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Contents

1. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

STCR Recommended Fertilizer with Organic Manures for Yield of Groundnut and Sustaining Soil Health in an Alfisols

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Groundnut (*Arachishypogaea*L.) crop is native to South America. It is grown all over the world and commonly accounts the ***'King of Oilseeds'***. It is an excellent source of nutrition to both human and animal due to it's high protein content. At world level groundnut contributes to fourth major edible oil source and third major vegetable protein to human population. Seeds of groundnut is considered as rich nutritional source to human being which is composed on an average of 50 per cent oil, 25 per cent protein, 20 per cent starch and 5 per cent minerals and fiber.

India has the largest acreage (6.7 million ha) among Asian nations, followed by China (4.7 million ha). It holds head position in the worldwide oilseed scenario accounting 6.7 million hectares of total area and production was 7.4 million tonneswith the productivity of about 1.46 tonnes per ha.

Groundnut is cultivated in Tamil Nadu with the acreage of2,82,000 ha contributing to 5,82,000 tonnes groundnut production. The productivity of groundnut in Tamil Nadu is about 2.08 tonnes per ha. Approximately 85% of the total groundnut is produced from Andhra Pradesh, Gujarat, Tamil Nadu, Maharashtra and Karnataka. It is mostly cultivated in red soils (Alfisols) which is noted for the fairly low pH and EC.Organic manures are useful through farm products and associated sectors contribute to plant growth and development through their beneficial physico-chemical and biological properties impact. The potential outcomes of enhancing natural composts like FYM, poultry fertilizer, vermicompost and so on., with biofertilizers and inorganics for productivity and sustainability of the soil health.

Poultry manure contains all the essential plant nutrients and it improves the soil fertility. The composted poultry litter is considered as a low-cost manure as it contains higher macro and micronutrients and owing to this reason, poultry litter is widely used in meeting out the nutrient demands of various agricultural systems.

Rhizobium spp. inoculants have favourable effect on legumes like groundnut. Immunization and nodulation upgrades N fixation and activation of starch and carbohydrate synthesis, amino acids.

Humic acid (HA) could be a essential element an intimate a part of the organic soil structure and improves soil and plant growth characteristics. Humates are most sensitive in elevated carbohydrate plants such as groundnut, potatoes, carrots and corn, etc. Humic acid

includes 51-57% C, 4-6% N and 0.2-1% P and other micronutrients in minute quantities. Applying 20.0 kg ha-1 ofhumic acidto the soil can bring significant increases in crop yields (up to 20 per cent) and improvements in soil physico-chemical property.

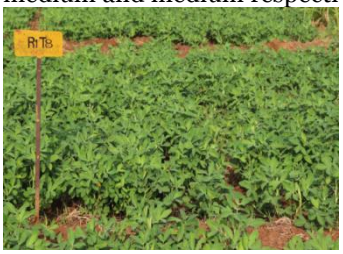
Regular and imbalanced application of inorganic nutrient sources by omitting organic leads to reduction in soil health besides restricting groundnut productivity and hence it is vital to improve the soil health by enhancing soil organic matter content.The lack of well-decomposed organic sources such as manure from poultry, manure from farms, rhizobium and humic acid contributes to low production. Organic amendments with inorganic fertilizers need to attain more productivity of groundnut and sustaining soil health.

The study on "Effect of organic and inorganic sources of nutrients on growth, yield and quality of groundnut (*Arachishypogaea*L.)in an Alfisols of the Tamiraparani Tract" was undertaken at Agricultural College and Research Institute, Killikulamwith the following major objectives.

- To study the influence of organic and inorganic nutrients on growth, yield and quality
- of groundnut.
- To work out the economic benefit of groundnut.

Characteristics of Alfisol

Alfisols are highly weathered soils and usually has low clay content. Kaolinite and illite are the predominant clays of alfisols. Most are sandy loams with high clay alluvium below the layer of plough. The red soils contain mostly kaolinite clay minerals, having less CEC and moisture retention capacity. The NPK status of the soil is low, medium and medium respectively.



The most predominant great-groups in Tamil Nadu are Haplustalfs, Rhodustalfs and Paleustalfs. They usually occur in middle slopes of hills and higher terrace. Alfisols has more than one horizon, which is very deeper and one of the following within the upper 15 cm *viz.*, argillic, nitric, glossic or kandic horizon. Alfisols have CEC of 20 c mol (p+) kg ha^{-1}, low saturated hydraulic conductivity in the argillic horizon and more than 35 per cent volume in surface soil. It has a hue of 7.5 YR. Alfisols are red soils that are usually productive in Tamil Nadu, covering an area of 3,16,600 ha (30.3%).These soils are distributed in all the oilseeds crops growing districts of Tamil Nadu. Alfisols occupy a higher proportion of cultivable soils of Tirunelveli and Thoothukudi districts.

The organic manures *viz.,* poultry manure, rhizobium and humic acid were combined with inorganic fertilizers.

The field experiment was laid out in randomized block design (RBD) replicated thrice with using test crop of groundnut TMV 13 variety. According to the Crop Production Guide (2014), the cultural activities were also followed. The main objective of the study was to find the effect of organic and inorganic sources of nutrients on yield of the groundnut and sustainability of soil health in an Alfisols of Tamiraparani tract.

The growth attributes in all stages were recorded. The yield and yield components,nutrient uptake were analysed. The soil fertility status was also assessed after post harvest ofcrop. The economics of the different treatments were also worked out to benefit : cost ratio.

The highest pod and haulm yield 2938.17 and 8936.50 kg per ha was obtained from the treatment applied with the fertilizer as 75% STCR + Rhizobium3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1}+ Poultrymanure @ 3 t ha^{-1}.

The highest oil and protein (50.24 and 25.72 %) content was obtained from the treatment applied with the fertilizer as 75% STCR +Rhizobium 3 kg ha^{-1} + Humic acid @ 20 kg ha^{-1}+ Poultrymanure @ 3 t ha^{-1}.Similarly the treatment recorded the highest oil and protein yield (1018.13 and 540.97 kg ha^{-1}).

The highest values of available NPK (278.32, 16.53 and 291.40 kg ha^{-1}, respectively) were obtained in treatment applied with 75% STCR + Rhizobium @ 3 kg ha^{-1} + Humic acid @ 20 kgha^{-1}+ Poultrymanure @ 3 t ha^{-1}.

The maximum net income (₹72433) and B:C ratio (2.46) were recorded with the application of fertilizer as 75% STCR + Rhizobium @ 3 kg ha^{-1} +Humic acid @ 20 kg Poultrymanure @ 3 t ha $^{-1}$.

From the result of this experiment, it can be concluded that the application of STCR recommended fertilizer as 75% STCR + 3 kg of Rhizobium ha^{-1} + Poutry manure @ 3 t ha^{-1} + 20 kg of Humic acid ha^{-1}is effective to maximize the yield and income of groundnut farmers of Alfisols ofthe Tamiraparani tract.

2. AGRONOMY

Doubling the Farmers Income- A Way for Sustainable Growth

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Agriculture is the mainstay of the Indian economy because of its high share in employment and livelihood creation. Agriculture in India engages nearly 119 million of farmers and 144 million landless labourers (Census 2011). In India about 80 percent of the farmers comesunder the small and marginal category (Agriculture Census, 2012) and the average size of land holding is 1.15 ha.It will decrease even more in upcoming years due to land fragmentation, industrialization and urbanization which are discourage farmers in farming activity. (Bhattacharyya *et al.,* 2018).Based on the estimates, the real income grew at the compounded rate of3.94 per cent per annum during 2004-05 to 2011-12 which is thefastest when compared to previous two decades. It took 18 yearsfor the income to double as income grew at the rate of 3.94 per cent (Chand*et al.,* 2015). At present the population of India gets increased in a drastic way. To feed the entire human population and to improve the standard of the farmers need to adopt new interventions and initiatives with improved technologies which attracts the young educated generationtowards agriculture.

Productivity of Major Crops Across Various Districts in the State

	Crop State average (kg/ha)	Highest (kg/ha)	lowest (kg/ha)
Rice	3532	3969(West Godavari)	1687 (Visakhapatnam)
Jowar	2435	6884 (Guntur)	304 (Anantapur)
Bajra	1366	2674 (SPS Nellore)	587 (Anantapur)
Maize	6390	7691 (Prakasam)	2731(Visakhapatnam)
Red gram	503	1558 (Guntur)	129 (Anantapur)
Bengal gram	1144	2303 (Guntur)	568 (Anantapur)
Ground nut	564	4538 (Guntur)	306 (Anantapur)
Sunflo	803	1125 (SPS Nellore)	334 (Anantapur)

wer			
Castor	575	1432 (Guntur)	440 (Prakasam)
Sugarcane	71847	116794 (Kurnool)	48330(Visakhapatnam)
Cotton	570	886 (Guntur)	239 (Anantapur)

(CMFRI, 2020)

From the above information we can clearly understand that, there is wide gap between crop production and productivity this can be reduced by adopting innovative and new technology for crop production.

Reason for Low Income of the Farmers

- Low resources availability
- Lack of marketing infrastructure
- High amount of post harvest losses
- Limited scope of farm mechanization
- Imbalance and more use of chemical fertilizer and pesticides
- Natural calamities
- Low productivity
- Higher production cost
- Lack of awareness among the farmers about new innovation and technology

Specific Strategies for Doubling Farmers' Income

Market Management

Like Agricultural price policy, post-harvest management, contract farming, Establishment of terminal market, National agriculture market and farmer producer organization.

