drone technology has gotten most of the recognition in the industry because of its diversity and considered the future for the agrarian community. The military initially used them. However, other sectors quickly embraced unmanned aerial vehicles (UAVs) because of its widespread applications. Drones don't merely enhance overall performance but also encourage farmers to solve other assorted barriers and receive plenty of benefits through precision agriculture. With the market for agricultural drones reaching a whopping $1.3 billion, UAVs (unmanned aerial vehicles) fill the gap of human error and inefficiency by traditional farming methods. The purpose of adopting drone technology is to exclude any guesswork or ambiguity and instead focus on accurate and reliable information.

Keywords: Drones, Agriculture, Practices, Benefits, Regulations

INTRODUCTION

External factors like weather, soil conditions, and temperature play a critical role in farming. Agriculture drone empowers the farmer to adapt to specific environments and make mindful choices accordingly. The gained data helps regulate crop health, crop treatment, crop scouting, irrigation, and carry out field soil analysis and crop damage assessments. The drone survey helps boost crop yields and minimize time and expenses.

Typically, drones include a navigation system, GPS, multiple sensors, high-quality cameras, programmable controllers, and tools for autonomous drones. The **DJI** is one such familiar drone utilized by the industry. Most farmers currently use satellite imagery as an introductory guide for farm management. Furnished with modern technology, unmanned aerial

vehicles (UAVs) can get more precise data than satellites for precision agriculture. They then process the data captured into agri-tech software to produce beneficial knowledge.

Capturing data from agriculture drone takes place as in the following stages

1. **Analyzing the area:** This identifies the territory being tested. Therefore, the first step includes establishing a boundary, analyses of the area, and then finally, uploading the technical GPS information into the drone's navigation system.
2. **Using Autonomous Drones:** Since unmanned aerial vehicles (UAVs) are independent, they enter flight patterns into their already established system to collect required data.
3. **Uploading the data:** After capturing all the required data through sensors such as the multispectral sensor/RGB sensor, it is processed through numerous software for further analysis and interpretation.
4. **Output:** After collecting the data, they format it so that farmers can understand the data with no hassle, bringing them a step closer to precision farming. 3D mapping or **Photogrammetry** are popular methods to display extensive data collected.

BEST DRONE PRACTICES

Drone technology quickly reestablishes traditional agrarian practices and is subsequently accomplishing them as follows

1. **Irrigation Monitoring:** Drones, including hyperspectral, thermal, or multispectral sensors, recognize areas that are too dry or need improvement by the farmer. Drone survey helps improve water efficiency and disclose potential pooling/leaks in irrigation by providing Irrigation monitoring yields calculations of the vegetation index to help realize the health of crops and emitted heat/energy.
2. **Crop Health Monitoring and Surveillance**: It is crucial to track the health of the vegetation and spot bacterial/fungal plagues in the early stages. Agriculture drones can see which plants reflect different amounts of green light and Near-infrared spectroscopy (NIRS) light. This data helps produce multispectral images to

track crop health. Quick monitoring and discoveries of any defects can help save crops. In circumstances of crop failure, the farmer can also document the damages for accurate insurance claims.

3. **Crop Damage Assessment**: Agricultural drones fitted along with multispectral sensors and RGB sensors also detect field areas inflicted by weeds, infections, and pests. According to this data, the exact amounts of chemicals needed to fight these infestations are known, and this helps diminish the costs inflicted by the farmer.
4. **Field Soil Analysis**: The drone survey allows farmers to obtain information about their land's soil conditions. Multispectral sensors allow seizing data useful for seed planting patterns, thorough field soil analysis, irrigation, and nitrogen-level management. Precise Photogrammetry/ 3D mapping permits farmers to analyze their soil conditions thoroughly.
5. **Planting:** Drone startups in India have invented drone-planting systems that allow drones to shoot pods, their seeds, and crucial nutrients into the soil. This technology doesn't only reduce costs by almost 85% but also increases consistency and efficiency.
6. **Agricultural spraying**: Through drone crop spraying, human contact with such harmful chemicals is limited. Agri-drones can carry out this task much quicker than vehicles/airplanes. Drones with RGB sensors and multispectral sensors can precisely identify and treat problematic areas. Professionals say that aerial spraying is five times faster with drones when compared to other methods.
7. **Livestock tracking:** The drone survey allows the farmers not to keep track of their crops only but also monitor the movements of their cattle. Thermal sensor technology helps find lost animals and detect an injury or sickness. Drones can carry out this function favorably, and this adds comprehensively to the production of vegetation.

BENEFITS OF DRONE TECHNOLOGY

As innovators introduce new technologies, their commercial uses increase day by day. The government has been easing restrictions for drone usage and is supporting startups to come up with novel ideas. As drone surveys become more common, they also become more cost-effective. In agriculture, they

have a plethora of advantages. Some are as follows:

1. **Enhanced Production** - The farmer can improve production capabilities through comprehensive irrigation planning, adequate monitoring of crop health, increased knowledge about soil health, and adaptation to environmental changes.
2. **Effective and Adaptive Techniques** - Drone usage results in regular updates to farmers about their crops and helps develop strengthened farming techniques. They can adapt to weather conditions and allocate resources without any wastage.
3. **Greater safety of farmers** - It is safer and more convenient for farmers to use drones to spray pesticides in terrains challenging to reach, infected areas, taller crops, and power lines. It also helps farmers prevent spraying the crops, which leads to less pollution and chemicals in the soil.
4. **10x faster data for quick decision making** - Drone surveys back farmers with accurate data processing that encourages them to make quick and mindful decisions without second-guessing, allowing farmers to save the time invested in crop scouting. Various sensors of the drone enable capturing and analyzing data from the entire field. The data can focus on problematic areas such as infected crops/unhealthy crops, different colored crops, moisture levels, etc. The drone can be fixed with several sensors for other crops, allowing a more accurate and diverse crop management system.
5. **Less wastage of resources** - Agri-drones enables optimum usage of all resources such as fertilizer, water, seeds, and pesticides.
6. **99% Accuracy rate** - The drone survey helps farmers calculate the precise land size, segment the various crops, and indulge in soil mapping.
7. **Useful for Insurance claims** - Farmers use the data captured through drones to claim crop insurance in case of any damages. They even calculate risks/losses associated with the land while being insured.
8. **Evidence for insurance companies** - Agricultural insurance sectors use Agri-drones for efficient and trustworthy data. They capture the damages that have occurred for the right estimation of monetary payback to the farmers.

DRONE REGULATIONS IN INDIA

- The Directorate General of Civil Aviation (DGCA) is the designated authority in India to regulate the use of drones in the country and they have released a set of drone regulations on 27th August 2018. (1)
- These regulations are targeted to formalize the productive use of drones for civilian applications both for scientific research and infrastructure planning in India in rural and urban sectors.
- In addition, the drones should have Equipment Type Approval (ETA) from the Wireless Planning and Coordination (WPC) Wing of Department of Telecommunications for operating in the de-licensed frequency band(s). In other words, all drones need to be approved to use radio frequencies!
- Urban and rural planning agencies in India can derive great benefits from low-cost commercial drones, but it's too onerous for them to ask permission for radio frequency usage. Such permissions should only need to be obtained by the merchants who should be obliged to sell products that comply with Indian law on radio frequency usage. This will go a long way to popularize the use of drones for various applications.
- Security clearance from Ministry of Home Affairs (MHA) would be required for (a) an individual citizen of India, and (b) an Indian company registered in India or elsewhere. The central and State Government institutions are not required to get MHA clearance.
- While this is an important step from a security concern, it requires effective implementation in terms of ease of obtaining security clearances. At this stage, there is very little clarity on the steps to be followed and the process is yet to be made operational possibly due to technical difficulties.
- Civilian drone operators will require an Unmanned aircraft Operator Permit (UAOP) equivalent to pilot's license, except for nano-drones operating below 15 m and microdrone operating below 60m in uncontrolled airspace/enclosed premises.

- Given the widespread use of microdrones, the exemption of microdrones from requiring UAOP would be useful. However, the limitation of 60m height is a little discouraging because most scientific operations fly at 100–120 meters.

CONCLUSION

Agricultural drone technology is undoubtedly the future of the Indian agrarian community. It can transform traditional farming methods in uncountable ways. Even though this technology is more complex to be familiar with, it will yield its results in no time once learned. Farmers must understand the entire process. Determination of goals, creating an equilibrium in the drone and software utilized, and being familiar with the principles of using such technology will stand as a challenge. The farmers will inevitably need comprehensive training or partnerships with third-party experts in the drone industry for the acquisition of reliable data. Drones have changed the course of obtaining data in almost every type of industry, and will only deem to become bigger and better in the coming years.

REFERENCES

- https://www.easa.europa.eu/sites/default/files/dfu/204696_EASA_concept_drone_brochure_web.pdf

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GREEN LEAF MANURES

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ABSTRACT

Green leaf manuring is the principal supplementary means of adding organic matter to the soil. The green-manure crop supplies organic matter as well as additional nitrogen, particularly if it is a legume crop, due to its ability to fix nitrogen from the air with the help of its root nodule bacteria.

Keywords: Soil fertility, green leaf manures

INTRODUCTION

Green manuring can be defined as a practice of ploughing or turning into the soil undecomposed green plant tissues for improving physical structure as well as soil fertility. Green manuring, wherever feasible, is the principal supplementary means of adding organic matter to the soil. The green-manure crop supplies organic matter as well as additional nitrogen, particularly if it is a legume crop, due to its ability to fix nitrogen from the air with the help of its root nodule bacteria. The green-manure crops also exercise a protective action against erosion and leaching. Green manure to be incorporated in soil before flowering stage because they are grown for their green leafy material, which is high in nutrients and protects the soil. Green manures will not break down in to the soil so quickly, but gradually, add some nutrients to the soil for the next crop. The nutritional potentials and nutritional contents of some important green manures are given in the Table 1 and 2 respectively.

Table 1: Nutrient potential of green manures

Green Manure	Biomass (tonnes)	N accumulation (Kg/ha)
Sesbania aculeate	22.50	145.00
S. rostrata	20.06	146.00
Crotalaria juncea	18.40	113.00

Tephrosia perpurea	6.80	6.00
Green gram	6.50	60.20
Black gram	5.12	51.20
Cow pea	7.12	63.30

Table 2: Nutrient content of important green manures

Crop	**Nutrient content (% on dry weight basis)**		
Green manure	**N**	**P**	**K**
Sesbania aculeata	3.3	0.7	1.3
Crotalaria juncea	2.6	0.6	2.0
Sesbania speciosa	2.7	0.5	2.2
Tephrosia purpurea	2.4	0.3	0.8
Phaseolus trilobus	2.1	0.5	
Green leaf manure			
Pongamia glabra	3.2	0.3	1.3
Gliricidia maculeata	2.9	0.5	2.8
Azadirachta indica	2.8	0.3	0.4
Calotropis giganteum	2.1	0.7	3.6

ADVANTAGES OF GREEN LEAF MANURES:

- Usage of green leaf manure is advantageous both for crops and soil. The advantages are:
- As they decompose rapidly, it is easy to retain the organic matter in the soil.
- Green manures improve both physical and chemical properties of the soil.
- They provide energy to microbes.
- They provide nutrients to the standing crop and also to the next crop.
- Addition of green manure crops to the soil, acts as much and prevent soil erosion.
- Leaching of nutrients in light soils can be prevented by addition of green manure.
- Cultivating green manure crops can control weeds.
- Majority of green manure crops being legumes, use of nitrogenous fertilizers can be minimized.

There are different green leaf manure crops that can be cultivated and they are:

1. COWPEA: Cowpea is one of the important leguminous green leaf manure crops. As this plant is easily decomposable and very well suited for green manure purpose. June-July months are best suited for sowing of this manure. Even though it is being cultivated in summer months (March to April). Use of effective Rhizobium bacteria increase the fixation of nitrogen up to 40 kg/ha.

2. DHAINCHA *(Sesbania aculeata):* Dhaincha is suitable for loamy and clayey soils. It is fairly resistant to drought as well as stagnation of water. It grows well even in alkaline soils and corrects alkalinity if grown repeatedly for 4-5 years. The roots have plenty of nodules. It yields about 10-15 tonnes of green manure per ha and requires a seed rate of 30-40 kg/ha. Use of effective Rhizobium strain with seeds fixes the Nitrogen 1 kg / day.

3. SESBANIA SPECIOSA: It is a valuable green manure for wetlands and can be grown in a wide range of soils. Seed production is prolific however, pods are frequently attacked by insects. This green manure can be raised on the field borders. Sesbania seedling (21days) can be planted in a single line at 5-10 cm apart in the borders of the fields. In about 90 days it produces about 2-4 tonnes of green manure per ha. It does not affect the rice yield by shading or root effect. If second rice crop is planted immediately after the first crop, the manure can be incorporated into the field. About 300-400g of seeds are sufficient to raise nursery and plant the seedlings around the boundary of one hectare. To control insects *Verticillium lecanii* (Liquid) fungi is useful.

4. SUNNHEMP *(Crotalaria juncea):* It is a quick growing green manure crop and gets ready for incorporation in about 45 days after sowing. It does not withstand heavy irrigation leading to flooding. The crop is at times subject to complete damage by leaf eating caterpillars. The crop can produce about 8-12 tonnes of green biomass per ha. The seed requirement is 30 kg/ha.