Agricultural Input Management

Climate smart agriculture, risk management, bridging yield gap, use of biotechnology for enhancing yield, enhancing income by improving yield of crops, integrated farming system, increase in cropping intensity and agricultural productivity, easy availability of improved quality seed, soil test based nutrient management, water and weed management and crop insurance.

Reference

Bhattacharyya S., Burman R. R., Sharma J. P., Padaria R. N., Paul S. and SinghA. K. 2018. Model villages led rural development: A review of conceptual framework and development indicators. Journal of Community Mobilization and Sustainable Development 13(3): 513-26.

Chand, Ramesh, SaxenaR. and RanaS. (2015): Estimates and Analysis of Farm Income in India, 1983-84 to 2011-12, Economic andPolitical Weekly, May 30, 32.

CMFRIK. (2020). State Specific Strategies for Doubling Farmers Income-2022.

3. GENETICS AND PLANT BREEDING

Quality Breeding in Forage Crops for Livestock

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India has agriculture based economy and farming and livestock forms an integral part of rural living. India provides about 20% of the total world livestock and shares 16% of cattle population over the world i.e. a leader country in animal husbandry.The fodder crops are plant species cultivated for feeding the animals and contribute an important role in livestock industry. These crops are used in the form of forages as cut green and fed fresh, silage and hay to the animals.

Forage crops are broadly cereal fodder, leguminous, annual and perennial grasses and tree fodders. Important forages pertaining to our country includes fodder maize, fodder sorghum, fodder pearl millet, cowpea, lucerne, napier grass, guinea grass, cumbunapier hybrid, and *Stylosanthus*.Maize, pearl millet and sorghum are considered ideal forage because of C_4 nature they grow quickly, produce high yields, and the biomass is palatable, is rich in nutrients, suitable for silage making and help to increase body

weight and milk quality in cattle.

Cowpea and Lucerne are the leguminous fodders that are highly nutritional and short duration in growth. They are high in protein content and have reduced fiber portions conferring increased digestibility, palatability and intake rate. Among the grass fodders Cumbunapier hybrid has revolutionized the livestock industry. CO_4 variety of Cumbunapier hybrid is ideotypically obsessed with ideal features of ultra- soft, less fibrous with sugary juice, making the fodder more palatable. With green fodder yield of 382 t/ha/year the variety paved way for dairy farmers to triumph in their contribution to white revolution.

Themajor quality characteristics of forage are determined by Forage intake potential with good nutrient composition, digestibility, voluntary intake, and lack of anti-nutritive factors.

Forage Intake Potential: The amount of forage consumed is the major determinant of production by animals fed forage-based diets. Intake often accounts for more than twice as much variation in animal performance as do herbage digestibility. Physical limitations occur when animals eat until the rumen is full. Therefore, physical fill limits intake of forages with high NDF (an estimate of cell wall) concentration when fed to animals with high energy demands, such as high producing dairy cows. This is why NDF concentration is negatively related to intake potential of forage.

Nutrient Availability: Constituents in plants that provide most of the energy for animals are carbohydrates, proteins, and lipids. The portion that is digestible is more important in determining energy availability to animals. The most meaningful division of plant dry matter into energy-yielding components for animals is between cell walls and cell contents. The reason that legumes are more digestible than grasses is because they contain less cell wall material, not that their cell walls are more digestible. Digestibility, expressed as dry matter, organic matter, energy, or total digestible nutrients, is the most commonly used index of energy availability.

Herbage Age: There is usually a strong correlation between herbage age (time following initiation of spring growth or since previous harvest) and digestibility for most spring grown, cool season forages (20). As plants advance in maturity, the leaf:stem ratio usually decreases. Additionally, cell wall concentration within stems and most leaves increases, and digestibility decreases with age.

Voluntary Intake of Dry Matter: Productivity of ruminants depends on their ability to consume and extract usable energy from available feeds. However, voluntary dry matter intake (VDMI) may be limited for ruminants consuming forages as a result of restricted flow of digestion through the gastrointestinal tractresulting in decreased intake.

Lack of Anti-Nutritive Factors: Some of the anti-nutritional substances often present in the forage crops causing ill effects on the health of the cattle include nitrate, oxalates, saponins, tannins, cyanogen, glucosinolates, mimosine etc. Conventionally, we screen a large germplasm for minimum content of these components to develop a forage crop variety. In addition to this, we have advanced techniques of QTL analysis, marker assisted selection (MAS) and gene knock-out methods for eliminating these compounds.

Breeding Objectives

The major breeding objectives include:

- high dry matter yield
- better quality components– crude protein content, in-vitro dry-matter digestibility, low percentage of neutral detergent fiber and toxicity,
- high response to inputs,
- tolerance to adverse soils- acidic/saline soils, tolerance to extreme weather conditions – high rainfall/ low moisture regime,
- resistance to diseases and insect-pests,
- greater persistence summer persistence in annual multi-cut forages,
- greater aggressiveness/ fast growth and competing ability or complementation with the companion crops

Breeding forage crops for quality could be rightly progressed with standardized methods for quality assessment and by understanding of the gene action governing the traits. According to the

pollination behavior of the crop breeding methodologies such as Plant Introduction, selection, Pedigree breeding, multiline varieties, synthetic varieties and hybrid breeding could be followed.

The successful fodder varieties released from different parts of our country are mentioned in the following Table.1.

Table 1. Ruling Forage crop varieties of India

Crop	Varieties released	Crop	Varieties released
Maize	African Tall Composite	Fodder Sorghum	CO 27
	APFM-8		K 11
	J-1006		CO (FS) 29
	PratapMakka Chari 6		
Fodder Cowpea	CO 5	Cumbu Napier	KKM 1
	CO (FC) 8		CO 3
		hybrid	CO (CN) 3
Lucerne	CO 1		

Though there exist breeding limitations in forage crops such as non-synchronous flowering, overlapping of vegetative and reproductive growth, apomictic nature, incompatible to crossing etc., Forage crops paves a wide potentials for the plant breeder to exploit their skills and significantly influence the livestock industry.

References

Babu, C., K. Iyanar,S.D. Sivakumar and K. Ganesamurthy. 2018. Forage Crops and Dairying. ISBN No. : 978-93-83799-91-6.

Vinutha, K.S., G.S. Anil Kumar, Michael Blümmel and P. SrinivasaRao. 2017. Evaluation of yield and forage quality in different sorghum and pearl millet lines. 2017.Tropical Grasslands-ForrajesTropicales, Vol. 5(1):40–49.

4. AGRICULTURAL MICROBIOLOGY

Role of Potassium in Plants and its Management through Potash Mobilizing Bacteria (*Frateuriaaurantia*)

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Introduction

Potassium is involved in large number of physiological processes like osmoregulation, cation-anion balance, protein synthesis and activation of enzymes. Being a major inorganicsolute, it plays a key role in the water balance of plants. It also reduces lodging, imparts disease resistance and improves the quality and shelf life of crop produce. Considering its role in crop production potassium is regarded as major element.

Nutrient potassium (K) is less mobile in soils because of the strong affinity with some exchange sites of clays. Large rates of K uptake can be attributed to its high mobility due to the large permeability of cell membranes to K-ions, which arise from the occurrence of a range of highly K selective, low and high affinity ion channels and transporters. The large K uptake rates achieved by roots result in a steep depletion of solution K in the rhizosphere region. It has been well established that a significant proportion of plant needs of K is met from non-exchangeble fraction of soil K (Srinivasarao et al., 2010). At agronomic level, the demand for K largely varies with plant species and productivity. The large portion of K uptake essentially occurs during the vegetative stage and can reach values of 10 kg/ha/day and above.

It is accepted that Indian soils are rich in potassium and a profitable response to applied K has not always been observed so as to warrant blanket application (Ghosh and Hasan, 1976). The fertilizer K use has tremendously been increased from 29000 t in 1960-61 to 3312000 t in 2008-09. Scrutiny of the past and recent information on K status over four decades showed that there is a gradual decline in K status in Indian soils from high to medium and medium to low status. As a result wide spread K deficiency

in soils and crops were observed in recent times.

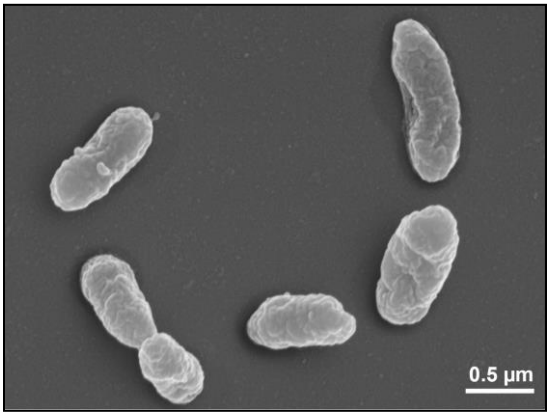
Functions of Potassium in Plants

Potassium plays a vital role in the formation of amino acids and proteins from ammonium ions, which are absorbed by roots from the soil. It is also responsible for the transfer of carbohydrates, proteins, etc., from the leaves to the roots. Potassium plays a major role in the uptake of other elements particularly nitrogen, phosphorus and calcium, potassium regulates the permeability of the cellular membrane. It increases the hydration of protoplasm. Potassium increases the resistance of crops to hot and dry conditions and insect pests' occurrences. It increases the stiffness of the straw in cereals and therefore the lodging of cereals is reduced.

Potassium is most connected to with the quality of seeds and fruits. It converts the starch into sugar due to which sweetness of fruits, sugar crops increases. It is necessary for early ripening of crops. Its use improves the quality of fruits and vegetables and they can be stored for a longer period of time. Potassium deficient in plants has a stunted and bushy growth. In deficient plants, the height of plant is negatively affected and plant remains short. Tips and edges of the leaves become burned. There is a reduction in sweetness and juice of fruits occurs in potassium deficient plants. Lack of potassium causes the water stress in light drought conditions.

Intensive cultivation with mere use of high dose of fertilizers without adequate organic manures depletes the micronutrient status of the soil as well. Further it leads to a decline in organic carbon status of the soil resulting in natural nitrogen fixation or nutrient solubilization or mobilization like phosphorus and micro nutrients. Therefore, it's time to explore the feasibilities of tapping the natural resources available in the soil to sustain the soil fertility and crop productivity. Biofertilizers therefore has become an inevitable and integral part of integrated nutrient management or integrated plant nutrient supply system.

Potash mobilizing bacteria (*Frateuriaaurantia*), a microbe is predominant and plays a vital role in help plants in potassium uptake. The bacteria belonging to the family pseudomonaceae and the salient features of the bacteria ar



- Gram negative bacteria
- Rod shape and motile
- Growth from 15°C to 42°C temperature
- It could grow from pH 3.5 to 11.0
- It can be grown upto 7% NaCl concentration
- It is able to grow in anaerobic conditions
- It could produce acid from the following carbohydrates Dextrose, Fructose, Galactose, Lactose, cellobiose and insulin.

Beneficial free living soil bacteria isolated from the rhizosphere of the plants, which have been shown to improve the plant health or increase yield are usually referred to as plant growth promoting rhzobacteria. Frateuriaaurantia also to be considered as PGPR.

Method of Application

Potash mobilizing bacteria could be applied individually however, it is recommended along with nitrogen fixers like rhizobium, azospirillum and with phosphorus solubilizers will respond more with co- inoculants and soil application is prepared. The following are the method of application of potash mobilizing bacteria in soil and plants (Krishan Chandra, 2010).

Seed treatment	:	Mix 3.5 ml of potash mobilizing bacteria (KMB) liquid formulation in sufficient water and coat the seeds (1 kg) well with this solution and shade dry for half an hour before sowing

Seedling dipping	:	Mix 50 – 100 ml of KMB liquid formulation in 10-20 litres of water and dip the seedlings for 30 minutes before transplanting
Sett dipping	:	Mix 200 ml of KMB liquid in 25-30 litres of water and dip the sets required for 1 acre for 30 minutes before transplanting
Soil application	:	250 – 500 ml of KMB liquid formulations can be mixed with 100 kg of well decomposed farm yard manure. Blend the mixture well and broadcast it over one acre of land before last ploughing or first irrigation. Same quanitity of Azotobacter for nitrogen, phosphorus solubilizing bacteria for phosphorus nutrients could be applied for better results
Drip irrigation	:	500 ml of KMB liquid formulation recommended for one acre of land

For better results, the potash mobilizing bacteria can be used with any other biofertilizers in combination.

Advantages of Potash Mobilizing Bacteria Biofertilizers

- Reduce cost of potash application by 50 – 60 percent
- Improves resistance of crop plants
- Suitable to a wide range of soil pH and temperature
- Improves crop growth and yield by 20 – 30 percent
- Compatible with other beneficial microbes in the rhizosphere
- It encourages early root development and enhances soil health and soil fertility
- Also secretes growth hormones to increase crop productivity
- Benefits to the next crop also due to its residual effect

The available potassium present in the soil showed shifted from medium to high in 1960-70 and now it's become high to medium. Recent studied showed that the potassium availability or availability in red, lateritic soil is depleted continuously. Crops grownon these soils were found to suffer from potassium deficiency. The potassium deficiency in crops grown on these soils is further aggravated by imbalanced potassium use by farmers. Potash mobilizing bacteria is an alternative source for tapping the potassium nutrient available in the soil. Integrated nutrient management practices along with potash mobilizing bacteria would helpful to minimize the potassium fertility depletion and maintain productivity and sustainability and also economize the fertilizer cost.

5. GENETCIS AND PLANT BREEDING

Heterotic Groups and Heterotic Patterns

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Introduction

The greatest contribution of plant genetics to the advancement of agricultural technology over the past century has been the use of heterosis in crop breeding and production. For a hybrid breeding effort, knowledge of heterotic groupings of germplasm is crucial. To fully utiliseheterosis for the creation of hybrid cultivars, various heterotic groups of germplasm must be assigned. Similar to this, knowledge of genetic diversity is essential for hybrid breeding and population improvement projects in order to characterize the germplasm, determine their level of genetic diversity, and divide them into several heterotic groupings. It is preferable to group the germplasm into heterotic groups for an effective hybrid breeding effort.

Concept ofHeterotic Groups and Pattern

Heterotic group:

Melchinger and Gumber (1998) defined a heterotic group —as a group of related or

unrelated genotypes from the same or different populations, which display similar combining ability and heterotic response when crossed with genotypes from other genetically distinct germplasm groups.

HeteroticPattern:

Heterotic pattern refers to a specific pair of two heterotic groups, which express high heterosis and consequently high hybrid performance in their cross. The concept of heterotic patterns includes the subdivision of the germplasm available in a hybrid breeding program in at least two divergent populations, which are improved with inter-population selection methods.

Need of Grouping

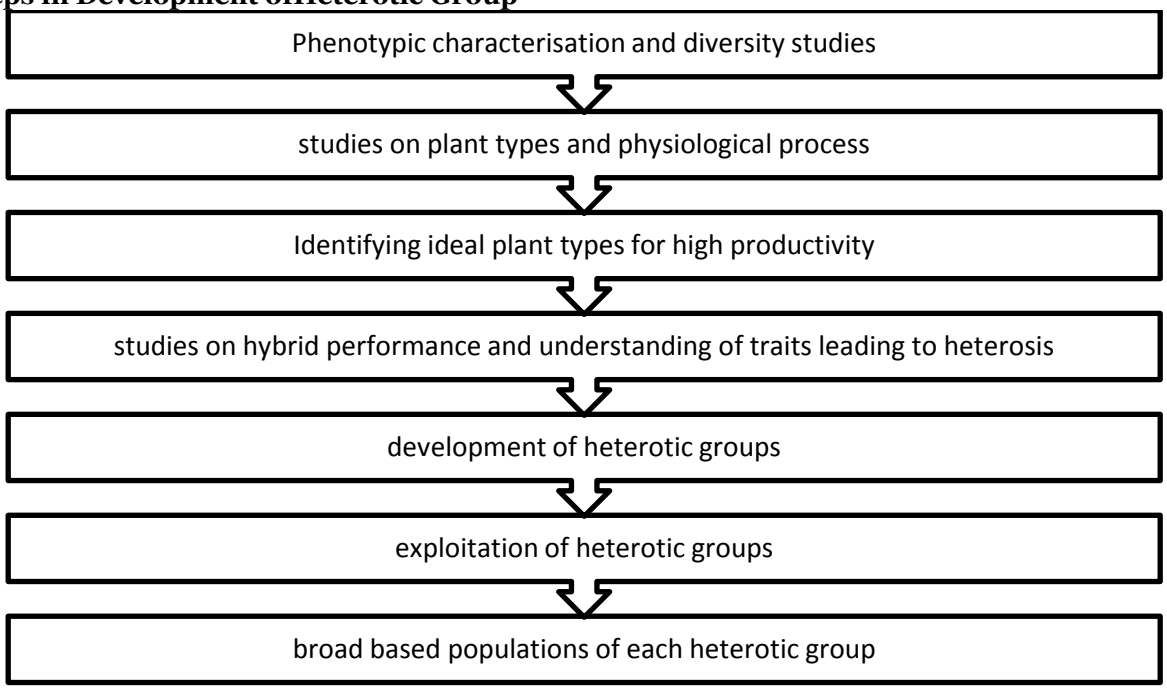
- For a hybrid breeding effort, knowledge of heterotic groupings of germplasm is crucial.
- To fully utiliseheterosis for the creation of hybrid cultivars, separate heterotic groupings of germplasm must be assigned.
- In a similar vein, knowledge of genetic diversity is crucial for hybrid breeding and population improvement projects in order to evaluate the degree of genetic variety, characterize the germplasm, and divide it into several heterotic groupings.
- It is ideal to arrange the germplasm into heterotic groups for a successful hybrid breeding effort.

Criteria for the Identification of New Heterotic Groups and Patterns

Several criteria have been suggested to choose promising heterotic groups:

- high mean performance and large genetic variance in the hybrid population in the target region(s)
- high per se performance and good adaptation of the parent populations
- higher ratio of the variance due to general (σ2 GCA) versus specific combining ability (σ2 SCA).
- Low inbreeding depression in the source materials for the development of inbreds
- A stable CMS system without deleterious side effects, as well as effective restorers and maintainers, if hybrid breeding is based on cytoplasmic male sterility.

Steps in Development ofHeterotic Group



Various Methods toDevelop Heterotic Groups

1. **Pedigree analysis:**The heterotic pattern boosts the effectiveness of hybrid development, inbreeding recycling, and population growth. Based on a pedigree and geographic examination of inbred lines employed in the Corn Belt, the Reid and Lancaster groups were recognised. Based on pedigree research, Wu (1983) tried to categorise inbred lines into four or five groups and anticipate the heterotic patterns that were prevalent in China.
2. **Quantitative Genetic Analysis:**Melchinger (1999) examined the various methods for categorising and locating heterotic groups. In tropical and temperate corn, diallel or factorial designs have been utilised when there were few people or groups. In order to improve combining ability, hybrid breeding in maize and other cross-pollinated crops involves the development of hybrid oriented heterotic populations.
3. **Geographical Isolation Inference:**The two populations' different geographic origins played a role in the cross's high grain yield. Heterotic rice hybrids typically descend from parents with different ecotypes or distant geographic origins. Based on wild abortive (WA) male sterile cytoplasm, two heterotic groups—early season indica from southern China and midor late season indica from Southeast Asia—were found for three-line hybrid rice in the earlier stages of growth in China (Yuan 1977).
4. **Use of Molecular Markers:**Genotyping and cluster analysis of extracted genotypic DNA from the mutants and respective parents from their young leaves (1 to 2 weeks after seed germination), using the Cetyltrimethyl ammonium bromide (CTAB) method.