5. MANILA AGATHI *(Sesbania rostrata):* One of the important features of this green manure is that in addition to the root nodules, it produces nodules in the stem. The stem nodulation is an adaptation for waterlogged situation since flooding limits growth of green manures and may reduce root nodulation. Under normal condition, both root and stem nodules are effective in N fixation. It has higher N content of 3.56% on dry weight basis. Biomass production is higher during summer (April – June) than in winter (Dec. – Jan.)

season. This green manure can also be produced by raising seedlings (30 days old) and planted in the paddy field along the bunds or as intercrop with rice. Use of Rhizobium bacteria increase the nitrogen fixation about 60-100 kg/ha/year.

6. WILD INDIGO *(Tephrosia purpurea):* This is a slow growing green manure crop and cattle do not prefer to graze it. The green manure is suitable for light textured soils, particularly in single crop wetlands. It establishes itself as a self-sown crop and the seeds remain viable till the harvest of rice. On an average about 3-4 tonnes of green manure is obtained in one ha. The seed rate is 30 kg/ha. The seeds have a waxy impermeable seed coat and hence scarification is required to induce germination. Soaking seeds in boiling water for 2-3 minutes is also equally effective in promoting germination.

7. INDIGO (*Indigofera tinctoria)*: It resembles wild indigo and is a long duration crop with more leafy growth. It comes up well in clayey soils with one or two irrigations.

8. PILLIPESARA *(Phaseolus trilobus):* This is a dual-purpose crop yielding good fodder for the cattle and green manure. Pillipesera comes up well in hot season with sufficient soil moisture. Loamy or clayey soils are best suited. After taking one or two cuttings for fodder or light grazing by animals, the crop can be incorporated into the soil. About 5-8 tonnes of manure can be obtained from one ha.

9. GLYRICIDIA *(Gliricidia maculeata):* This is a shrubby plant that comes up well in moist situations. Under favourable conditions, it grows well like a tree. It can be easily grown in waste lands, farm road sides, field bunds, etc. The crop can be established by stem cuttings or seedlings planted in the field borders. It can be pruned for its tender loppings and compound leaves for green leaf manuring at the time of puddling rice. On an average, a well-established plant yields 12-15 kg green matter. About 400 plants on the peripheral bunds yields 5-6 tonnes green manure/ha.

10. KARANJ (*Pongamia glabra):* It is a leguminous tree grown in wastelands. On an average, a tree can yield 100-120kg of green matter. The leaves contain about 3.7% N (on dry weight basis).

11. CALATROPIS *(Calotropis gigantea)*: On roadsides and fallow lands, the plant grows wild under different soil and climatic conditions. The leaves are more succulent and a

plant can produce about 4-5 kg of green matter. Besides it also helps in controlling soil born pests like termite.

	
DHAINCHA	**MANILA AGATHI**
	
INDIGO	**WILD INDIGO**

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TRADITIONAL IMPORTANCE OF KODAMPULI (*Garcinia cambogia*)

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INTRODUCTION

In the west coast of South India, Garcinia cambogia is commonly known as "Malabar Tamarind". The fruit, which is 4 - 5cm in diameter is green in colour changes to yellow or red when ripe and resembles a small pumpkin. It has deep longitudinal grooves (6-8) and 6 to 8 seeds surrounded by a succulent aril. With exceeding sharp but pleasant acidity the fruit though edible, is eaten raw perhaps at meals, as an appetizer in the East lndies. Scientific data showed that hydroxy citric acid is the major constituent present in Garcinia cambogia. The seeds contain 30 - 31% edible saturated fat resembling kokam butter obtained from Garcinia *Indica.* The Garcinia fat is rich in oleic acid. Garcinia seed fat is used as cosmetic ingredient, since it has a good emollient feeling.

TRADITIONAL PROCESSING OF THE FRUIT

Usually, the ripe fruit is halved or sectioned and spread in thin layers, dried in the sun for three to seven days to moisture level of about 15 to 20 percent and smoked. Commercially available rind is loaded with considerable amounts of common salt,

which is added during drying. In Sri Lanka, the thick rind was cut into sections, dried in the sun and preserved for future use. This dried material along with salt is used for curing.

TOXICOLOGY OF HCA

The dried rind of Garcinia cambogia fruits has been used for centuries in Southern India as a condiment for flavouring curries in place of tamarind or lime and as a food preservative. Having a long history of traditional use as preservative and flavouring material, Garcinia cambogia and its extracts have proved as safe for human consumption. Neither acute nor chronic toxicity is reported with regular consumption of Garcinia products as food or as dietary supplement.

CONSTITUENTS AND ACTIVE INGREDIENTS

The active ingredients of Garcinia cambogia fruit are identified as (-) hydroxy citric acid (HCA) which provides characteristic acidic taste. Chemically HCA is very similar to the citric acid found in orange and other citrus fruits. HCA is 1,2 di-hydroxy propane **1, 2, 3 t**ri -carboxylic acid. The sour taste of the fruit is mainly due to this compound. HCA is very unstable and usually exists as its lactone. Apart from this organic acid the dried fruit contains very low percentage of some other organic acids like citric acid, proteins, crude fibre, pectins, reducing sugars, carbohydrates and plant pigments like anthocyanins. The commercial grade dried fruits usually contain 20 - 25% moisture.

TRADITIONAL APPLICATION OF GARCINIA CAMBOGIA FRUIT

The fruit rind and extracts of Garcinia species are used in many traditional recipes especially for fish curries. In the Indian Ayurvedic system these types of fruits having sour taste are said to promote digestion. Various species of Garcinia are used in food preparation in Thailand, Malaysia, Burma and other southeast Asian countries. The "Colombo curing" is a method of fish preservation in which the anti-bacterial properties of the Garcinia fruit are considered wealth of India. Apart from these uses in food preparations and preservation, the fruit juice possesses anti-scorbutic, anthelmintic and cardiotonic properties. Hence it finds application in the treatment of piles, dysentery, tumors, pains and heart complaints. The decoction of the fruit rind is given in rheumatism and bowel complaints. It is also employed in veterinary medicine as

a rinse for diseases of the mouth in cattle. The dried rind is also used for polishing gold and silver and as a substitute for acetic and formic acids in the coagulation of rubber latex. The yellow resin obtained from the fruit is soluble in turpentine and used as varnish.

MODERN APPLICATION OF GARCINIA CAMBOGIA FRUIT

Apart from the traditional uses of Garcinia cambogia, it finds a wide value of applications in "Nutraceutical" field. Nutraceutical is the word used for any nutritional I herbal product which is marketed as OTC (Over the counter sale) products. The major market is in US, followed by Japan and Europe. *Garcinia cambogia* is a revolutionary component in nutraceutical dietary supplement areas as a source of Hydroxy citric acid (HCA), which is known as a weight reducing agent. In addition to tablets and capsules, it is marketed as biscuits, chewing gum, snack bar etc. Water-soluble HCA is available as soft drinks and beverages. The modern applications are based on the fact that in the body carbohydrates of the food are broken down into glucose which is stored as glycogen. When glycogen storage is saturated, excess glucose is converted into fat and cholesterol. Garcinia cambogia extract inhibit body's conversion of glucose into fat and cholesterol by inhibiting certain enzyme process. The increase in glycogen stores, help significantly reduce cravings for food, reduce appetite and induce weight loss.

CONCLUSION

The nutraceutical industry is flourishing, and interest in establishing scientific credibility has attained importance for many companies and scientists. In the recent years, more clinical trials had been conducted to elucidate the functional effects of *Garcinia*/HCA supplementation on promoting human health. However, definitive conclusions that *Garcinia*/HCA supplements are efficient tools against various health problems especially obesity remain to be proven in larger-scale and longer-term clinical trials, despite substantial public interest in such supplements. In addition, awareness of the safety and efficacy of the weight management supplements available in the market should be raised among health care providers in order to assist their patients in analyzing the risks and benefits of the dietary supplements. Thus, scientific investigations on the potential health promoting effects of herbal

preparations as diet supplement are prerequisites for new discoveries of alternative therapies.

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MEDICAL MIRACLE OF *ALOE VERA*

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INTRODUCTION

Aloe vera has a long history of popular and traditional use. It is used in traditional Indian medicine for constipation, colic, skin diseases, worm infestation, and infections. In Chinese medicine, it is often recommended in the treatment of fungal diseases. The genus Aloe belonging to family Alliaceae is a succulent herb of 80 - 100 cm in height which matures in 4 - 6 years and survives for nearly 50 years under favorable conditions. *Aloe vera. Aloe barbadensis* is most biologically active among 400 species. According to World Health Organization, medicinal plants would be the best source for obtaining a variety of drugs. *Aloe vera* has been used externally to treat various skin conditions such as cuts, burns and eczema. It is alleged that sap from *Aloe vera* eases pain and reduces inflammation. It has antiseptic and antibiotic properties which make it highly valuable in treating cuts and abrasions. Aloe has been marketed as a remedy for coughs, wounds, ulcers, gastritis, diabetes, cancer, headaches, arthritis, immune-system deficiencies and many other conditions when taken internally. However, the general internal use is as a laxative. In Western society, *Aloe vera* is one of the few herbal medicines in common usage, and it has found widespread use in the cosmetic, pharmaceutical, and food industries.

CHEMICAL CONSTITUENTS

Aloe contains two classes of Aloins: (1) nataloins, which yield picric and oxalic acids with nitric acid, and do not give a red coloration with nitric acid; and (2) barbaloins, which yield aloetic acid ($C_7H_2N_3O_5$), chrysammic

acid (C7H2N2O6), picric and oxalic acids with nitric acid, being reddened by the acid. This second group may be divided into a-barbaloins, obtained from Barbados aloes, and reddened in the cold, and b-barbaloins, obtained from Socotrine and Zanzibar Aloes, reddened by ordinary nitric acid only when warmed or by fuming acid in the cold. Nataloin forms bright yellow scales. Barbaloin forms yellow prismatic crystals.

Constituents	Number and Identification	Properties and Activity
Amino acids	Provides 20 of the 22 required amino acids and 7 of the 8 essential ones	Basic building blocks of proteins in the body and muscle tissues
Anthraquinones	Provides Aloe emodin, Aloetic acid, alovin, anthracine	Analgesic, antibacterial
Enzymes	Anthranol, barbaloin, chrysophanic acid, smodin, ethereal oil, ester of cinnamonic acid, isobarbaloin, resistannol	Antifungal and antiviral activity but toxic at high concentrations
Hormones	Auxins and gibberellins	Wound healing and anti-inflammatory
Minerals	Calcium, chromium, copper, iron, manganese, potassium, sodium and zinc	Essential for good health
Salicylic acid	Aspirin like compounds	Analgesic
Saponins	Glycosides	Cleansing and antiseptic
Steroids	Cholesterol, campesterol, lupeol, sistosterol	Anti-inflammatory agents, lupeol has Antiseptic and analgesic properties
Sugars	Monosaccharides: Glucose and Fructose Polysaccharides: Glucomannan/polymannose	Anti-viral, immune modulating activity of Acemannan.
Vitamins	A, B, C, E, choline, B12, folic acid	Antioxidant (A, C, E), neutralises free radicals.

HEALTH BENEFITS

HELPS DIGESTION

Drinking Aloe vera juice naturally allows the body to cleanse the digestive system. It encourages the bowels to move and helps with elimination if a person is constipated. And if you have diarrhoea, it will help slow it down.

INCREASES ENERGY LEVELS

Our diets include many substances which can cause fatigue and exhaustion. Taken regularly, *Aloe vera* juice ensures a greater feeling of well-being, allowing energy levels to increase and also helps maintain a healthy body weight.

BUILDS IMMUNITY

It is especially great for those who have chronic immune disorders like polysaccharides or fibromyalgia since the polysaccharides in *Aloe vera* juice stimulate macrophages, the white blood cells that fight viruses.

DETOXIFIES

Aloe vera juice is a great natural aid to detox. With our stressful lives, the pollution around us and the junk foods we eat, we all need to cleanse our systems from time to time. Drinking *Aloe vera juice* provides a fantastically rich cocktail of vitamins, minerals and trace elements to help our bodies deal with these stresses and strains every day. 5.5 Reduces inflammation: It improves joint flexibility and helps in the regeneration of body cells. It strengthens joint muscles, which therefore reduces pain and inflammation in weakened or aged joints.

Other Benefits of Aloe Vera

- Repairs "sludge blood" and reverses "sticky blood". - Boosts the oxygenation of your blood. - Protects the body from oxidative stress.
- Alkalizes the body, helping to balance overly acidic dietary habits. - Nourishes the body with minerals, vitamins, enzymes and glyconutrients.
- Replaces dozens of first aid products, makes bandages and antibacterial sprays obsolete.
- Prevents and treats Candida infections.
- Functions as nature's own "sports drink" for electrolyte balance, making common sports drinks obsolete.
- Boosts cardiovascular performance and physical endurance.

- Speeds recovery from injury or physical exertion. - Prevents kidney stones and protects the body from oxalates in coffee and tea. - Hydrates the skin, accelerates skin repair.

CONCLUSION

The active ingredients hidden in its succulent leaves have the power to soothe human life and health in a myriad way. The plant has importance in everyday life to soothe a variety of skin ailments such as mild cuts, antidote for insect stings, bruises, poison ivy and eczema along with skin moisturizing and anti ageing, digestive tract health, blood and lymphatic circulation and functioning of kidney, liver and gall bladder makes it a boon to human kind. *Aloe vera* as the "wonder plant" is multiple from being an antiseptic, anti-inflammatory agent, helps in relieving like cancer and diabetes, and being a cosmetic field. The plant is in need to a greater research emphasis for better utilization of this plant for humankind. *Aloe vera* is undoubtedly, the nature's gift to humanity for cosmetic, burn and medicinal application and it remains for us to introduce it to ourselves and thank the nature for its never-ending gift.

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MOISTURE STRESS – A CRITICAL DYNAMIC FACTOR FOR PULSES

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Introduction

Water is essential for agricultural production and food security. It is the lifeblood of ecosystems, including forests, lakes and wetlands, on which our present and future food and nutritional security depends. Water contained in soil is called soil moisture. Soil water is the major component of the soil in relation to plant growth. Soil moisture is the most restricting element in dry cultivating and dry land farming situations. Plants absorb water to normal function like nutrient absorption, transpiration, metabolic activities leading to growth, development and yield.

Water scarcity

Yet, our freshwater resources are dwindling at an alarming rate. Growing water scarcity is now one of the leading challenges for sustainable development. This challenge will become more pressing as the world's population continues to grow, their living standards increase, diets change and the effects of climate change intensify. Water shortage is the major problem in arid and semi-arid regions. In these regions moisture stress represents the most important factor that affecting plants.

Major causes of water shortage

- Climate change.
- Natural calamities such as droughts and floods.
- Increased human consumption.
- Overuse and wastage of water.
- A global rise in freshwater demand.
- Overuse of aquifers and its consequent slow recharge.

Moisture stress in plants and their effect in crop growth

Moisture stress is a form of abiotic stress that occurs when the moisture of plant tissues is reduced to suboptimal levels. Water stress occurs in response to atmospheric and soil

water availability when the transpiration rate exceeds the rate of water uptake by the roots and cells lose turgor pressure. Stress is due to higher transpiration and less absorption. Moisture stress affects all aspect of plant growth. It affects water relation in plants, photosynthesis, respiration, metabolic reactions, hormonal reactions. nutrition, growth, development and yield.

Moisture stress is one of the most important elements influencing plant growth, development, and yield profitability, posing a substantial threat to sustainable agriculture. Water stress affects, particularly every aspect of plant growth: modifying anatomy, morphology, physiology and biochemistry. Some of the adverse effects of deficit soil moisture stress on plant growth, development and yield are:

- Loss of turgidity leading to cell enlargement and stunted growth
- Decrease in photosynthesis due to decreased diffusion of CO2 with the closure of stomata to conserve water and reduced leaf area.
- Increase in respiration resulting in decreased assimilation of photosynthates
- Breakdown of RNA, DNA and proteins
- Inhibition of synthesis and translocation of growth regulators
- Hydrolysis of carbohydrates and proteins leading to increase in soluble sugars and nitrogen compounds
- Affects germination, cell expansion, cell division, growth of leaves, stems, fruits and root development. The duration of crop in general is increased when the stress occurs before flowering and decreased when occurs after flowering.
- The degree and duration of moisture stress at these stages finally dictates the economic yield. The dry matter, number of fruits and individual grain weight are affected.
- Delaying the first irrigation for some days after germination in order to impose some amount of water stress encourages deeper penetration of roots that enables the crops to explore water from deeper layers of soil and withstand drought conditions better.

Moisture stress in pulses

Pulses are an important commodity group of crops that provide high quality protein complementing cereal proteins for pre-dominantly substantial vegetarian population of the country. Pulses are mostly grown with rainfed conditions in marginal to sub-marginal lands where irrigation facilities are inadequate. These include chickpea, groundnut, lentil, mungbean, urd bean, faba bean, lathyrus, peas etc. Pulses are predominantly grown under resource poor and harsh environments frequently prone to drought and other biotic and abiotic stresses. In addition, pulses also play an important role in improving soil health, long term fertility and sustainability of the cropping systems. It meets up to 80% of its nitrogen fixation from air and leaves behind substantial amount of residual nitrogen and organic matter for subsequent crops. These pulse crops give low seed yield mainly due to poor management practices.

N fixation

Biological nitrogen fixation is one of the most important sources of nitrogen in the production of leguminous crops. A symbiotic relationship between rhizobia and legume plants can provide large quantities of N to the plant. Kimura *et al*. (2004) estimated contributions of N from N2 fixation to range from 24 to 50% in field grown beans at different growth stages. The factors which can determine the amount of N2 produced from legumes are the type of species of legume grown, the percentage of N2 in the plant tissue and total biomass produced, hence, environmental circumstances that bound legume growth, such as moisture stress can reduce the amount of N2 produced (Hirel *et al.,* 2011). Marginal lands with low rainfall are among most problematic environments for rhizobia. The modification of rhizobial cells by water stress will eventually lead to a reduction in infection and nodulation of legumes. The rate of inhibition of the symbiosis depends on the stage of growth and development, as well as the severity of the stress (Williams and De Mallorca, 1984).

During dry spells, there is a decrease in populations of rhizobia which can be associated with poor nodulation of legumes, resulting in low levels of N2 fixation and ultimately low yields (Mohammadi *et al.,* 2012). Moisture stress, which results from periodic dry spells during the growing

season, is among the limiting factors for common bean production worldwide. It influences symbiotic interactions by inhibiting growth, survival and metabolic activity of nitrogen fixing bacteria and ultimately growth of plants (Werner and Newton, 2005). Periods of water stress during the reproductive phase have been reported to be associated with significant reductions in nodulation and subsequently grain yields (Emam and Seghatoleslam, 2005).

The factors that influence growth, survival and metabolic activity of nitrogen fixing bacteria and plants and their ability to forge efficient symbiotic interactions include low pH, nutrient availability, temperature and low moisture status (Werner and Newton, 2005). Kalima (2013) reported that the severity of effects of water stress depend on many factors, such as stage of development of the plant, duration and degree of stress. The influence of soil water activity on plant growth and hence nodulation in relation to growing stages should be taken into consideration especially in this era of climate change where many areas are becoming drier. The stage of the crop growth during which drought occurs can result in profound effects on nodulation and nitrogen fixation.

Therefore, moisture stress levels no matter of the degree of its severity has the capacity to affect/reduce nodulation, nitrogen fixation, root and shoot biomass and finally yield at different growing stages. This indicate that when stress is imposed at a late stage of plant development, the effect is low because the plants are already well developed and they can modify themselves to cope with stress compared to the case when stress is imposed at early stages. Hence, for maximum nodulation and nitrogen fixation to be achieved, moisture stress must be avoided at the early growing stages. Since the period of nodulation is short, timing for planting is of great importance to escape dry periods at these early stages, otherwise irrigation scheduling should be undertaken to favour these growth stages.

References

- Mohammadi, K., Sohrabi, Y., Heidari, G., Khalesro, S., & Majidi, M. (2012). Effective factors on biological nitrogen fixation. African Journal of Agricultural Research, 7(12), 17 1788.
- Kimura, D. S., Schmidtke, K., Tajima, R., Yoshida, K., Nakashima, H., &Rauber, R. (2004). Seasonal N uptake and N fixation by common and adzuki bean at various spacing. Plant Soil, 258, 91-101.

- Hirel, B., Tétu, T., Lea, P. J., & Dubois, F. (2011). Improving Nitrogen Use Efficiency in Crops for Sustainable Agriculture. Sustainability, 3, 1452-1485.
- Williams, P. M. & De Mallorca, M. S. (1984). Effect of osmotically induced leaf moisture stress on nodulation and nitrogenase activity of Glycine max. Plant Soil, 80, 267-283.
- Werner, D., & Newton, W. E. (2005). Nitrogen fixation in agriculture, forestry, ecology and environment. Springer, Netherlands pp. 255-276.
- Emam, Y., &Seghatoleslami, M. J. (2005). Crop yield: Physiology and processes. First edition. Shiraz University Inc., Shiraz. pp. 593.
- Kalima, S. P. (2013). Physiological responses of common bean (Phaseolus vulgaris L.) genotypes to water stress. A thesis for Award of MSc. Degree at University of Zambia, Lusaka, Zambia, pp. 74.

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PEST - PREVENTION AND CONTROL

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Introduction

The word 'Pest' conjures up, for many people, a vision of hordes of greenfly on roses or black fly on broad beans. The vision is quite justified because both are pests and both tend to infest on an epidemic scale. Agriculturists and horticulturists view any organism that interferes with crops as pest - whether it be a virus or a predatory animal.

Ubiquitous Slug Snail

The leaves aside the viruses (fungi and bacteria) and the animals like rabbits and moles and concentrates on insects and insects - like pests, including also slugs and snails and nematodes.

Cabbage White Caterpillar

Insects are the largest group of creatures on earth. In evolutionary terms they are highly successful, and have proved to be man's fiercest competitors. Historically, insects have caused more details to mankind than all wars put together.

Cabbage White Butterfly

Insects will attack most plants, whether they live in the garden, the house or the greenhouse. Like all illnesses and disorders, prevention is better than cure and the best way to reduce your losses is to ensure that your plants are healthy when planted and then well cared for.

Many physiological disorders of plants (caused, for instance, by too little water or too much nitrogen fertilizer)

pave the way for attack by pests. So as soon as you notice any signs of distress or damage act promptly.

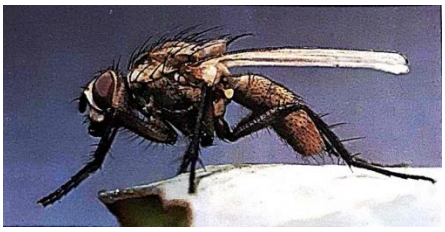
Aphid

Knowing what to look for

The pest itself may be almost invisible. Eelworms, for instance are difficult to see under a microscope. But their size bears no relation to the damage they can do. Even visible pests may not always be sitting in full view. You may have to dig underground and study the roots to determine the cause of the trouble, or wait for night to catch such creatures as slugs.

Cabbage Root Fly Larvae

Pests which attack leaves and flowers are the most easily identified because the damage occurs rapidly and is usually quite recognizable. Two main groups of pest attack leaves: those which have biting mouthparts (beetles) and those with sucking mouthparts (greenfly). They may hide inside or outside the leaves or like the notorious leaf miner, burrow between the middle layers of leaf tissue.



Onion fly - *Delia antiqua*

Larger pests (cater pillars) are usually more noticeable but they may attack and run (fly) away, in which case you should spray or lay bait, against the next visit.

Fortunately, there are many methods of control at your fingertips, providing you diagnose the enemy correctly and act as swiftly as you can.

Understanding the Enemy

Knowing something about the life cycles and habits of pests can help you in anticipating and preventing trouble. For instance, a major factor in determining how active they are is temperature; the warmer it becomes the busier they get. And up to 35^{o}c they breed faster too. Cold winters greatly decrease the numbers overwintering in the garden.

Red Spider Mite

Day length also plays a part in controlling the breeding seasons and migration pattern of many insects. This is why they always become scarce in autumn, even before cold weather arrives.

Clear away and burn garden refuse every autumn because it provides ideal shelter for overwintering pests. Many overwinter as eggs which can also be destroyed by the use of insecticides.

Use of Insecticides

Most pesticides are sold under trade names, partly because the chemical names and formulae are cumbersome and difficult to remember. You can, however, be sure of getting the right product by reading the contents on the label and checking with the chemical, or proper, name given here. Full chemical names are often abbreviated.

Always use protective clothing. Rubber gloves are important and be sure always to wash hands and face thoroughly after using insecticides. Never allow children or animals to be with you when sprays are being applied, and don't let them eat anything that has just been sprayed. Also wash out all spraying equipment after use but not in the kitchen sink.

In some cases, you may be able to use physical methods of combat such as picking caterpillars off plants and burning them. These are always preferable to spraying, because all sprays have some adverse effect on the plant. This is why you must adhere strictly to the manufacturer's recommended rate of application.

How Insecticides Work

Insecticides kill in two main ways; first as a stomach poison, when the pest either eats its with the leaf or sucks it up with the plant sap. Alternatively, if the pest is sprayed directly, the chemical will poison through the 'skin' or suffocate the pest. The method you choose depends on several factors, such as climate, type of insect and type of plant involved.

Non-systemic (Knock-down) Insecticides

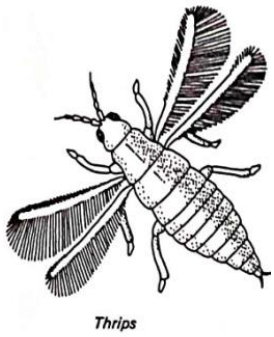
Many early insecticides killed either by blocking the breathing processes or by poisoning when

absorbed through other exterior surfaces. But they did not persist for long and had to be used frequently in order to be effective. However, some are still very useful for certain purposes.

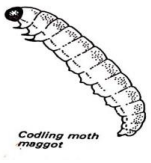
Systemic Insecticides

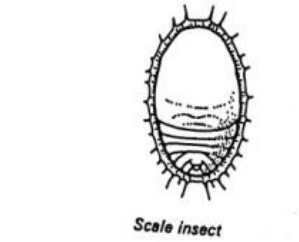
The systemic are absorbed by the plant and dispersed throughout its entire system; any biting or sucking insect will ingest them while feeding and be killed. These pest killers remain in the plant for several days (sometimes even weeks) and they act against a wide variety of pests.