   A very new method to develop heteroticgroups is suggested by Patil

- This basic formula: HF1 = Σdy2 explains how performance (heterosis) of hybrid depends on genetic diversity and extent of dominance existing at different yield influencing loci.
- Development of hybrid oriented heterotic populations and application of schemes for improving combining ability is an integral part of hybrid breeding in maize and other cross pollinated crops.
- In the recent years the concept of developing heterotic populations is put to test in self-pollinated crops like cotton.

Future Research into Heterotic Patterns and Groups

- To enrich the germplasm pool
- To create a straightforward, more effective technique for detecting heterotic groupings and patterns.
- To describe the molecular processes and genetic relationships behind heterotic patterns. The identification and use of heterotic pattern is the single most crucial component of a breeding programme.

References

Singh, S., Gupta, SK. 2019. Formation of heterotic pools and understanding relationship between molecularheterosis in pearl millet [*Pennisetumglaucum* (L.) R. Br.]. *PLoS ONE* 14(5):e0207463. .https://doi.org/ 10.1371/journal.pone.0207463

Meena, A.K., Gurjar.D 2017.Concept of Heterotic Group and its Exploitation in Hybrid Breeding. *International Journal of Current Microbiology and Applied Sciences* Volume 6:pp61-73.

Singode. A., Manivannan, A. 2017. Heterotic Grouping in Early Maturing Indian Maize Lines. *International Journal of Agriculture Innovations and Research .VOL 6 :2319-1473*

Reif ,J.C., Hallaeur, A.R .2005. Heterotic Patterns in Maize. *Maydica 50*:215-223

6. HORTICULTURE

Post HarvestManagement and Handling in Different Vegetable Crops

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Introduction

The term postharvest losses are defined as "losses that occur after harvest till the produce reaches consumers. It can be quantity as well as qualitatively losses.

Reasons for Postharvest Losses

- Moisture loss causing wilting / shrinkage
- Loss of photosynthates like carbohydrates, proteins occur
- Physical damage through pest and diseases attack
- Physiological loss such asFibre development, Greening (Potato), freezing, bruising.

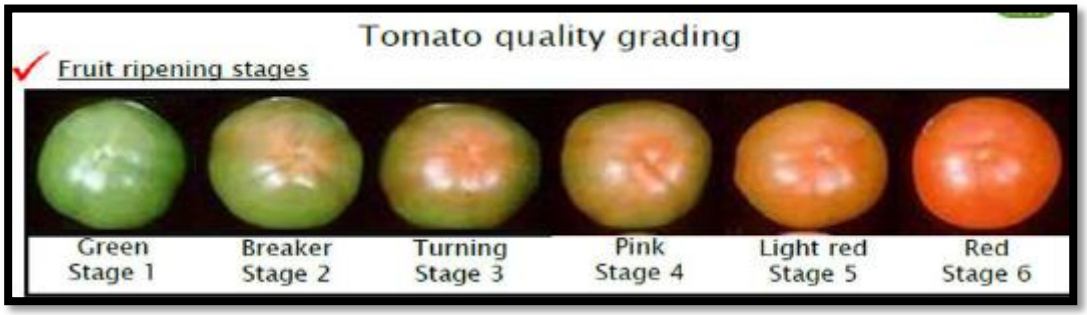
Leaf breakage and crushing

Fruit cracking and rotting

Improper transport

Minimisation of Post-Harvest Losses by Various Technological Adoptions

1. **Selection of Varieties:** Varieties with better keeping and processing quality and lesser handling susceptibility should be bred and selected for different vegetables. A few examples of varieties with long shelf life are Arka Vishal, PusaGaurav (Tomato), ArkaNidhi and ArkaNeelakanth (Brinjal).
2. **Harvesting:** Harvesting at optimum stage of maturity ensures maximum quality and yield. Care must be taken to avoid mechanical injury to product.
3. **Sorting/Grading:** Sorting of harvested vegetable produce is done to remove diseased, damaged, misshapen, over mature, insect attacked and rotten vegetable.



4. **Washing:** The Produce is cleaned/washed to remove adhering dirt, dust, insects, mould and spray residues and to improve appearance.
5. **Trimming:** Trimming is done in crops like cabbage and lettuce etc. To remove

unwanted, discolored, rotten and damaged parts. Trimming enhances visual quality, reduces deterioration of produce, and facilitates handling packaging and transport.

6. **Curing:** Curing is a drying process for toughening of outer skin and tightening of necks(onion &garlic). Potato curing is most effective at about 20°c and 80% relative humidity.
7. **Waxing:** Waxing is done mainly to minimize water loss and reduce shriveling and wilting to enhance therefore storage life. Some of the common coating materials are prolong and waxol. Vegetables like tomato, brinjal, sweet pepper, cucumber, muskmelon, carrot are often waxed
8. **Precooling:** Pre-cooling is the process of removing field heat from the harvested commodity, particularly when harvested during hot weather. There are several methods of pre-cooling process as Room cooling, Hydro-cooling, Contact icing, Vacuum cooling.

Hydro cooling

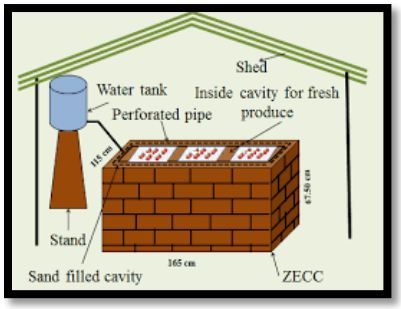
Vacuum cooling

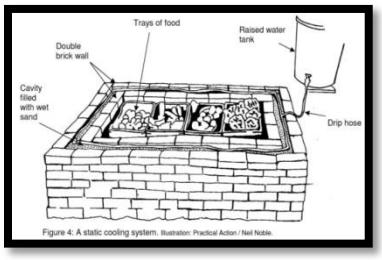
9. **Post- Harvest Disease Control:** Succulence of vegetables makes them prone to infection by micro-organisms Mechanical injuries, contamination by diseases vegetables, heat and other environmental agencies pre-dispose products to diseases. Post-harvest diseases can be controlled by use fungicides as sprays or dips.
10. **Sprout Inhibition:** Sprouting is a growth resumption process. Sprouting causes huge loss due to respiratory utilization of substrates. Maleic hydrazide (MH-40), Methyl naphthalene acetic acid (MENA) and 2,3,4,6 tetra nitro benzene (TCNB) are commonly used as sprout inhibitors.
11. **Packaging:** It improves storage life of produce and provides greater attraction to the produce. packaging material should provide cushioning to fresh produce as several types like bamboos baskets, sacks (mode of plastic or jute),wooden crates, corrugated fibre board (CFB) cartons are used. Vegetables mostly bamboo baskets, gunny bags, plastic crates are used for packaging purposes.

12. **Transport:** Transport of produce during cool hours of night, use of ventilated, insulated evaporative cooled or refrigerated vehicles ensures preservation of quality.

13. **Waxing:** Vegetables such as tomato, brinjal, sweet pepper, cucumber, muskmelon, carrot etc. are often waxed with a water emulsion by dipping or spraying to retard the moisture loss from the product.
14. **Marketing System:** Vegetable market is often suffering from several constraints due to their high perishable nature, season market and bulky nature. Very often the products are formed to dispose of their produce at a very nominal price where there arises a seasonal glut due to these bottle necks. Hence, close co-ordination among Agricultural Marketing Board, National Horticulture Board and state department of agriculture/Horticulture should be ensured to formulate an action plan for regulating marketing of vegetables in a smooth and streamlined way.
15. **Storage:** Storage of vegetable produce an important for improving shelf life avoiding market glut and to ensure supply throughout the year and increase profit to the producers. Different methods of storage of vegetable produce like Refrigerated storage, Controlled/Modified atmosphere, Hypobaric storage andZero-energy cool chamber.

Zero-Energy Cool Chamber: In tropical areas like India, tremendous amount of quality deterioration take place immediately after harvest of produce due to lack of on farm storage facilities to overcome this problem, low cost environmental friendly zero energy cool chambers are developed by IARI New Delhi these chambers work on principle of evaporative cooling using locally available materials like brick sand and bamboos. The temperatures in these chambers are less than surrounding atmosphere. These chambers can be used for short term storage of products at the farmers field itself.





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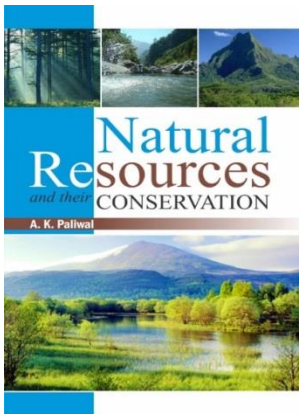

7. SOIL SCIENCE

PotentialofBiofertilizerstoReplaceChemicalFertilizers

Shalini[1] and Vimalashree, H.[2]

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Introdution

A biofertilizer is a substance which contains living microorganisms, when applied to seed, plantsurfaces,orsoil,colonizestherhizosphere ortheinteriooftheplantandpromotesgrowthb yincreasingsupply or availability of primary nutrients to the hostplant.