But too often spraying can result in the development of pests that are resistant to them. So spray on sighting the enemy rather 'just in case'. Systemic insecticides that control most aphids, red spider mite, scale insect, mealy bug, caterpillar and leaf hoppers. Systemic insecticides are also one of the most successful ways of killing many of the root feeding insects.

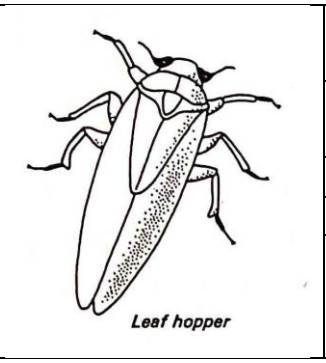
VEGETABLE GARDEN PEST			
Place	**Common Pest**	**Plant Area**	**Other Advice**
Vegetable Garden  *Thrips*	Caterpillars	Leaves	Pick caterpillars off where possible
	Cutworm	Roots, Stems	Prevention is better than cure
	Slug Snails	Leaves Stem	These pests usually attack at night
	Pea/bean Weevil Grubs Thrips	Leaves Pods Peas	Apply appropriate insecticides when first flowers open and again 2 weeks later
	Flea Beetle	Leaves	Keep seedlings covered with dust until true leaves appear
	Aphids	Leaves Shoots	Watch for a reinfestation
	Whitefly	Leaves	Spray systemic insecticides
	Cabbage Root Fly Carrot Fly	Roots	Keep seedlings covered with dust until true leaves appear

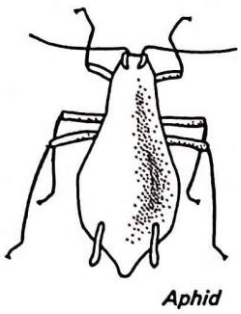
FRUIT GARDEN PEST			
Place	**Common Pest**	**Plant Area**	**Other Advice**
Fruit Garden	Caterpillar	Leaves	Pick caterpillars off where possible
	Aphids	Leaves Shoot	Watch for a reinfestation
	Woolly Aphids	Stems	Systemic insecticides can be used, but

			at least 21 days before harvesting
	Maggots	Fruits	Spray twice, in mid and late summer, as prevention
	Gooseberry Sawfly	Leaves	Attack usually occurs in early summer
	Capsid Bug	Leaves fruit	Prompt action is essential
	Red Spider Mite	Leaves	Spray systemic insecticides 21 days before picking

FLOWER GARDEN PEST			
Place	**Common pest**	**Plant area**	**Other advice**
Flower garden  	Caterpillar	Flowers	Pick caterpillars off by hand
	Leaf Miner	Leaves	Pick off and burn badly infected leaves
	Frog Hopper (Cuckoo spit)	Leaves Stem	Can be washed off with spray of soapy water
	Slug Snails	Leaves Stem	These pests are most active at night
	Thrips	Flowers	Prompt action is important
	Red Spider Mite	Leaves	Pick off and burn badly infected leaves
	Aphids Whitefly	Leaves Stems Flower	Spray systemic insecticides
	Scale Insect	Leaves Stems	Scrape off insects where possible
	Earwigs	Flowers	Place inverted, straw filled flower pot traps on 1m canes near plants; burn resulting earwig nests
	Capsid Bug	Leaves Stems Flower	Prompt action is essential

GREEN HOUSE PLANTS			
Place	**Common Pest**	**Plant Area**	**Other Advice**
Green house plants	Aphids Whitefly	Leaves Stems Flowers	Make sure all vents are closed while fumigating. Do not enter until fumes have dispersed
	Scale insects	Leaves	Scrape insects off where possible

 Leaf hopper	Red spider mite	Leaves	Pick off and burn badly infected leaves
	Mealy bug	Leaves Stem	Scrape insects off where possible
	Leaf hopper	Leaves	Spray systemic insecticides
	Leaf miner	Leaves	Pick and burn infected leaves
	Vine weevil	Roots	Incorporate naphthalene among the crocks when known susceptible plants are repotted

HOUSE PLANTS			
Place	**Common pest**	**Plant area**	**Other advice**
House plants  Aphid	Aphides Whitefly	Leaves Stems Flowers	Check all newly acquired potted plants and eradicate any pests to prevent them spreading among your existing plants
	Mealy bug	Leaves Stems	Scrape insects off where possible
	Scale insect	Leaves	Place your house plants in the green house when you fumigate and do both jobs at once
	Leaf hopper	Leaves	Spray systemic insecticides
	Leaf miner	Leaves	Pick off and burn badly infected leaves
	Vine weevil	Roots	Spray systemic insecticides

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PULSES – A HEALTHY NUTRITION

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Introduction

India needs around 32 million tons of pulses by 2030, to feed the estimated population of about 1.68 billion. Global supply of pulses is limited, as India happens to be the largest producer and consumer of pulses. Hence, India needs to produce the required quantity, but also remain competitive to protect indigenous pulses production. Improved technologies (improved, high yielding varieties and appropriate crop management practices) are available. However, a concerted effort by farmers, researchers, development agencies, and government are needed to ensure that India becomes self-sufficient in pulses in the next 5-10 years. The recent efforts and programs initiated by the government are bearing fruits, and it is hoped that this momentum is sustained and strengthened to make India self-sufficient in pulses.

The Role of Health Organizations in Promoting Pulse Consumption

"Pulses are seen as a staple food because they are nutritious and provide most of the ingredients that help to improve health. This could encourage more consumers who are concerned about their health to consider eating pulses more frequently."

We all know that eating pulses is good for our better health, but how do we get that message? It is the role of health organizations to advise the best nutritional path in order to prevent and alleviate chronic disease. Vegetarianism is one such path where organizations such as the Vegetarian Society UK and the Vegetarian Resource Group "promote vegetarianism as a good option for remaining healthy and avoiding metabolic diseases." They usually refer to the American Dietetic Association in learning how to approach a meat-free diet that relies on pulse

foods, grains, fruits and vegetables and nuts and seeds. Other organizations involved with cancer, diabetes, heart disease, and obesity also promote plant-based diets that utilize pulses in order to provide protein and other nutrients as well as fiber for good nutrition and a feeling of satiety.

Pulses and Nutrition

Pulses are part of a healthy, balanced diet and have been shown to have an important role in preventing illnesses such as cancer, diabetes and heart disease. Pulses are a low-fat source of protein, with a high fibre content and low glycemic index. Pulses are very high in fibre, containing both soluble and insoluble fibres. Soluble fibre helps to decrease blood cholesterol levels and control blood sugar levels, and insoluble fibre helps with digestion and regularity. Pulses provide important amounts of vitamins and mineral. Some of the key minerals in pulses include: iron, potassium, magnesium and zinc. Pulses are also particularly abundant in B vitamins; including folate, thiamin and niacin.

Pulses typically contain about twice the amount of protein found in whole grain cereals like wheat, oats, barley and rice, and in most developing countries constitute the main source of protein for most populations. In addition to contributing to a healthy, balanced diet, pulses nutritional qualities make them particularly helpful in the fight against some non-communicable diseases. The World Health Organization estimates that up to 80% of heart disease, stroke, and type 2 diabetes and over a third of cancers could be prevented by eliminating risk factors, such as unhealthy diets and promoting better eating habits, of which pulses are an essential component. Pulses can help lower blood cholesterol and attenuate blood glucose, which is a key factors in against diabetes and cardiovascular disease. Eating pulses as a replacement to some animal protein also helps limit the intake of saturated fats and increases the intake of fibres.

Pulses have also been shown to be helpful in the prevention of certain cancers, because of their fibre content but also because of their mineral and amino-acid contents, in particular folate. Pulses are included in all ‘food baskets’ and dietary guidelines. The World Food Programme (WFP) for instance includes 60 grams of pulses in its typical food basket, alongside cereals, oils and sugar and salt. Encouraging awareness of the

nutritional value of pulses can help consumers adopt healthier diets.

In developing countries, where the trend in dietary choices tends to go towards more animal-based protein and cereals, retaining pulses is an important way to ensure diets remain balanced and to avoid the increase in non-communicable disease often associated with diet transitions and rising incomes.

Nutritional Parameters

Protein: Protein content in pulse seeds varies from 18 – 32%. The proteins are located in the cotyledons and the embryonic axis of beans with only a small amount being present in seed coat. There is a wide variability in seed protein of all cultivated species of pulses. The cultivars, growing season, soil and climatic conditions and management practices considerably influence protein content. In general, pulse proteins exhibited a wide range of variation in their essential amino acids. Pulse protein are deficient in sulphur containing amino acids (especially methionine) and tryptophan, but are rich in lysine. Environmental factors under which the pulse crop is grown influence their amino acid composition. Application of phosphorus, molybdenum and nitrogen influence the level of methionine. Most of the pulses have low biological value and it ranges from 32 – 78% and there is large variation within varieties of same species. The low biological value is attributed to the relatively low concentration of sulphur amino acids. Addition of even a very low concentration of methionine and tryptophan increases the protein efficiency ratio (PER) of pulses. Pulse seed protein, in general, has poor digestibility. However, mungbean is an excellent source of protein with higher digestibility. The nutritive value and protein digestibility of raw pulses are very poor unless subjected to cooking or some other form of heat treatment.

Carbohydrates: Total carbohydrate of pulses ranges between 53.3 and 68.0%. These include total sugars (mono and oligosaccharides), starch and other polysaccharides. Total sugars represent only a small percent of total carbohydrates. Among the sugars, oligosaccharides of the raffinose family (raffinose, stachyose, verbascose and ajugose) predominate in most pulses and account for a significant value (31.0 % to 76.0%) of the total soluble sugars. The oligosaccharides of the raffinose family of sugars from beans cause

flatulence in human beings. Accumulation of flatus in the intestinal tract results in discomfort, abdominal rumblings, cramps, pain, diarrhea etc. The starch content of pulses varies from 31.5 to 53.6 per cent. Amylose constitutes a significant portion of the starch. Amylose and amylopectin are responsible for the structural form of starch granules. Crude fiber consists of cellulose, hemicellulose, lignin, pectic and cutin substances. Pulses contain appreciable amount of crude fibre (1.2 – 13.5%). Carbohydrate digestibility has been reported to vary among pulses. Several process *viz.*, boiling, roasting, germination etc. increases the carbohydrate digestibility.

Lipids: Total lipid content in pulses varies from 1.0 to 5.0%, depending up on variety, location, climate, environmental condition and type of soil on which they are grown. However, with few exceptions, most of the pulses are low in total lipid content. These lipids are comprised of several classes *e.g.,* neutral lipids, phospholipids and glycolipids. Neutral lipids are the predominant class of lipids in most of the pulses. Neutral lipids primarily consist of tri-acyl glycerol accompanied by smaller proportion of di- and mono-acyl glycerol, free fatty acids, sterols and sterol esters. Fatty acids are the main components of neutral lipids, phospholipids and glycolipids. The main fatty acids of pulses are palmitic, oleic, linoleic and linolenic, which are present in varying proportion. The fatty acids are important from nutrition point of view. The unsaturated fatty acids are used for esterification of cholesterol and subsequently reduce cholesterol content in the serum and liver. Chickpea, pigeonpea, mungbean and urd bean have been shown to lower cholesterol level in serum, liver and heart. This has been attributed due to a high content of polyunsaturated fatty acids such as linoleic and linolenic acids in pulses.

Minerals: Pulses are good source of minerals such as calcium, phosphorus, iron, copper, zinc, potassium and magnesium. Potassium contributes 25 to 30% to the total mineral content in pulses. It can be utilized beneficially in the diets of people who take diuretics to control hypertension and who suffer from excessive excretion of potassium through body fluids. Pulses are considerably rich in calcium as compared to most of the cereals. Pulses are moderately good source of iron, containing on an average 5 to 9 mg/100

g of seeds. They also contain significant amount of phosphorus. This is largely present as phytic acid. Chickpea and sprouted mungbean are good source of iron.

Vitamins: Pulses are good source of thiamin, riboflavin and niacin. Most of the pulses contain only small amount of carotene. The thiamin content of pulses is approximately equivalent to or slightly exceeds that of cereals. The non-decorticated pulses contain vitamin E than whole grain. Pulses are good source of folic acid also.

References

- Lambrides, C.J., Lawn, R.J. Godwin, I.D., Manners, J. and Imrie, B.C., 2000. Two genetic linkage maps of mungbean using RFLP and RAPD markers. *Australian Journal of Agricultural Sciences* 51: 415-425.
- Muntz, K., Christav, V. Sallbach, G. Sallbach, I, Waddel, D, Pickardt, T. Schieder, O. and Wustenhagen, O. 1988. Genetic engineering for high methionine grain legumes. Nahrung Food 42: 125 – 127. Edited by Masood Ali & Shiv kumar, IIPR, Kanpur.
- Paterson, A.H., Lander, E.S., Hewitt, J.D., Paterson, S. Lincolin, S.E. and Tanksley, S.D. 1988. Resolution of quantitative traits into Mendelian factors by using a complete linkage map of restriction fragment length polymorphisms. Nature 335: 721-726.
- Singh, D.P. and Satyanarayana, a. 1997. Creating higher genetic yield potential in urdbean. Pages 157-172. In: Recent Advances in Pulses Research. (AN Asthana and Masood Ali, eds). Kanpur, India: Indian Society of Pulses Research and Development.