Bio-fertilizersaddnutrientsthroughthenaturalproc essesofnitrogenfixation,solubilizingphosphor us,and stimulatingplant growththrough the synthesisof growth-promotingsubstances.

WhatisBiofertilizer?

- Biofertilizersarenaturalfertilizersthat aremicrobialinoculantsofbacteria,alg aeandfungi(separatelyorin combination).
- whichmayhelpbiologicalnitrogenfixa tionforthebenefitofplants.Theyhelpb uildupthesoilmicro-flora and therebythe soil health.
- Biofertilizeralsoincludeorganicfertili zers (manure,etc.)
- Useof bio-fertilizeris recommendedforimprovingthe soilfertility inorganic farming

DisadvantagesofChemicalFertilizers

1. Chemicalfertilizerisafertilizercomposedo fnon-organiccultivatedelementsthatstimulatet hegrowthof crops
2. Theyconsistofchemicalnutritionalelemen tsthatareartificiallyextracted
3. Chemicalfertilizersareuniformandconsta ntincompositionandworkfasterthanorga nicfertilizersbecausethey almost immediatelydissolvein water however,they work for ashort time
4. Theycannot provideplantswith thenecessary nutritionfor along time.
5. Noorganicmaterial isaddedto thesoil, sothesoillifewill notbeenrichedorstimulated
6. Asthechemicalfertilizersareverysalty,theyextr actthemoisturefromthe soil
7. inorganic fertilizers-Inorganic fertilizers are actually artificial or synthetic fertilizers. When plants arein dire need of nutrients because they are already dying, an inorganic fertilizer is the most immediatesolutionto infusenutrients immediately to theplants.

Conceptof Biofertilizer

To overcome the disadvantages of chemical fertilizers concept of organic farming in which biofertilizersascomponent included.

- Biofertilizer concept goes back as early as 300BC when our ancestors realized the importance oflegume crops bearing nodules. The perspective of biofertilizer came into existence through discoveryofmanyorganismscapableofnitr ogenfixation,P-solubilization,P.mobilization,potashsolu bilization andmicronutrient transformation in the soil. Legume root nodules33 Rhizobiumbacteria inside nodule. The role of biofertilizers assumes special significance due to increased cost ofchemicalfertilizers and their ill effects on soil health.
- Thetermbiofertilizerreferstopreparationc ontaininglivemicrobeswhichhelpsinenha ncingthesoil fertility either by fixing atmospheric nitrogen, solubilization of phosphorus or decomposingorganicwastesor byaugmenting plantgrowthby producinggrowth hormoneswiththeir biological

TypesofBiofertilizers

1. Bacteria:

Symbiotic nitrogen fixers.eg.:*Rhizobium, Azospirillum*spp.Freelivingnitrogenfixers.eg.:*Azo tobacter,Klebsiella*etc.

2. Algalbiofertilizers:

BGAinassociationwithAzolla andAnabena,Nostoc,Ocillatoria

3. Phosphatesolubilisingbacteria: Pseudomonas,Bacillusmegaterium
4. Fungalbiofertilizer:VAM
5. Earthworms

PotentialforUse ofBiofertilizersinIndiaStateWise

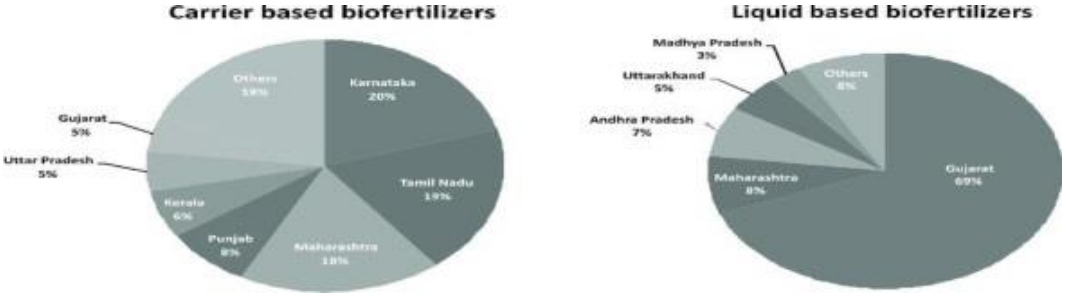

Figure3:ImageshowinguseofbiofertilizersinIndia(Statewise),whichshowthereismorepotentialto use biofertilizers in replaceofchemicalfertilizers in agriculture. ment.

ImportanceofBiofertilizers:

Sustainable agriculture is the act of farming using principles of ecology, the study of relationshipsbetween organisms and their environment. Biofertilizer are microorganisms that help plants to grow byincreasing the quantity of nutrients. Biofertilizer are defined as preparations containing living cells orlatent cells of efficient strains of microorganisms that help crop plants for the uptake of nutrients bytheirinteractions in therhizosphere.Some importanceofthesebiofertilizers isgivenbelow:

1. **IncreasingYields**
   a. Averageincreasecropyieldsby20to30 percent.
   b. Algae-basedfertilizershaveimprovedyieldsi nriceat rates ranging between 10 and 45%.
2. **ImprovingsoilStructure**:
   a. Useofmicrobialbiofertilizersimprove sthesoilstructurebyinfluencingtheag gregationofthesoilparticles
3. **BetterWaterRelation**
   a. Arbuscularmycorrhizalcolonizationi nducesdroughttoleranceinplantsby
      i. improvingleafwaterandturgorpo tential,
      ii. maintainingstomatalfunctioning andtranspiration
      iii. increasingrootlengthanddevelop
4. **LoweringProductionCosts**
   a. Made from easily obtained organic materials such as rice husks, soil, bamboo,andvegetables etc.
   b. Reducetheinputexpensesbyreplacingthe costofchemicalfertilizers.
5. **FortifyingtheSoil**
   a. Aquaticcyanobacteriaprovidenaturalgro wthhormone,protein,vitaminsandminera lstothesoil.
   b. Azotobacterinfusethesoilwithantibioticpe sticideandinhibitthespreadofsoil-bornediseaseslikepythiumand phytophthora.
6. ImprovingSustainability
   a. Biofertilizerstrengthen thesoilprofile.
   b. leave watersourcesuntaintedand
   c. Edifyplantgrowthwithoutdetrimentalside -effects.

AdvantagesofBiofertilizers

- Renewablesourceofnutrients
- Sustainsoilhealth
- Supplementchemicalfertilizers.
- Replace 25-30% chemical fertilizers increase the grain yields by 10-40%. Decompose plantresidues,and stabilizeC:N ratio of soil
- Improvetexture,structureandwater holdingcapacityofsoilNo adverseeffectonplant
- growthandsoilfertility.

- Stimulatesplantgrowthbysecretinggrowthhormones.Secretefungistaticandantibioticlikesubstances
- Solubilizeandmobilizenutrients
- Eco-friendly,non-pollutantsandcost-effectivemethod

Role ofBio-FertilizerInOrganicAgriculture

- Conventional fertilizers contain compost; household wastes and green manure. Those are notas effective as chemical fertilizers. So, farmers often try to use chemical fertilizers in the fieldforcrop development.
- But obviously the chemical fertilizers are not environment friendly. They are responsible forwater, air and soil pollution and can spread cancer causing agents. Moreover, they maydestroy the fertilityof the soilina longrun. Scientistshave developed Biofertilizers topreventpollution andto makethisworld healthy foreverybody inanaturalway.
- Adequate supplyof nutrientstothe hostplants andensures their proper developmentofgrowthand regulation in their physiology.
- Livingmicroorganismsareusedinthepreparationofbiofertilizers.Onlythose microorganismsareusedwhichhavespecificfunctionstoenhanceplantgrowthandreproduction.
- Therearedifferent typesofmicroorganisms whichareused inthebio-fertilizers.
- Bio-fertilizer being essential components of Organic farming play vital role in maintaininglongterm soil fertility and sustainability.

PromotingBio-FertilizersinIndianAgriculture

- Thegreenrevolutionbroughtimpressivegainsinfoodproductionbutwithinsufficientconcernforsustainability.InIndiatheavailability and affordability offossil fuel basedchemicalfertilizersatthe farmlevel havebeenensuredonlythrough importsandsubsidies.
- Dependence on chemical fertilizers for future agricultural growth would mean further loss insoilquality,possibilitiesofwatercontaminationandunsustainableburdenonthefiscalsystem.
- The Government of India has been trying to promote an improved practice involving use ofbio-fertilizersalong with fertilizers.
- These inputs have multiple beneficial impacts on the soil and can be relatively cheap andconvenientfor use.
- Consistent with current outlook, the government aims not only to encourage their use inagriculturebut alsoto promoteprivate initiativeand commercialviability ofproduction.
- Considering the social benefits promised the government has ample grounds to intervene toset up an effective market for the new product while encouraging private players. But thepolicyand the instrumentsof intervention needtobedesigned withcare.
- Biofertilizers have important environmental and long-term implications, negating the adverseeffectsof chemicals.
- At the farm level, the gains from increased use of then technologycan spill over to otherfarms and sectors through lesser water pollution than chemicalfertilizers and even toanextentorganic manures can create.
- Itisagoodpracticetopromotebiofertilizeraasaninputconjunctivetootherformsoffertilizers, but keeping in view the protection given to chemicals, there is some ground forsubsidizingtheformertoencouragetheiruse.

Conclusion

Biofertilizer have great role in increasing the crop production. They improve the soil health statusand provide different growth promoting hormones and phytohormones to the plant. Also do not leavethe residual effects like that of the chemical fertilizers. Hence the use of Biofertilizer could be theproperoption forsustainable

agriculture.

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8. HORTICULTURE

STCR Recommended NPK with Zinc and Boron for Yield of Onionand Sustaining Soil Health in an Alfisols

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Introduction

Onion (*Allium cepa* L.), the '***Queen of Kitchen'*** is one of the major important commercial vegetable crop cultivated extensively in India. It belongs to the family Alliaceae. It grows well under mild climate without extreme heat or cold or extreme rainfall. The edible part of onion is green leaves, immature and mature bulbs. Onion bulb is rich in phosphorus, calcium and carbohydrates. Onion has strong flavour due to presence of sulphur containing amino acids like lysine and phenylalanine are present in onion bulb. It is cultivated for food, medicines, religious purpose, spices and condiments since early times. It has medicinal and diuretic properties, relieves heat sensation, hysterical faintness, insect bites and also heart stimulation.

India ranks second position in both area and production after China in the world. In India, onion is being grown in an area of 12.94 lakhs ha with production of 2017.18 tonnes and the productivity is 16.8 t ha^{-1}. The total area under onion production in Tamil Nadu was 347.03 MT in an area of 34.08 thousand ha with the productivity of 10.18 t ha^{-1}.

The low production of onion is due to improper application of fertilizers and growing unsuitable varieties under the agro-climatic condition of an area. Optimum fertilizer application for onion and cultivation of suitable varieties in proper environment are necessary for obtaining good yield of onion. Among the many constraints for low productivity in onion, imbalanced nutrition is the main limiting factor (Tariq Bhat*et al*., 2018).Micro nutrients play an active role in the plant metabolic process from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymes activity, nitrogen fixation etc. It also plays an essential role in improving better growth, yield and quality (Alam*et al*., 2010).

Soil application of micronutrients during crop growth period was successfully used for correcting their deficits and improving the mineral status of plant (Ali, 2003). The onion like any other crops not only needs macronutrients, but also micronutrients in adequate and balanced amounts (Ballabh*et al*., 2013).

Zinc is a micronutrient which is required plant growth and development relatively in small amount. Zinc is involved in the formation of chlorophyll and carbohydrate and is also involved in a diverse range of enzyme system. Application of zinc increased the growth and yield of onion.

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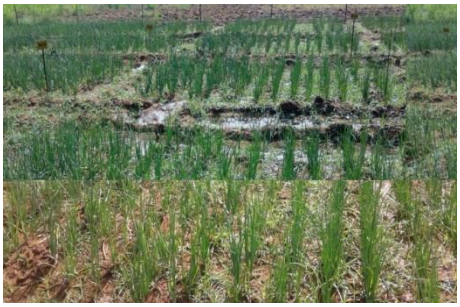

Boron is essential for normal growth and production of sound and healthy vegetables. Boron is one of the important micronutrient for onion production and is essential for cell division, nitrogen and carbohydrate metabolism, protein formation and water relation in plant growth. Application of boron increases bulb size, weight per bulb and yield of onion. Improvement in onion growth and yield has been reported through micronutrient by many scientist at different types of soils. However little information is available on the use of zinc and boron with inorganic fertilizers for onion in Alfisols of Tamirabarani tract. Keeping this in view, the experiment was undertaken.

The investigation was carried out at Agricultural College and Research Institute, Killikulam, Tamil Nadu during the *rabi* season with onion variety of CO (On) 5, to study the effect of soil test crop response application of N, P, K along with zinc and boron.

The experiment soil is reddish brown sandy clay loam with low in organic carbon (0.46%), pH 6.68, non-saline, electrical conductivity (0.22 dS/m), available nitrogen (236 kg ha^{-1}), available phosphorus (16.8 kg ha^{-1}), available potassium (245 kg ha^{-1}) and available zinc (1.02 ppm) and Boron (0.32 ppm). Zinc sulphate as a zinc source and borax for boron were used in different doses and methods for this experiment and based on the soil test values N, P, K fertilizer were added.

The growth and yield was influenced due to application of soil test crop response (STCR) application of N, P and K along with zinc and boron.

Application of STCR + $ZnSO_4$ @ 25 kg ha^{-1} +Borax @ 10 kg ha^{-1}significantly exhibited its superiority to increase the maximum plant height (55.2 cm), number of leaves (17.2), fresh leaf weight(21.6 g) and total dry matter production of plants (1.49 t ha^{-1}) and bulbs (4.83 t ha^{-1}). Application of zinc and boron through soil or foliar or in combination had a beneficial effect on the growth of onion.

Soil and foliar application of zinc and boron along with STCR fertilizers influenced the yield attributes and yield of onion. Significantly maximum values for polar diameter (3.35 cm), equatorial diameter (2.98 cm), bulb lets $clump^{-1}$ (6.4), average bulb weight (85.2 g) and bulb yield(16.85 t ha^{-1}) were obtained in STCR fertilizer with$ZnSO_4$ @ 25 kg ha^{-1} and 0.5% foliar spray. This may be due to the improved growth characters as a result of foliar application of micronutrient which would have enhanced photosynthesis and other metabolic activities, which lead to increase in cell division and elongation. The increase in bulb yield related characters and total bulb yield of onion with the soil and foliar application of zinc might be due to enhanced synthesis and translocation of photosynthates to the bulbs (Manna, 2016). The higher photosynthesis accumulation in the bulbs would ensure higher individual bulb weight and large bulb diameter which collectively increases the bulb yield of onion.Further the improvement of bulb yield was due to better vegetative growthreflect of vigorous vegetative growth and healthy plants(Tariq Bhat*et al.*, 2018).The increase in total bulb yield was 42.6 percent over control treatment.

The highest values of available NPK (278.32, 16.53 and 291.40 kg ha^{-1}, respectively) were obtained in treatment applied with STCR fertilizers as 106:97:54 kg of NPK ha^{-1}+ $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}

The maximum net income (₹72433) and

B:Cratio (2.46) were recorded with the application STCR fertilizers as 106:97:54 kg of NPK ha^{-1}+ $ZnSO_4$ @ 25 kg ha^{-1} + Borax @ 10 kg ha^{-1}

The next best treatment was the application of STCR + borax @ 10 kg ha^{-1} with 0.5% foliar spray which had significantly superior to all other treatments. This might be due to beneficial effect of boron on growth parameters which has increased yield and yield related parameters of onion. There may be favourable effects of boron on root development, formation of carbohydrates, regulation of water and translocation of photosynthates to bulbs from leaves. The higher photosynthesis accumulation in the bulbs would ensure higher individual bulb weight and large bulb diameter which collectively increases the bulb yield of onion. The lesser bulb yield was recorded in control treatment which registered 9.71 t ha^{-1}. This might be due to unavailability of required quantity of nutrient present in soil during crop period.

Conclusion

Based on the experimental finding, it can be concluded that application of soil test crop response (STCR)fertilizersas 106:97:54 kg of NPK ha^{-1} + $ZnSO_4$ @ 25 kg ha^{-1} with 0.5% foliar spray is the best practice in sustaining productivity of onion and soil health in the Alfisols.

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9. HORTICULTURE-POMOLOGY

Chironji: Benefits, Uses and Side Effects

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Chironji, a nutty seed touted for its sweet and salty taste, is one such ingredient that is commonly found stacked in most Indian kitchen cabinets. Called by the vernacular name “charoli”, the chironji seeds are often considered as a substitute for almonds and are used extensively for making delicious cuisines and mouth-watering sweets during many festivals. The holistic science of Ayurveda classifies this seed as an absolute remedy for several health conditions including headache, respiratory disorders, mouth ulcers, cough, skin rashes, infertility, and constipation. Be it the seeds or nuts, kernels, fruits, root, oil, or gum, each and every part of the chironji plant has immense therapeutic properties and is extensively used for formulating several traditional medicines.

What is Chironji?

Chironji is a nutty seed that comes from the plant which goes by the botanical name *Buchananialanzan*. This plant belongs to the Anacardiaceae family to which mango belongs and is also known as Almondette tree. Although the chironji plant is native to India, it is also widely grown throughout Thailand, Vietnam, Burma, Laos, and Yunnan. The tree is naturally found growing in the tropical deciduous forests of Northern, Western and Central India.

Chironji is an evergreen tree of deciduous origin that grows to a height of 18 meters featuring a straight trunk and tomentose branches. The plant is found growing in semi-evergreen forests, open and dry forests, and lowland forests, dry and moist deciduous forests. The plant can withstand adverse climatic conditions and usually thrives well on yellow sandy-loam soils.

The external surface of the plant is rough and grayish-brown, whereas the internal surface is reddish-brown and fibrous. Leaves are broad, oblong, pinnate and arranged alternately on the branches. Flowers are small, greenish-white in colour, followed by black drupes on fertilization.

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Fruits are initially green and turn to purplish-black as they mature, whereas seeds are small creamish-brown with dark spots.

Nutritional Content of Chironji

Chironji seeds are a pretty good source of protein. With a relatively low-fat content and calorific value, these nutty seeds are a great addition to the daily diet. It has a pretty impressive fibre content which makes digestion easier. The host of healthful nutrients includesvitamin B1, B2 and C as well as niacin. It also contains minerals like iron, calcium and phosphorus.

Chemical Constituents of Chironji

The fruits and seeds of the Chironji plant also contain a bulk of essential oils and bioactive constituents like flavonoids, galactosides, 8-cineole, camphene, myrcene, triglycerides, sabinene, Y-terpinene and tannins. The presence of such an exemplary combination of constituents offers incredible benefits in the cosmetic, therapeutic and food industry.

The seed kernel in Chironji consists of about 50-52% of oil which is usually extracted by the cold compression method. While the oil can be used as a substitute for almond or olive oil for cooking purposes, the whole kernel can be used as sweet-meats. The oil extracted from the fruits generally goes by the name 'char' and has incredible medicinal uses including treating skin diseases. It can also be used as an expectorant and tonic.