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BREEDING OF HIGH YIELDING BLACKGRAM VARIETIES SUITABLE UNDER RICE FALLOW ECOSYSTEM MEDIATED BY GENETIC ENHANCEMENT OF MICROBIOME COLONIZATION

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Abstract

Rice fallow cultivation of Blackgram is a traditional method being adopted by farmers from very long time. It essentially mobilizes nutrients and with less or no input requirements produce yields of Blackgram generating income. Development of high yielding blackgram varieties suitable for rice fallow conditions are essential for yield increase, as the yield of rice fallow Blackgram varieties remain stable over period of time like for many decades. Rhizosphere enhancement with beneficial microbes' association will be highly sustainable for genetic improvement of yield of Blackgram varieties suitable under rice fallow conditions. Component traits should be brought into one genetic background viz., nutrients mobilization, root exudations, microbial colonization, tolerance to biotic and abiotic stresses and quality traits.

Keywords: Blackgram, rice-fallow pulse, microbiome, high-yield

Introduction

Rice fallow pulses cultivation is a unique practice being followed in CDZ zone immediately after the samba rice crop by dibbling the seeds in harvested paddy field near the stubbles without tillage. Totally 3.1 lakh ha comes under rice fallow cultivation of blackgram and greengram contributing more than 40% total pulse production of the state. Both blackgram and greengram generally occupy an area of 1.96 lakh ha annually under rice fallow conditions and yield levels ranging from 300-500 kg per ha (Umamageswari *et al*. 2019). Rice fallow blackgram ADT-3 was released during 1981 and it was a pureline selection from Tirunelveli local. A high yielding variety with maturity of 70-75- days. With hairy pods with 100 seed weight of 3.6 g. Erect pods, non-synchronous maturity and susceptible to yellow mosaic virus. It is a ruling variety of CDZ for four decades and recently a new

variety of blackgram from TRRI Aduthurai was released for the cultivation under rice fallow condition viz., ADT-6. ADT 6 was hybrid derivative of VBN 1 X VBN 4 with erect pods with hairs, with 100 seed weight of 4.5 g and average yield of 740 kg/ ha with duration of 75 days. There is a need to develop rice fallow blackgram variety with stability on yield, tolerance to yellow mosaic with synchronous maturity and low input responses. Microbiome mediated approaches will be highly useful to develop high yielding blackgram varieties with enhanced rhizosphere which can effectively mobilize nutrients and tolerance to abiotic stresses like salinity and drought.

Microbiome association in rice fallow ecosystems

Rice fallow cultivation of Blackgram is a zero-tillage method where the seeds of Blackgram are being dibbled in the harvested rice stubbles under optimum moist conditions preferably wetland ecosystems of Cauvery delta zone. Since the soil is not disturbed by tillage operations, the regions of rice stubbles and rice roots are supposed to be enriched with beneficial microbes. Rice cultivation depletes the soil nitrogen, phosphorus, potash and other micronutrients for its growth and development. Hence the stubble region of harvested rice is characterized by nutrient deficiency conditions. During germination processes, the developing young roots of blackgram release root exudates which include flavonoids, amines and free amino acids and soluble sugars. These root exudates attract the beneficial microbes present in the rice stubbles region and colonization of microbes takes place. When the seed reserves of the blackgram deplete by the seedling's growth and development on 7-10 days after germination (cotyledonary leaf stage), the microbes responsible for nitrogen fixation, phosphorous, zinc and iron mobilization actively start their functions by deficient inducible mechanisms. Without the tillage practices, there will be a network of microbes in the blackgram rhizosphere to soil. Slowly the rice stubbles will be decomposed by the increase in microbial population due to continuous secretion of root exudates from blackgram which enhance microbial population and their activities. Hence, the nutrients required for growth and development are being met through continuous supply mediated by enhanced rhizobiome of

blackgram grown in rice fallow conditions.

Ecological, economical and nutritional benefits of cultivation of rice fallow blackgram varieties

1. Rice fallow cultivation of blackgram varieties enhance the microbial population and diversity in the soil which improve the soil fertility. It also improves the physical, chemical and biological properties of the soil.
2. Mobilization of unavailable nutrients and effective utilization by rice fallow blackgram varieties for growth and development. Blackgram fixes 40 kg available nitrogen in one hectare of rice fallow field. It also mobilizes the phosphorus, zinc, iron and other micronutrients. Remaining root regions after harvest of upper ground portions of rice fallow redgram is highly beneficial to successive rice crop.
3. Tolerance to drought and biotic stresses due to microbiome association in roots and phyllosphere. Microbiome mediate stomatal closure regulations and enhance drought tolerance by preventing transpiration through stomata. Due to colonized microbiome in roots and above ground portions, induced systemic acquired resistance plays major role by imparting tolerance against powdery mildew, wilt, and root rot diseases.
4. It is low and no input application response cultivation method. Hence the cost of cultivation is always low and profit is always on higher side.
5. Rice fallow blackgram varieties like ADT 1, lalgudi local (midhi ulunthu), ADT 3 are having excellent battering quality due to stronger microbiome association. The taste, flavour and digestabilities are better than other blackgram varieties.
6. It is the traditionally proven no tillage cultivation method by cultivation of specialized varieties of blackgram which conserve natural resources like soil water and environment.

Necessities of rice fallow blackgram varieties development through breeding

The popular rice fallow varieties cultivated in Cauvery delta zone of Tamil Nadu are basically pureline selection viz., ADT1, and ADT3. There was no clear scientific understanding of mechanisms of adaptations of these varieties during their selection, they were selected based on the yield performance under rice fallow conditions. Now during the era of advancement of culture plant microbe interactions, structural, and functional genomics studies, it is essential to identify the component traits which constitute rice fallow cultivation adaptations and identifying the genetic blocks regulating the adaptations in blackgram for targeted breeding. There are no recent varieties of blackgram highly adapted to rice fallow conditions.

Strategies of breeding of rice fallow blackgram varieties

1. Screening of germplasm lines, varieties and reconstituted lines under rice fallow conditions and identifying better performing lines.
2. Identification of extreme lines grown under no input conditions of rice fallow system and characterizing their ability to mobilize nutrients, root exudations, tolerance to biotic and abiotic stresses.
3. Each line with traits of interest should be crossed to develop magical populations.
4. Transcriptomic, biochemical and microbiome analysis will be done to understand the mechanisms of each donor lines.
5. Selecting processes involve raising segregating lines under rice fallow conditions and stability analysis will be done on homozygous lines which are performing better.
6. Quality and yield analysis will be done on superior performing lines.

Conclusion

Development of blackgram varieties suitable for rice fallow conditions is an important task and the initiatives should be holistic approaches by combining various component traits involved in nutrients mobilization, root exudation, microbiome colonization, tolerance to biotic and abiotic stresses and quality traits. Rice fallow cultivation of pulses will improve the productivity and production of blackgram if the variety gives higher yield under low input conditions and it has to be

achieved by stronger microbiome association in roots and phyllosphere through breeding.

References

- Bacilio-Jimenez M, Aguilar-Flores S, Ventura-Zapata E, P ´ erez- ´ Campos E, Bouquelet S and Zenteno E (2003) Chemical characterization of root exudates from rice (*Oryza sativa*) and their effects on the chemotactic response of endophytic bacteria. Plant Soil 249: 271–277.
- Chaparro JM, Badri DV, Vivanco JM (2014) Rhizosphere microbiome assemblage is affected by plant development. ISME J 8:790– 803. doi:10.1038/ismej.2013.196
- Haichar FZ, Santaella C, Heulin T, Achouak W (2014) Root exudates mediated interactions belowground. Soil. Biol. Biochem. 77:69– 80. doi: 10.1016/j.soilbio.2014.06.017
- Lakshmanan V, Kitto SL, Caplan JL, Hsueh YH, Kearns DB, Wu YS, Bais HP (2012) Microbe-associated molecular patternstriggered root responses mediate beneficial rhizobacterial recruitment in Arabidopsis. Plant. Physiol. 160(3):1642–1661. doi:10.1104/pp.112.200386

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ADVANCED STRATEGIES FOR MANAGEMENT OF NEMATODE PARASITES OF CROP PLANTS

Article ID: AG-V02-I05-17

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Introduction

Plant parasitic nematodes (PPNs) are obligate parasites, which feed and damage on roots causing severe yield loss all over the world. Various methods have been developed for management of PPNs including field sanitation; use of nematode free planting material/tissue culture plants, crop rotation, intercropping with non-host / nematode antagonistic plants, addition of organic manures, biocontrol agents, application of chemical nematicides etc. Though application of chemical nematicides proved most effective in managing PPNs, detrimental effects of these nematicides on environment and human health have compelled various developed and developing countries to impose ban on their use. Recent scientific and technological advancements opened various new avenues and options for management of parasitic nematodes. This article gives an overview of the recent technologies which are in vogue for nematode management.

Engineering Plants for Nematode Resistance

- In the past, several nematode resistance genes were identified, cloned, characterized and few were transferred. Successful incidence includes, *Mi* gene from tomato for resistance against *Meloidogyne incognita*, $Hs1^{pro-1}$ from sugar beet (*Beta vulgaris*) against *Heterodera schachtii*, *Gpa*-2 from potato against *Globodera pallida* and *Hero A* from tomato against *Globodera rostochiensis*. Protease inhibitors (cowpea trypsin inhibitor, cystatins and serine proteases) and post-transcriptional gene silencing are two strategies mainly used for the production of nematode resistant transgenic plants. Maize cystatin was successfully transformed in to plantain (*Musa* sp.) (Tripathi *et al*.,

2015). This transgenic banana controlled the reproduction of important nematode species *viz*., *Radopholus similis*, *Helicotylenchus multicinctus*, and *Meloidogyne* spp (**Table 1**).

Gene Silencing / RNAi

RNAi refers to sequence specific and homology-dependent gene silencing through a complex mechanism in which double stranded RNA (dsRNA) is recognized which leads to the degradation of both the dsRNA and homologous RNA. RNAi was first demonstrated in the model free living nematode, *Caenorhabditis elegans* and this phenomenon of RNAi has been successfully used to suppress essential genes of PPNs involved in parasitism, nematode development and mRNA metabolism. RNAi technology was demonstrated successfully in many plants' parasitic nematodes both *in vitro* as well as *in planta*.

Table 1. Transgenic plants with nematode resistance using protease inhibitors

Protease Inhibitors	Crop	Nematode	Reference
Cowpea Trypsin Inhibitor (CpTI)	Potato	*Globodera pallida*	Hepher and Atkinson, 1992
Cystatin Oc-IΔD86	Arabidopsis	*Heterodera schachtii* and *Meloidogyne incognita*	Urwin *et al*., 1997
Maize Cystatin	Plantain (*Musa* spp., cv. Gonja manjaya)	*Radopholus similis*, *Helicotylenchus multicinctus*, *Meloidogyne* spp.	Tripathi *et al*., 2015
Taro Cysteine Proteinase Inhibitor (CeCPI) & Fungal Chitinase (PjCHI-1)	Tomato	*Meloidogyne incognita*	Chan *et al*., 2015

***In-vitro* RNAi**

Three different methods are being used in nematode for introduction of dsRNA which include feeding on bacteria expressing target gene dsRNA (Timmons and Fire, 1998; Kamath *et al*., 2001; Timmons *et al*., 2001), soaking of nematodes in dsRNA solution facilitating its oral uptake (Tabara *et al*., 1998) and microinjection (Fire *et al*., 1998; Mello and Conte, 2004). But, in case of PPNs, microinjection has not been effective because of the small size of the infective stages and their inability to ingest fluid without host plant infection. Among the plant parasitic nematodes, RNAi was first demonstrated in cyst nematodes, *Heterodera glycines* and *Globodera pallida* (Urwin *et al*. 2002). Using RNAi technology, root-lesion nematodes, *Pratylenchus thornei* and *P. zeae* were successfully knocked down by soaking mixed stages of these nematodes in dsRNA of genes, pat-10 and unc-87. Nematode ingested dsRNA resulted in paralysis and un-coordinated movements with significant reduction in nematode reproduction (Hwa *et al*. 2012). Similar results were also observed in *P. coffeae*, when these nematodes were soaked in dsRNA of genes Pc-pat-10 and Pc-unc-87 (Joseph *et al*. 2012) (**Table 2**).

***In-planta* RNAi**

Host-delivered RNAi through transgenic plants is an important technology for the management of plant parasitic nematodes where genes essential for nematode parasitism can be targeted (functional genes). Host generated RNAi has been demonstrated by targeting different nematode genes which may be broadly classified under three categories: housekeeping genes, parasitism or effector genes and genes associated with nematode development. A dsRNA construct for the target gene is developed by cloning a part of the target gene cDNA in sense and antisense orientation separated by an intron or spacer region. A strong tissue specific or constitutive promoter may be used to drive the expression of the dsRNA. Transcription of the sense and antisense strands results in the formation of a self-complimentary hairpin structure with the removal of the intron by splicing. The dsRNAs so formed can either be directly ingested by the PPNs or can be processed by the host plant's own RNAi machinery and the resulting siRNAs can be subsequently ingested by the PPN. This

strategy was successfully demonstrated in plants *viz*., *Arabidopsis*, tobacco, soy bean, tomato, potato *etc* against root-knot nematodes (*Meloidogyne incognita*; *M. javanica*) and burrowing nematode (*Radopholus similis*). Using this approach, nematode suppression was achieved by targeting different functional genes including genes responsible for secretory proteins responsible for parasitism (Huang *et al*. 2006; Antonino de Souza Júnior *et al*. 2013; Xue *et al*. 2013), developmental genes (Lourenço-Tessutti *et al*. 2015) and housekeeping genes (Yadav *et al*. 2006; Li *et al*. 2010). Host-delivered RNAi was first demonstrated in tobacco plant against *M. incognita* (Yadav *et al*. 2006) by silencing dsRNAs of two genes, which encode an integrase and a splicing factor. Nematode resistance against four major root-knot nematode species was successfully demonstrated in Arabidopsis plants by expressing of dsRNA of the parasitism gene 16D10 (Huang *et al*. 2006) (**Table 3**).