Parts of Chironji and its Specific Uses

The entire Chironji tree holds a special position in both Ayurveda and modern medicines. Each and every part possesses therapeutic qualities and is extensively used for treating numerous conditions. The leaves portray digestive, cooling, expectorant, aphrodisiac properties and are hence used in the treatment of constipation, flatulence, seminal weakness, cold, cough, bronchitis, skin diseases and burning sensation in the body. The latex or gum exuding from the tree is useful in loose motions whereas consumption of the seed powder gives strength. The powdered seed kernel can be applied topically on skin diseases to cure itching, spots and blemishes on the face and the oil is applied on glandular swellings on the neck to reduce pain and inflammation.

ChironjiSide Effects

Although it is considered safe when consumed in measured quantities, as per the instructions of an ayurvedic doctor or practitioner yet the seed powder of Chironji can reduce the appetite if consumed in bulk quantity without the doctor's consent. Other side effects of chironji seed powder or oil include constipation and excessive urination.

Conclusion

Chironji, which is known for its nutty flavour and sweet and salty taste, is blessed with a myriad of health benefits. Thanks to the goodness of the essential bio-active ingredients, it is widely used for regulating diabetes, managing cough and cold, remedying sore throat, treating digestive anomalies, enhancing cardiac functioning, preventing skin infections, promoting digestion, diminishing urinary problems and many more.


Chironjee Tree


Chironji inflorescence


Chironji fruit


Chironji Seeds

10. HORTICULTURE- POMOLOGY

Wood apple- A potential minor fruit

Sathish, B. R[1]

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Introduction

The wood-apple, FeronialimoniaSwingle (syns.F.elephantumCorrea;Limoniaacidissima L.;SchinuslimoniaL.) is the only species of its genus, in the family Rutaceae. Besides wood-apple, it may be called elephant apple, monkey fruit, curd fruit,kathbeland other dialectal names in India. In Malaya it isgelinggaiorbelinggai;in Thailand,ma-khwit;in Cambodia,kramsang;in Laos,ma-fit.

Nutritional Composition of Fruit

The unripe fruits contain 0.015% stigmasterol. Leaves contain stigmasterol (0.012%) and bergapten (0.01%). The bark contains 0.016% marmesin. Root bark contains aurapten, bergapten, isopimpinellin and other coumarins.

Uses

- **Pectin:**The pectin has potential for multiple uses in pectin-short India, but it is reddish and requires purification.
- **Rind:**The fruit shell is fashioned into snuffboxes and other small containers.
- **Gum:**The trunk and branches exude a white, transparent gum especially following the rainy season. It is utilized as a substitute for, or adulterant of, gum arabic, and is also used in making artists' watercolors, ink, dyes and varnish. It consists of 35.5% arabinose and xylose, 42.7% *d*-galactose, and traces of rhamnose and glucuronic acid.
- **Wood:**The wood is yellow-gray or whitish, hard, heavy, durable, and valued for construction, pattern-making, agricultural implements, rollers for mills, carving, rulers, and other products. It also serves as fuel.
- The heartwood contains ursolic acid and a flavanone glycoside, 7-methylporiol-b-D-xylopyranosyl-D-glucopyranoside.
- **Medicinal Uses:**The fruit is much used in India as a liver and cardiac tonic, and, when unripe, as an astringent means of halting diarrhea and dysentery and effective treatment for hiccough, sore throat and diseases of the gums. The pulp is poulticed onto bites and stings of venomous insects, as is the powdered rind.
- Juice of young leaves is mixed with milk and sugar candy and given as a remedy for biliousness and intestinal troubles of children. The powdered gum, mixed with honey, is given to overcome dysentery and diarrhea in children.
- Oil derived from the crushed leaves is applied on itch and the leaf decoction is given to children as an aid to digestion. Leaves, bark, roots and fruit pulp are all used against snakebite. The spines are crushed with those of other trees and an infusion taken as a remedy for menorrhagia. The bark is chewed with that of *Barringtonia* and applied on venomous wounds.
- Leaves of wood apple contains methanol which helps to reduce cholesterol and blood sugar levels.
- Fruit is a rich source of nutrients likefiber, phosphorous, iron and beta-carotene

Description

The slow-growing tree is erect, with a few upward-reaching branches bending outward near the summit where they are subdivided into slender branchlets drooping at the tips. The bark is ridged, fissured and scaly and there are sharp spines :3/4 to 2 in (2-5 cm) long on some of the zigzag twigs. The deciduous, alternate leaves, 3 to 5 in (7.5-12.5 cm) long, dark-green, leathery,

often minutely toothed, blunt or notched at the apex, are dotted with oil glands and slightly lemon-scented when crushed. Dull-red or greenish flowers to 1/2 in (1.25 cm) wide are borne in small, loose, terminal or lateral panicles. They are usually bisexual. The fruit is round to oval, 2 to 5 in (5-12.5 cm) wide, with a hard, woody, grayish-white, scurfy rind about 1/4 in (6 mm) thick. The pulp is brown, mealy, odorous, resinous, astringent, acid or sweetish, with numerous small, white seeds scattered through it.

Origin and Distribution

The wood-apple is native and common in the wild in dry plains of India and Ceylon and cultivated along roads and edges of fields and occasionally in orchards. It is also frequently grown throughout Southeast Asia, in northern Malaya and on Penang Island. In India, the fruit was traditionally a "poor man's food" until processing techniques were developed in the mid-1950's.

Climate

The tree grows up to an elevation of 1,500 ft (450 m) in the western Himalayas. It is said to require a monsoon climate with a distinct dry season.

Soil

Throughout its range there is a diversity of soil types, but it is best adapted to light soils.

Varieties

There are 2 forms, one with large, sweetish fruits; one with small, acid fruits.

Propagation

The wood-apple is generally grown from seeds though seedlings will not bear fruit until at least 15 years old. Multiplication may also be by root cuttings, air-layers, or by budding onto self-seedlings to induce dwarfing and precociousness.

Season

In Malaya, the leaves are shed in January, flowering occurs in February and March, and the fruit matures in October and November. In India, the fruit ripens from early October through March.

Harvesting

The fruit is tested for maturity by dropping onto a hard surface from a height of 1 ft (30 cm). Immature fruits bounce, while mature fruits do not. After harvest, the fruit is kept in the sun for 2 weeks to fully ripen.

Major Pest

1. Citrus butterfly
2. Fruit borer

Major Constraints in Area Expansion

- Lack of awareness among the consumers regarding nutritional importance of the fruit
- Lack of research regarding standardization of package of practice and breeding work
- Non availability of genuine planting material
- Non availability of commercial, varieties which can adopt to varied climatic conditions

Future Thrust

- Creating awareness among the consumers regarding importance of the crop
- Scientific research has to take up with respect to crop improvement
- Standardization of package of practice for different parts of the country can be done.

References

Morton, F. and Miami, F. L., 1987.Wood-Apple. p. 190–191. In: Fruits of warm climates.

11. PLANT PATHOLOGY

Artificial Intelligence (AI): An Early Diagnosis Technique for Plant Disease Detection

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Abstract

Agriculture, which contributes 4% of the world's GDP and as much as 25% of GDP in some least developed nations, is also essential to economic progress. Plant illnesses are a result of persistent, phytopathogenic organisms (biotic or infectious disease agents) irritating the physiological functioning of plants. Plant diseases are thought to be responsible for 14.1% of crop losses worldwide, or $220 billion USD, per year. For this reason, it is critical to transition to automated disease detection techniques, such as artificial intelligence, in order to guarantee the quality and security of agricultural products. Artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence. Deep machine learning techniques are employed to quickly and accurately identify plant diseases. Farmers may benefit from real-time model application, especially in less developed countries. There is the proper equipment to diagnose diseases. Therefore, in order to improve the technologies now in use and raise the productivity of primary sectors, future researchers should organise a proper dataset that covers every aspect of agriculture.

Keywords: Agriculture, Artificial intelligence, Plant Diseases, Disease detection.

Agriculture is also crucial to economic growth: accounting for 4% of global gross domestic product (GDP) and in some least developing countries,it can account for more than 25% of GDP.Global population is expected to rise by 2.3 billion people, or more than a third, live between 2009 and 2050 (Figure 1). This is a much slower rate of growth than the one seen in the past four decades during which it grew by 3.3 billion people, or more than 90 percent. Nearly all of this growth is forecast to take place in the developing countries.Agriculture and the allied sector proved to be the most resilient to the Covid-19 shock as it registered a growth of 3.6 per cent in 2020-21 and improved to 3.9 per cent in 2021-22, driving the overall Indian economy's real GDP expansion of 9.2 per cent in 2021-22, according to theEconomic Survey2021-22.