RNAi has emerged as a powerful strategy to control multiple pest and pathogens including nematodes especially as we are moving toward the goal of phasing out chemicals that are harmful to environments and ecosystems. Management of nematodes however, presents some unique challenges as these are obligatory parasites requiring living host for feeding. The use of host induced RNAi to combat plant pathogenic nematodes has so far been effective especially with respect to root-knot and cyst nematodes. The advancement in the area of functional genomics availability of genome sequence data and new bioinformatics tools have enabled design and engineering of effective dsRNA expression constructs addressing concerns of off-target silencing. Stacking of dsRNA sequences to target multiple genes has emerged as an attractive proposition for effective nematode control. Use of nematode induced and plant tissue specific promoters limiting dsRNA gene expressions to specific plant tissue/s in response to particular nematode can also mitigate bio-safety concerns. The ability to precisely edit genomes is rapidly transforming the landscape of novel ways to target plant pathogens. CRISPR/Cas system is emerging as a powerful approach for loss of function analysis, insights into host–parasite and parasite–vector interactions, and the genetic basis of parasitism.

References

- Antonino de Souza Júnior JD, Ramos Coelho, R, Tristan Lourenço, I, da Rocha Fragoso R, Barbosa Viana AA, Lima Pepino de Macedo L, Maria Cristina Mattar da Silva, Regina Maria Gomes Carneiro, Gilbert Engler, Janice de Almeida-Engler, Maria Fatima Grossi-de-Sa (2013) Knocking-down *Meloidogyne incognita* proteases by plant-delivered dsRNA has negative pleiotropic effect on nematode vigor. *PLoS One*. **8**:e85364
- Chan, Y.-L., He, Y., Hsiao, T.-T., Wang, C.-J., Tian, Z., and Yeh, K.-W. (2015). Pyramiding taro cystatin and fungal chitinase genes driven by a synthetic promoter enhances resistance in tomato to root-knot nematode *Meloidogyne incognita*. *Plant Sci*. **231**, 74–81
- Fire A, Xu S, Montgomery MK, Kostas SA, Driver SE, Mello CC (1998) Potent and specific genetic interference by double-stranded RNA in *Caenorhabditis elegans*. *Nature*. **391**(6669):806-811
- Huang, G, Allen, R, Davis, EL, Baum, TJ, Hussey, RS (2006) Engineering broad root-knot resistance in transgenic plants by RNAi silencing of a conserved and essential root-knot nematode parasitism gene. *PNAS*. **103**(39): 14302-14306
- Hwa TJAC, Jones MGK, Nyarko JF (2012) Gene silencing in root lesion nematodes (*Pratylenchus* spp.) significantly reduces reproduction in a plant host. *Experi Parasitol*. **133**(2): 166-178
- Joseph S, Gheysen G, Subramaniamam K (2012) RNA interference in *Pratylenchus coffeae*: Knock down of Pc-pat-10 and Pc-unc-87 impedes migration. *Mol Biochem Parasitol.* **186**: 51–59
- Li J, Todd TC, Oakley TR, Lee J, Trick HN (2010) Host-derived suppression of nematode reproductive and fitness genes decreases fecundity of *Heterodera glycines* Ichinohe. *Planta.* **232**:775–785
- Lourenço-Tessutti, IT, Souza Junior, JDA, Martins-de-Sa, D, Viana, AAB, Carneiro, RMDG, Togawa, RC, de Almeida-Engler J, Batista JA, Silva MC, Fragoso RR, Grossi-de-Sa MF (2015) Knockdown of heat-shock protein 90 and isocitrate lyase gene expression reduced root-knot nematode reproduction. *Phytopath*. **105**: 628–637
- Tabara H, Grishok A, Mello CC (1998) RNAi in *Caenorhabditis elegans*: soaking in the genome sequence. *Science*. **282**(5388):430-431
- Timmons L, Court DL, Fire A (2001) Ingestion of bacterially expressed dsRNAs can produce specific and potent genetic interference in *Caenorhabditis elegans*. *Gene*. **263**(1-2):103-112
- Tripathi, L., Babirye, A., Roderick, H., Tripathi, J. N., Changa, C., Urwin, P. E., *et al*. (2015). Field resistance of transgenic plantain

to nematodes has potential for future African food security. *Sci. Rep*. **5**:8127.

- Urwin P, Lilley CJ, Atkinson HJ (2002) Ingestion of double-stranded RNA by preparasitic juvenile cyst nematodes leads to RNA interference. *Mol Plant-Microbe Inter*. **15**(8): 747-752
- Xue B, Hamamouch N, Li C, Huang G, Hussey RS, Baum TJ, Davis EL (2013) The 8D05 parasitism gene of *Meloidogyne incognita* is required for successful infection of host roots. *Phytopath*. **103**(2): 175-181
- Yadav BC, Veluthambi K, Subramaniam K (2006) Host-generated double stranded RNA induces RNAi in plant-parasitic nematodes and protects the host from infection. *Mol Biochem Parasitol*. **148**(2): 219-222

Table 2. *In vitro* RNAi against Major Nematodes

Nematode Species	Gene Description	Gene Targeted	Effect	Reference
Root-knot nematode, *Meloidogyne incognita*	Esophageal gland proteins	Mi-crt	65% reduction in transcript level	Rosso *et al.*, 2005
		Mi-pg-1	30% reduction in transcript level	
	Extracellular matrix proteins	Dual oxidase	70% reduced egg mass production	Bakhetia *et al.*, 2005
	Parasitism	16D10	74-81% reduced infection	Huang *et al.*, 2006
	Larval molting	Cathepsin L cysteine proteinase	60% less infection	Shingles *et al.*, 2007
	Esophageal gland protein (Pectate lyase)	Mi-gsts-1	Decreased egg mass production and 90% reduction in transcript level	Dubreuil *et al.*, 2007
	FMRFamide-like Neuropeptide	Mi-flp-18	Decreased transcript level and inhibition of migratory ability	Dalzell *et al.*, 2010a
	Microprocessors of miRNAs	drsh-1 and pash-1	Lethal and abnormal embryo	Dalzell *et al.*, 2010b
	Cell death programming gene	Mi-ced-9	40% reduction in gall formation	Gaeta *et al.*, 2011
	Esophageal gland protein (Calreticulin)	Micrt-1	Reduction in transcript and plant infection	Arguel *et al.*, 2012
	Zinc finger protein	Mi-Pos-1	85% reduced transcript 40% reduced hatching	Matsunaga *et al.*, 2012
Root-knot nematode, *Meloidogyne javanica*	Avirulence effector	Cg-1	Increased virulence on tomato with Mi-1	Gleason *et al.*, 2008
	Esophageal gland protein	Cellulose binding protein	53-58% reduction in egg mass production	Adam *et al.*, 2008
Burrowing nematode, *Radopholus similis*	Esophageal gland protein (endoxylanase)	Rsxyl	53-66% reduction in plant infection	Haegeman *et al.*, 2009
Root-lesion nematode, *Pratylenchus thornei*	Muscle myofilament calponin	Ptunc-87	30-fold reduction in transcript level	Tan *et al.*, 2013

Table 3. *In planta* RNAi against Major Nematodes

Nematode Species	Host Plant	Gene(s) Targeted	Effect	Reference
Burrowing nematode, *R. similis*	Tobacco	Rs-cb-1	Reduced reproduction and pathogenicity	Li *et al.*, 2015
Root-knot nematode, *M. incognita*	Tobacco	HSP90, Heat Shock Protein	Delayed gall formation and reduction in the number of eggs	Lourenço-Tessutti *et al.*, 2015
		ICL, Isocitrate lyase	Reduction in egg oviposition	
	Arabidopsis	MiMSP40	Reduction in the number of galls	Niu *et al.*, 2016
Root-knot nematode, *M. javanica*	Tomato	Fatty acid and retinol binding protein (Mj-far-1)	Ceased development of nematodes along with reduction in giant cell number	Iberkleid *et al.*, 2013
Root-knot nematode, *M. incognita*	Tobacco	Mi-asp-1 +Mi-ser-1 +Mi-cpl-1 (fusion); Mi-cpl-1, Cysteine protease; Mi-ser-1, serine protease	Reduction in number of eggs	Antonino de Souza Júnior *et al.*, 2013
	Grapevine	16D10	Transgenic hairy root lines showed less susceptibility to nematode infection	Yang *et al.*, 2013
	Tobacco	flp-14, flp-18, FMRF amide like peptide	Reduction of parasitic ability	Papolu *et al.*, 2013
	Arabidopsis	Calreticulin – MiCRT	Reduction in number of galls	Jaouannet *et al.*, 2013
	Arabidopsis	Parasitism gene 8D05	Reduction in number of galls	Xue *et al.*, 2013
	Tomato	AF531170, parasitism gene	Reduction in number of developing females	Choudhary *et al.*, 2012
	Tomato	Mi-Rpn7	Reduction in reproduction and motility	Niu *et al.*, 2012
	Soybean	Tyrosine Phosphatase, Mitochondrial stress -70 protein precursors, Lactate dehydrogenase	Decreased number of galls	Ibrahim *et al.*, 2011
Root-knot nematode, *M. javanica*	Tobacco	MjTIS-11, Putative transcription factor		Fairbairn *et al.*, 2007
Root-knot nematode, *M. incognita*	Tobacco	Integrase, Splicing factor	Decreased number of established nematode	Yadav *et al.*, 2006
Root-knot nematodes,	Arabidopsis	Secreted peptide 16D10	Decreased number of galls and gall size	Huang *et al.*, 2006

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SANKALP SE SIDDHI SCHEME

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Introduction

The central government has introduced a new Scheme termed as Sankalp Se Siddhi Yojana. The new scheme has been introduced with an aim to benefit the nation. The central government aims at looking into all matters related to the economic and social welfare of the nation. It was introduced on Aug 2017 by Prime minister Narendra Modi on the occasion of quit India movement. It will be effective from 2017 – 2022 (5 years) and will supervised by Farmers and Agricultural welfare Ministry

Aims

1. To activate the Van Dhan Vikas Kendras in these villages
2. To aid a complete transformation of the tribal ecosystem
3. It is a 100-day drive which started on the 1st April 2021
4. The drive will entail 150 teams visiting ten villages each of which 10 in each region from TRIFED and State Implementation Agencies, visiting ten villages each.
5. According to the Ministry of Tribal Affairs, 100 villages in each region and 1500 villages in the country will be covered in the next 100 days.
6. The visiting teams will also identify locations and shortlist potential Van Dhan Vikas Kendras for clustering as TRIFOOD, and Scheme of Fund for Regeneration of Traditional Industries- SFURTI units as larger enterprises.
7. They will also identify tribal artisans and other groups and empanel them as suppliers so that they can have access to larger markets through the Tribes India network – both physical outlets and TribesIndia.com.
8. Rs 200 crore Sales during the next 12 months is targeted as a result of this initiative once the

VDVKs are activated in these 1500 villages.

Key Features of the Sankalp Se Siddhi Yojana

1. It is certain that the government has announced the new scheme as a five-year plan starting from 2017. Under this scheme it is certain that the central government aims at introducing a number of policies and other related schemes for benefiting Indian citizens.
2. Activity And Events: The government will organize a number of social activities and events under the scheme. By running these programs, the government will make people aware of issues related to the country concerning social developments.
3. Raising Issues: The government also aims to raise a number of issues under this program including hygiene, education, poverty, caste, discrimination and religion. The government aims to eliminate these issues completely by implementing this scheme thus offering benefit to the people of India.
4. The scheme is introduced to help the people belonging to the lower income category to help them increase their earnings including farmers. The government shall provide with solutions to help them double their income by the year 2022. The program will also facilitate Tribal families to generate more income annually.

Issues Resolved Under the Scheme

Under the scheme the government aims at looking into and focusing on 6 to 7 different issues by raising awareness through organizing events for

1. Literacy
2. Clean India
3. Corruption
4. Terrorism
5. Poverty
6. Caste discrimination
7. Communalism eradication

Implementation Process

1. The Farmers and Agricultural welfare shall be organizing the campaigns and events nationwide **starting from 19th to 31st Aug (current year).**
2. It is certain that over 53 ATMA's, 578 KVKs (Krishi Vigyan Kendra) and 29 SAU's or ICAR institutions

will be involved in implementing the events.

3. At the time of the launch of the program the authorities had also shared a short movie clip with others.
4. There were over 33 MLA's and MPs who had acted in the short movie clip along with 129 celebrities and well-known faces acting in the movie. This will encourage citizens of the country to make India a better place.

Involved Area Under the Event

1. As per the sources it is certain that the central government has involved over 18 states to participate in the scheme.
2. **State names are**: Telangana, Gujarat, Andaman & Nicobar, Rajasthan, Maharashtra, Kerala, Madhya Pradesh, Tamil Nadu, Odisha, Himachal Pradesh, Punjab, UP, Bihar, Chhattisgarh, Manipur, Haryana, Meghalaya and Nagaland were involved in the program.
3. The program was organized in 32 distinct locations throughout India.

Scheme of Fund for Upgradation and Regeneration of Traditional Industries' (SFURTI)

Ministry of Micro Small and Medium Enterprises (MSME), Govt. of India has launched this scheme in the year 2005 with a view to promote Cluster development.

Schemes Merged under SFURTI

1. The Scheme for Enhancing Productivity and Competitiveness of Khadi Industry and Artisans
2. The Scheme for Product Development, Design Intervention and Packaging (PRODIP)
3. The Scheme for Rural Industries Service Centre (RISC) and
4. Other small interventions like Ready Warp Units, Ready to Wear Mission, etc.

TRIFOOD

1. TRIFOOD Scheme is a joint initiative of Ministry of Food Processing Industry, Ministry of Tribal Affairs and TRIFED
2. TRIFOOD Scheme, implemented in the backdrop of VanDhan Yojana
3. TRIFOOD aims to enhance the income of tribals through better

utilization of and value addition to the Minor Forest Produce collected by the tribal forest gatherers

Van Dhan Vikas Kendras

1. They are set up under VanDhan Yojana in predominantly forested tribal districts.
2. They are tribal community-owned.
3. A Kendra shall constitute of 15 tribal SHGs, each comprising of up to 20 tribal NTFP gatherers or artisans i.e., about 300 beneficiaries per Van Dhan Kendra.
4. The Kendras would act as common facility centres for procurement cum value addition to locally available MFPs.

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SUPER FERN AND THEIR ROLE IN MANKIND

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Introduction

In general, ferns are not recognized as economically valued product when compared to other plant groups. Ferns are non-flowering, moist loving plants mostly occur in marshy and aquatic areas. Some species are used as food source, indoor decoration and few in medicine.

The aquatic fern, mosquito fern, duckweed fern, fairy moss, water fern was collectively called as Azolla belongs to the family Salviniceae. It is considered as invasive plant in freshwater lakes, wetland and helps in altering the ecosystem and maintains the environment in a sustainable way.

Dual culture fish farming and rice cultivation along with Azolla, serves as food for fishes and gives nitrogen for rice fields. Introduce/ inoculate Azolla into the rice field when permanent standing water is available. Intercropped Azolla is usually not fertilized. Under both systems, Azolla can be incorporated several times during the crop cycle.

Symbiotic Nitrogen Fixation: In Association with *Anabaena sp*

Azolla lives symbiotically with *Anabaena azollae*, nitrogen fixing blue green algae. Azolla fronds are floats on the surface of water individually or in mats. The size is ranging from 1 to 15 cm in diameter. Azolla in association with blue-green alga anabaena can fix atmospheric Nitrogen (N) into ammonia which can be utilized by rice plant when it is incorporated into soil. Azolla contains from 2–5% N, 0.3–6.0% Potassium (K) (dry weight).

As a Protein Source for Cattle/Livestock Feed

Azolla was rich in proteins, minerals (Calcium, Phosphorous, Iron, Copper, Magnesium) essential vitamins and amino acids (Vitamin A, Vitamin B12, Beta carotene). Whereas, content of carbohydrate and oil is very low. It is considered as efficient and economic

substitutes for livestock as it is easily digested. It is recommended as regular feed for dairy animals and poultry. Sometimes it is used as supplementary food for fish also. As a result, there is an increase in food production (milk, meat, egg).

As a Good Source of Calories for Human

For habitation on extraterrestrial planets, such as moon and Mars, bio-regenerative agricultural system is requested to support human life. We evaluated nutrition of a candidate menu designed for space agriculture. A combination of rice, soybean, sweet potato, green-yellow vegetable, silkworm pupa, loach and azolla was found to be an appropriate diet that fulfills the human nutritional requirements**.** Scientists had proposed it as a food for future space travel.

Mass Multiplication

- *Azolla* is mass multiplied under field conditions in one cent plots as follows
- Select a wetland field and prepare thoroughly and level uniformly
- Mark the field into one cent plots (20m x2m) by providing suitable bunds and irrigation channels
- Maintain water level to a height of 10 cm
- Sprinkle @ 10 kg of cattle dung mixed in 20 litres of water per plot
- Apply 100 g super phosphate per plot as basal dose
- Inoculate fresh *Azolla* at 8 kg per plot by spreading over the standing water
- Apply super phosphate 100 g as top dressing on 4^{th} and 8^{th} day after *Azolla* inoculation to each plot
- Apply carbofuran (Furadan 3G) granules at the rate of 100 g/plot on 7^{th} day after *Azolla* inoculation to control pests.
- Maintain water level at 10 cm throughout the growth period approximately for three weeks.

Conclusion

Azolla is nutrient rich meal for animals and humans. Breeding and selection for more favorable *Azolla* strains as well as bio-refining to produce multiple value-adding products likely will further enhance the value of an *Azolla* production chain.

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ROLE OF SWINE AS A MULTICENTRIC HOSTS OF NOVEL EMERGING ZOONOTIC PATHOGENS

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Abstract

The susceptibility of pigs to many of the emerging zoonotic pathogens is of particular interest since humans acquire most of these zoonotic diseases through direct contact with live animals; risk groups being veterinarians, farm workers, abattoir workers as well as the general human population. In most cases, swine can serve as a potential reservoir for Nipah virus and as an amplifier for Japanese Encephalitis virus. The ability of swine to get co-infected with human and avian influenza viruses has led to the "mixing vessel" theory. Recently reported G4 EA H1N1 strain of swine flu virus from China has not yet been shown to infect humans, but exhibits "reassortment capabilities" of a pandemic virus. The purpose of this review article is to provide an insight into the dynamics of viral zoonoses existing in the swine population.

Keywords: Japanese Encephalitis, Nipah, Swine and Viral zoonoses

Introduction

Majority of emerging infectious diseases are zoonotic in origin. The novel emerging pig-borne pathogens may have resulted from the growth in the pig food industry, as 20 of the 29 top pork-producing countries that have demonstrated increased production in recent decades have also reported new pig pathogen variants. Pork production has increased upto 80 per cent with a predicted seven per cent increase in annual pork demands. A review of emerging pig pathogens showed that at least 77 novel emerging species have been characterized since 1985, 30 of which were

zoonotic (Pappas, 2013). These are of two categories: pig-specific pathogens, and zoonotic agents that have other animal reservoirs. The zoonotic potential of novel agents in pigs was evident during Nipah outbreak from Malaysia. Pigs may also serve as amplifiers for zoonotic infections. Thirty-five of novel species were pig- specific, usually tending to be DNA viruses, whereas RNA viruses were multi-host pathogens. Pigs are considered as important hosts or "mixing vessels" for the generation of pandemic influenza viruses (Ma *et al*., 2009). Recently strengthened influenza virus surveillance in pigs has revealed that influenza virus transmission from humans to swine is far more frequent than swine-to-human zoonoses. Scale of human-to-swine transmission of Influenza virus represents the largest 'reverse zoonosis' of a pathogen documented to date (Nelson and Vincent, 2015).

Some of the important swine associated viral zoonoses are described below.

1. Nipah

Nipah is a highly fatal viral encephalitis affecting human beings caused by Henipa virus. The first outbreak of Nipah was from Malaysia in 1998. Initially the symptoms observed in the outbreak mimicked that of Japanese Encephalitis (Looi and Chua, 2007). Later, a new infectious agent Nipah virus was isolated from the cerebrospinal fluid of a deceased victim from Sungai Nipah village (Field *et al.,* 2001). Nipah virus was identified as a new genus Henipa virus (Hendra + Nipah) in *Paramyxoviridae* family. Epidemiology of the disease was correlated to the Malaysian Island flying foxes of *Pteropus* genus. Flying foxes acted as the natural host for the virus. The failure of fruiting of forest trees due to El-Nino effect and anthropogenic fires in Indonesia has led to the disruption of roosts of fruit-bats. This has led to their migration to nearby orchards and piggeries (Chua *et al.,* 2002). Bats transmitted virus to pigs and subsequently it was transmitted to humans who came in contact with infected pigs and their products. The import and surreptitious movement of infected pigs to other states in Malaysia and Singapore resulted in more cases. During outbreaks in

Malaysia, 265 individuals were affected with 105 deaths (Parashar *et al.,* 2000). More number of cases were reported from pig farm and abattoir workers who were directly associated with infected pigs. Animal surveillance in sick pigs as part of investigation in human cases revealed that pigs developed "porcine respiratory and neurological syndrome" (also known as "porcine respiratory and encephalitis syndrome"), or "barking pig syndrome" (McLean and Graham, 2019). The billion dollar pig farm industry in Malaysia suffered huge economic losses during the outbreak as nearly one million pigs were culled to control the spread of the virus (Lam, 2003).

In 2001, second major outbreak of Nipah was observed from Siliguri district of India and Bangladesh. Bat-to-human transmission of virus through the consumption of raw date palm soup contaminated by fruit bats was reported (Luby *et al.*, 2006). Human to human and hospital borne transmission was documented as the source of spread of infection in these Indo-Bangladesh outbreaks. There was neither involvement of pigs nor any other animal hosts in any of these infections. Recently, in July 2018, Nipah outbreak was confirmed in Kerala among 18 patients with signs of encephalitis of which 17 succumbed to death. A year later, in 2019, a single index case was reported from Ernakulam district. During these outbreaks, the Kerala Public Health department contained the infection with minimum casualties by tracing contacts and by keeping these cases under close surveillance. Disturbance of fruit- bat habitats around the house of the index case in Kozhikode was suggested as a possible reason for 2018 outbreak in Kerala (Chatterjee, 2018). Samples from domestic animals and pigs tested negative for virus during epidemiological investigation. Scientists have tried to understand the role of pig as intermediate hosts in transmission of Nipah virus by carrying out experimental studies. These studies proved that infection of pigs lead to a similar respiratory and neurological sign as seen in humans. But no pathognomonic symptoms for Nipah infection in pigs could be proved. This makes diagnosis under field conditions

much more difficult. Pigs were used in research studies as useful models to study the human Nipah infections and also for vaccine development.

2. Influenza virus

Influenza A virus are highly infectious respiratory pathogens capable of infecting multiple host species. Birds are the reservoir for all known influenza A subtypes (Ma *et al*., 2009). On rare occasions, major influenza pandemics occur when an avian influenza virus evolves the capacity to transmit human-to-human, as occurred in 1918, 1957, and 1968 (Nelson and Vincent, 2015). Swine influenza (H1NI) was first recognized during the influenza pandemic of 1918–1919 (Smith *et al*., 2011). Swine influenza cases in humans have been reported sporadically, but documented symptomatic infections with influenza viruses of swine origin were uncommon before 2009. Several research studies have revealed that pig farmers, veterinarians, and slaughter house workers coming in direct contact with infected swine demonstrated serological evidence of prior swine influenza infections.

Pigs are susceptible to both human and avian influenza virus and were considered as an intermediate host or "mixing vessels" in the generation of novel reassorted influenza viruses. In birds, the influenza virus binds to the sialic acid attached to galactose via α-2, 3 linkage, whereas in humans binding occurs through sialic acid attached with α-2, 6 linkages. Epithelial cells of trachea in pigs carried both α-2, 3 and α-2, 6 linkages. This finding provided solid molecular evidence for the fact that pigs can act as "mixing vessels" for both human and avian influenza viruses (Nelson and Worobey, 2018). The frequency of avian-to-swine transmission of Influenza virus is lower compared to the frequency of human-to-swine transmission (Nelson and Vincent, 2015). To date, two full or partial avian influenza viruses successfully adapting to swine were discovered. One being the Eurasian H1N1 swine viruses and the other - PB2 and PA segments associated with the triple-reassortant (TR) viruses that emerged in North American swine. The first influenza pandemic of 21st century in 2009 was caused by a novel reassortant of swine H1NI

virus with genetic segments from these two viruses (Garten *et al.*, 2009). Since the origin of 2009 pandemic H1N1 virus, the importance of pigs in causing new outbreaks with pandemic potential has increased globally. Influenza virus surveillance of pigs from 2011 to 2018 in China, recently identified Genotype 4-reassortant Eurasian avian-like (G4EA H1N1) virus, which bears 2009 pandemic and triple-reassortant (TR)-derived internal genes. Low antigenic cross-reactivity of human influenza vaccine strains with G4 EA H1N1 virus indicates that preexisting population immunity would not be sufficient to provide protection against G4 viruses (Sun *et al.*, 2020). Serological surveillance among population with occupational exposure showed that 10.4 per cent of pig farm workers were positive for G4EA H1N1 virus, indicating that the virus has acquired increased human infectivity. Intervention strategies for controlling the prevailing G4 EA H1N1 viruses in pigs should be implemented with a great deal of urgency as it has a potential of becoming yet another pandemic.

3. Japanese Encephalitis (JE)

Japanese Encephalitis is one of the leading causes of viral encephalitis in Asia. Japanese encephalitis virus (JEV) is a mosquito-borne Flavi virus under family *Paramyxoviridae* with five distinct genotypes (I to V). Annually around 30,000 to 50,000 cases of Japanese Encephalitis are reported worldwide. In India, the first human case was reported from Tamil Nadu in 1955 (Tiwari *et al.*, 2012). Outbreaks with JEV during 1978 to 2009 was observed in Uttar Pradesh and southern parts of India. Mosquitoes belonging to *Culex tritaeniorhynchus,*

C. vishnui and *C. pseudovishnui* act as main vectors for JEV (Tuno *et al.*, 2016), with water-birds such as egrets and herons as reservoirs and pigs as the amplifying hosts in human epidemics (Ricklin *et al.*, 2016). In recent years, a sharp surge has been observed in the number of cases of JE from Assam. Darrang is one of the floods affected district of Assam which was substantially hit by deadly JE due to the high prevalence of mosquito and their amplifying host. Pigs develop high viremia post-infection which can

persist up to three days to infect the mosquitoes. Furthermore, *C. tritaeniorhynchus* preferentially feeds on pigs. Factors favouring pigs as the main amplifying host for JEV are their large litter size providing a consistent source of susceptible naïve pigs every year. Vector-free transmission and persistence of Japanese encephalitis virus in pigs pose potential risk for human population (Ricklin *et al.*, 2016). Tonsils are the most important site of replication of JEV in pigs. Virus can persist in the tonsils of pigs for at least 25 days. Pigs can also shed the virus through their oro-nasal secretions. The severity of infection in pigs will be mild compared to dead-end hosts like humans and horses. In humans, fatality rate ranges from 20 to 30 per cent, with neurologic or psychiatric sequelae observed in 30 to 50 per cent of survivors in the form of convulsions, tremors, paralysis, ataxia, and other such symptoms.

4. Ebola Reston Virus

Ebolaviruses (family *Filoviridae*, order Mononega virales) cause often fatal, haemorrhagic fever in primates including humans. Reston Ebola virus (RESTV) was discovered in 1989 as the cause of serious illness and death of nonhuman primates exported from Philippines (Jahrling *et al.*, 1990). Reston virus is the single member of the Ebola viruses which does not cause severe disease in infected humans (Morikawa *et al.*, 2007). It is still considered as a high-hazard pathogen for humans, due to the potential for serious disease in humans and possible human-to-human transmission. It is included in the genus Ebola virus along with other highly virulent African species like Zaire, Sudan and Bundibugyo Ebola viruses. RESTV was detected in swine during an outbreak of highly pathogenic porcine reproductive and respiratory syndrome (PRRS) in 2008 (Pickering *et al.*, 2018). Based on phylogenetic evidence, it was suggested that RESTV has been circulating in swine for long adding swine to the list of potential filo virus reservoirs, in addition to the previously implicated bat species (Barrette *et al.*, 2009). Several pig farmers were found to be sero positive for RESTV antibodies, providing a strong indication that they acquired the

virus from infected pigs. The exact role of swine in the transmission cycle of this virus is not yet known (Barrette *et al.*, 2009). However, a cycle similar to Nipah infection in pigs might be possible.

5. Hepatitis E Virus

Hepatitis E virus (HEV), the causative agent of hepatitis E in humans. HEV was first isolated from domestic pigs in the Midwestern United States in 1997. HEV belongs to the genus Hepe virus in the family *Hepeviridae* which is composed of four distinct genotypes. Genotypes 1 and 2 HEVs only affect humans, while genotypes 3 and 4 are zoonotic (Yugo and Meng, 2013). Swine act as the reservoir for HEV and infection in swine is age-dependent with majority of the pigs infected by 4 months of age. On average, 23 per cent of swine were excreting HEV throughout the stages of production (Smith *et al*., 2011). Although HEV infection in pigs does not pose a major economical concern in swine production, the risk of zoonotic transmission to humans is an important public health concern. Consumption of undercooked or raw organs or tissues from swine has been linked to numerous cases of hepatitis E worldwide. Risk factors associated include the consumption of liver or organ meat more than once a month, contact with live swine by individuals such as farmers and veterinarians, or contact with swine products by abattoir workers (Smith *et al*., 2011). Cases of hepatitis E in Japan were also linked to the consumption of contaminated wild boar meat (Yugo and Meng, 2013). Development of an effective vaccine to immunize susceptible swine herds in the future will minimize the risk of zoonotic infection and improve pork safety.

6. Noro virus

Norovirus (NoV), belonging to the family *Caliciviridiae*, is the leading cause of acute gastroenteritis worldwide. NoVs are divided into 29 genotypes within 5 genogroups, of which GI, GII, and GIV are commonly known to affect humans. SW918, the prototype strain of NoV was detected in caecal contents of healthy adult pigs in Japan (Sugieda *et al.,* 1998). Human NoVs are genetically and antigenically related to SW918 and

other swine strains. Human NoVs have been shown to be adept at replicating in gnotobiotic pigs under experimental conditions and recombinant human NoV-like particles bind to gut epithelium of pigs (Smith *et al.*, 2011). Zoonotic transmission of NoV can occur in a bi-directional manner. Asymptomatic infection in pigs and appearance of porcine-human recombinant strains in swine presents challenges in zoonotic surveillance for swine NoV infections. The porcine NoV or human-porcine NoV recombinants can be considered at "Level 1" of potential zoonosis, considering that they can become pathogenic at a future date (Palmer *et al.,* 2005).

7. Menangle virus

Menangle virus, a new member of the family Paramyxoviridae was isolated in 1997 from stillborn piglets with deformities from a piggery in Australia (Philbey *et al*., 1998). The virus was found to be responsible for a single outbreak of reproductive disease, causing reduced farrowing rate, mummification and stillbirths with deformities. Extensive serological testing showed no evidence of any alternative cause. High levels of convalescent neutralizing antibodies to Menangle virus were detected in sera from pigs, in two humans who had contact with infected pigs and in fruit bats (*Pteropus* spp). Human illness was caused by Menangle virus, demonstrating a zoonotic potential that is yet to be fully characterized.

Conclusion

Pigs can serve as the intermediate or amplifier host for a number of novel emerging zoonotic pathogens (Pappas, 2013). Ecology and dynamics of viral infections like Nipah, Japanese Encephalitis and Influenza in swine is complex. Overlap of pig habitats with potential zoonotic host environments and increased interactions at the human–pig–wildlife interface supported transmission of infectious agents to mankind. Systematic surveillance of influenza viruses in pigs is a key measure for pre-warning the emergence of the next pandemic influenza. At this stage of global pandemic due to COVID-19,

potential harm from the new strain of H1NI has been flagged by scientists (Sun *et al*., 2020). G4EA H1N1 viruses with all hallmarks of a candidate pandemic virus is of great concern among human populations. Controlling the prevailing G4EA H1N1 viruses in pigs and close monitoring in human populations, especially the workers in swine industry should be implemented urgently. Overcoming the bias towards perceiving swine as sources of human viruses, rather than recipients, is key to understanding how the bidirectional nature of the human -animal interface produces threats to both hosts.

References

- Barrette, R.W., Metwally, S.A., Rowland, J. M., Xu, L., Zaki, S. R., Nichol, S. T., Rollin, P. E., Towner, J. S., Shieh, W. J., Batten, B. and Sealy, T. K. 2009. Discovery of swine as a host for the Reston ebolavirus. *Science*. **325**: 204-206.
- Chatterjee, P. 2018. Nipah virus outbreak in India. *The Lancet*. **391**: 2200.
- Chua, K.B., Chua, B.H. and Wang, C.W. 2002. Anthropogenic deforestation, El Niiio and the emergence of Nipah virus in Malaysia. *Malays. J. Path.* **24**: 15-21.
- Field, H., Young, P., Yob, J.M., Mills, J., Hall, L. and Mackenzie, J. 2001. The natural history of Hendra and Nipah viruses. *Microb. Infect.* **3**: 307-314.
- Garten, R.J., Davis, C.T., Russell, C.A., Shu, B., Lindstrom, S., Balish, A., Sessions, W.M., Xu, X., Skepner, E., Deyde, V. and Okomo-Adhiambo, M. 2009. Antigenic and genetic characteristics of swine-origin 2009 A (H1N1) influenza viruses circulating in humans. *Science.* **325**: 197-201.
- Jahrling, P.B., Geisbert, T.W., Johnson, E.D., Peters, C.J., Dalgard, D.W. and Hall, W.C. 1990. Preliminary report: isolation of Ebola virus from monkeys imported to USA. *The Lancet*. **335**: 502-505.
- Lam, S.K. 2003. Nipah virus-a potential agent of bioterrorism? *Antiviral Res.* **57**: 113-119. Looi, L.M. and Chua, K.B. 2007. Lessons from the Nipah virus outbreak in Malaysia. *Malays.*
- *J. Path.* **29**: 63-67.
- Luby, S.P., Rahman, M., Hossain, M.J., Blum, L.S., Husain, M.M., Gurley, E., Khan, R., Ahmed, B.N., Rahman, S., Nahar, N. and Kenah, E. 2006. Foodborne transmission of Nipah virus, Bangladesh. *Emerg. Infect. Dis*. **12**: 1888.
- Ma, W., Kahn, R.E. and Richt, J.A. 2009. The pig as a mixing vessel for influenza viruses: human and veterinary implications. *J. Mol. Genet. Med. : An Int. J. Biomed. Res.* **3**: 158.
- McLean, R.K. and Graham, S.P. 2019. Vaccine development for Nipah virus infection in pigs. *Front. Vet. Sci.* **6**: 16.
- Morikawa, S., Saijo, M. and Kurane, I. 2007. Current knowledge on lower virulence of Reston Ebola virus. *Comp. Immunol. Microbiol. Infect. Dis.* **30**: 391-398.

- Nelson, M.I. and Vincent, A.L. 2015. Reverse zoonosis of influenza to swine: new perspectives on the human–animal interface. *Trends Microbiol*. **23**: 142-153.
- Nelson, M.I. and Worobey, M. 2018. Origins of the 1918 pandemic: revisiting the swine "mixing vessel" hypothesis. *Am. J. Epidemiology*. **187**: 2498-2502.
- Palmer, S., Brown, D. and Morgan, D. 2005. Early qualitative risk assessment of the emerging zoonotic potential of animal diseases. *Bmj*. **331**: 1256-1260.
- Pappas, G., 2013. Socio-economic, industrial and cultural parameters of pig-borne infections. *Clin. Microbiol. Infection*. **19**: 605-610.
- Parashar, U.D., Sunn, L.M., Ong, F., Mounts, A.W., Arif, M.T., Ksiazek, T.G., Kamaluddin, M.A., Mustafa, A.N., Kaur, H., Ding, L.M. and Othman, G. 2000. Case-control study of risk factors for human infection with a new zoonotic paramyxovirus, Nipah virus, during a 1998–1999 outbreak of severe encephalitis in Malaysia. *J. Infect. Dis.* **181**: 1755-1759.
- Philbey, A.W., Kirkland, P.D., Ross, A.D., Davis, R.J., Gleeson, A.B., Love, R.J., Daniels, P.W., Gould, A.R. and Hyatt, A.D. 1998. An apparently new virus (family *Paramyxoviridae*) infectious for pigs, humans, and fruit bats. *Emerg. Infect. Dis.* ***4***: 269.
- Pickering, B.S., Collignon, B., Smith, G., Marszal, P., Kobinger, G. and Weingartl, H.M. 2018. Detection of Zaire ebolavirus in swine: assay development and optimization. *Transbound. Emerg. Dis.* 65: 77-84.
- Ricklin, M.E., García-Nicolás, O., Brechbühl, D., Python, S., Zumkehr, B., Nougairede, A., Charrel, R.N., Posthaus, H., Oevermann, A. and Summerfield, A. 2016. Vector-free transmission and persistence of Japanese encephalitis virus in pigs. *Nat. Commun.* **7**: 1-9.
- Smith, T.C., Harper, A.L., Nair, R., Wardyn, S.E., Hanson, B.M., Ferguson, D.D. and Dressler,
- A.E. 2011. Emerging swine zoonoses. *Vector-Borne Zoonotic Dis.* **11:** 1225-1234.
- Sugieda, M., Nagaoka, H., Kakishima, Y., Ohshita, T., Nakamura, S. and Nakajima, S. 1998. Detection of Norwalk-like virus genes in the caecum contents of pigs. *Arch. Virol.* **143**: 1215-1221.
- Sun, H., Xiao, Y., Liu, J., Wang, D., Li, F., Wang, C., Li, C., Zhu, J., Song, J., Sun, H. and Jiang,
- Z. 2020. Prevalent Eurasian avian-like H1N1 swine influenza virus with 2009 pandemic viral genes facilitating human infection. *Proceedings of the National Academy of Sciences*: 24th June, 2020.
- Tiwari, S., Singh, R.K., Tiwari, R. and Dhole, T.N. 2012. Japanese encephalitis: a review of the Indian perspective. *Braz. J. Infect. Dis.* **16**: 564-573.
- Tuno, N., Tsuda, Y. and Takagi, M. 2017. How zoophilic Japanese encephalitis vector mosquitoes feed on humans. *J. Med. Entomol.* **54**: 8-13.
- Yugo, D.M. and Meng, X.J. 2013. Hepatitis E virus: foodborne, waterborne and zoonotic transmission. *Int. J. Environ. Res. Public Hlth*. **10**: 4507-4533.

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