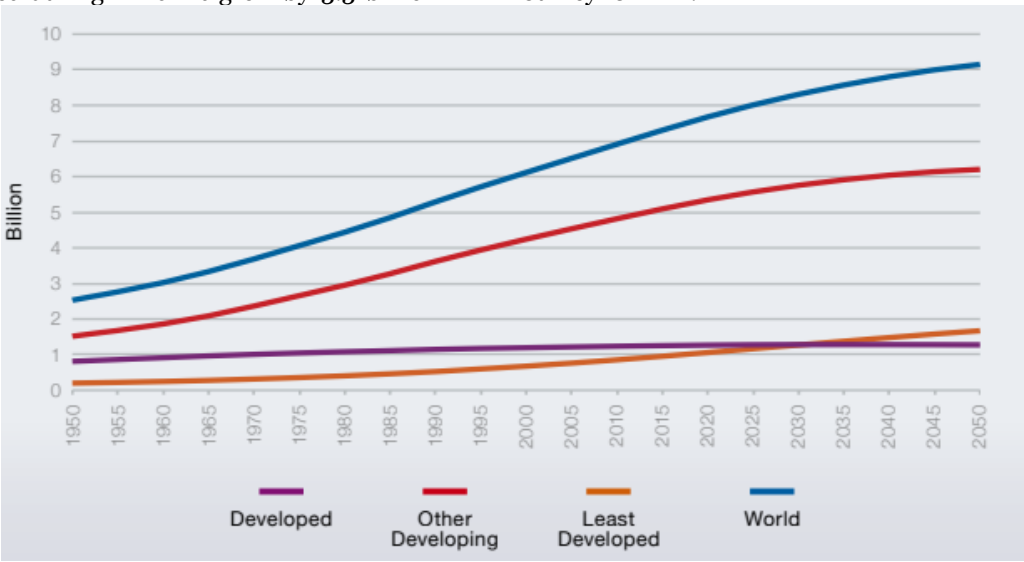


Fig.1 Population growth in the world (Mensbrugghe*et al.* 2009)

Protecting plant health is essential for all sectors. Plants not only contribute to global food systems but also supplies non-food crops for energy, fiber, feed, and horticultural uses.The physiological functioning of plants that are irritated by prolonged, phytopathogenic organisms (biotic or infectious disease agents) is called plant

diseases.Worldwide crop loss isestimatedannually to be $220 billion USD or 14.1% of crop loss dueto plant disease.Crop loss can be caused by biotic organisms which include oomycetes, fungi, viruses, bacteria, nematodes, andviroids, as well as abiotic factors like the environment.

Farming has become considerably simpler as a result of improvements in crop yield brought about by advances in agricultural practises. A variety of tasks can now be completed quickly and cheaply compared to earlier methods that took more time, money, and labour. Several agricultural applications, including fruit grading, weed detection, plant disease detection, and land cover categorization, are using the smart farming technique.However, very little progress has been made in the adoption of these techniques as the majority of farmers still rely on traditional farming methods, particularly in Asian and African nations where around 50% of the population depends on agriculture for employment. Nevertheless, this industry is costly as 30 to 40% of yearly production is lost due to diseases, which has a significant negative economic impact.

Early disease detection relied solely on manual methods, with farmers either using their own experience or hiring experts to identify symptoms and identify the disease so that the appropriate preventive measures could be done. The conventional approach had flaws since it was inaccurate, labor-intensive, time-consuming, and completely dependent on the expert's eyesight. As a result, it is urgent to switch over to automated disease detection methods like Artificial Intelligence in order to ensure the quality and safety of agricultural products. Early disease detection (AI) is crucial since it allows for easy management of the illness's progress without compromising crop quality or output.

Types of Plant Diseases

Infectious plant diseases are mainly caused by pathogenic organisms such as fungi, bacteria, viruses, protozoa, as well as insects and parasitic plants. With the development of agriculture, infectious plant diseases have become an increasingly significant factor affecting crop yield and economic efficiency. In the field environment, each plant cultivated as a monoculture has uniform conditions and requirements for planting, care, and harvesting, which leads to higher yields and lower production costs than in polyculture. Over the past half century, the use of modern technologies, including cultivation of monocultures, has allowed us to reduce the amount of additional land needed for food production. However, growing the same crop in the same location year after year depletes the soil and renders it unable to ensure healthy plant growth. Another crucial issue is the susceptibility of monocultures to infectious diseases. Losses can amount to up to 30% even at the stage of storage, transportation, and distribution to the consumer. The signs of plant diseases include wilting, spotting (necrosis), mold, pustules, rot, hypertrophy and hyperplasia (overgrowth), deformation, mummification, discoloration, and destruction of the affected tissue. Wilting results from the loss of turgor pressure in the cells and tissues. It is caused by both abiotic and biotic factors. Spotting is mostly associated with the partial death of plant tissues due to biotic factors. Mold and pustules occur as a result of fungal damage to a plant. Rot leads to both the death of intracellular contents (bacterial wet or fungal dry rot) and destruction of the intercellular substance and cell membrane (fungal dry rot). Hypertrophy and hyperplasia represent an excessive growth and proliferation of the affected tissue caused by pathogens. Deformations (leaf wrinkling, twisting, and curling; threadlike leaves, fruit ugliness, and double-floweredness) can be caused by various biotic and abiotic factors due to an outflow of the products of photosynthesis, uneven intake of nutrients by the plant, or uneven growth of various tissue elements(Cardinale*et al*., 2011).

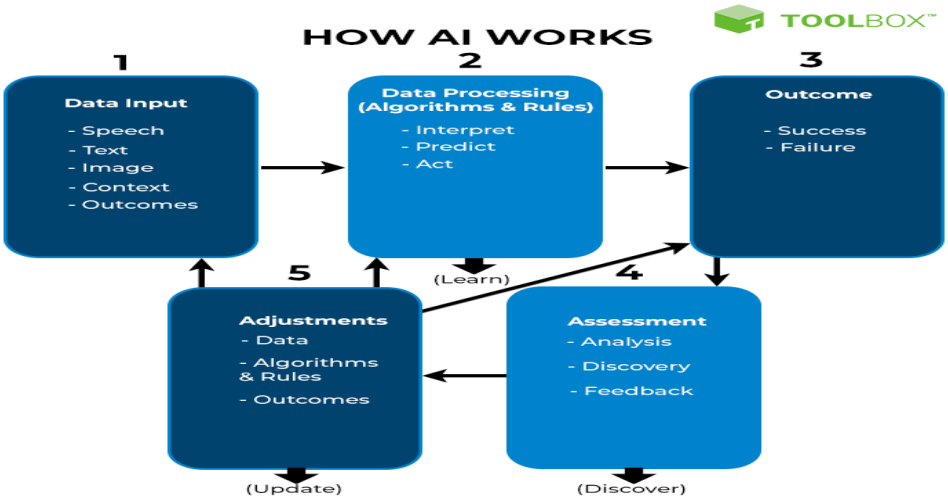
Artificial Intelligence (AI)

The term ‘artificial intelligence’ was coined by John McCarthy (1956) and had the first AI conference. Artificial intelligence is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of

using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable (John McCarthy, 2004).

How Does AI works?

To begin with, an AI system accepts data input in the form of speech, text, image, etc. The system then processes data by applying various rules and algorithms, interpreting, predicting, and acting on the input data. Upon processing, the system provides an outcome, i.e., success or failure, on data input. The result is then assessed through analysis, discovery, and feedback. Lastly, the system uses its assessments to adjust input data, rules and algorithms, and target outcomes. This loop continues until the desired result is achieved.



Plant disease Detection using AI

A farmer frequently has serious concerns about plant diseases. Companies engaged subject matter experts for their advice on how to identify a disease in a plant and suggest the actions. Globally, advanced technology has made it possible for easy detection and their counters. Traditional methods used photographs of plant leaves to resolve issue in the beginning of the 20th century. Five steps make up the entire procedure (Figure 2): starting with image collection by taking images in the field, occasionally in controlled circumstances. To create a huge image collection, the collected photographs will be used. The image was preprocessed in the second step, which also involved noise removal, cropping, scaling, image improvement, and transformation. The image was further separated into its component objects or sections in the third stage of segmentation. The most popular segmentation methods are Otsu's thresholding and k-means clustering. Different aspects, such as colour and textures, were utilised in the fourth step of feature extraction. In the fifth stage, the classifier made further use of these traits. The two classifiers that researchers employ the most frequently are artificial neural networks (ANN) and support vector machines (SVM). Figure 2 demonstrates that in agricultural research, the frequency of image-based plant disease has nearly multiplied by five in 2019. Prior to now, rule-based expert systems for many crops, including rice, wheat, and potatoes, has been created. AI approaches were used to create an algorithm that assisted specialists in their work. It was a capable, perceptive, and computer-aided decision-making tool.

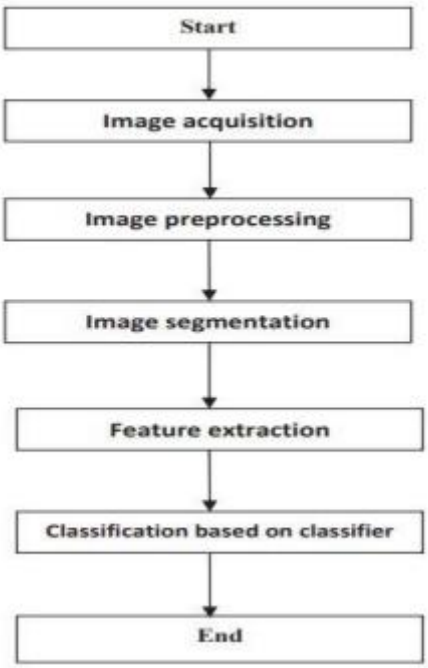


Fig.2 Steps in Disease Detection and classification

Convolutional Neural Network (CNN)

models were developed through deep learning approaches in order to do plant disease identification and diagnosis utilising straightforward leaf images of healthy and diseased plants. The user must first take a screenshot of a plant leaf using the app. This photograph will be sent by the app to our AI system. The image is processed through a number of processes, including preprocessing, feature extraction, feature selection, etc. An innovative approach to building a visual database has been utilized to train CNN, a deep learning system that has 97.8% accuracy in identifying four species of insects. Convolutional neural networks may process data in any format, including speech, pictures, video, audio, and natural language. CNN is a deep, feed-forward ANN class that has been effectively used in computer vision applications. In the vast majority of the problems where they were used, CNN achieved great precision, outperforming other well-known image-processing methods (Figure 3).

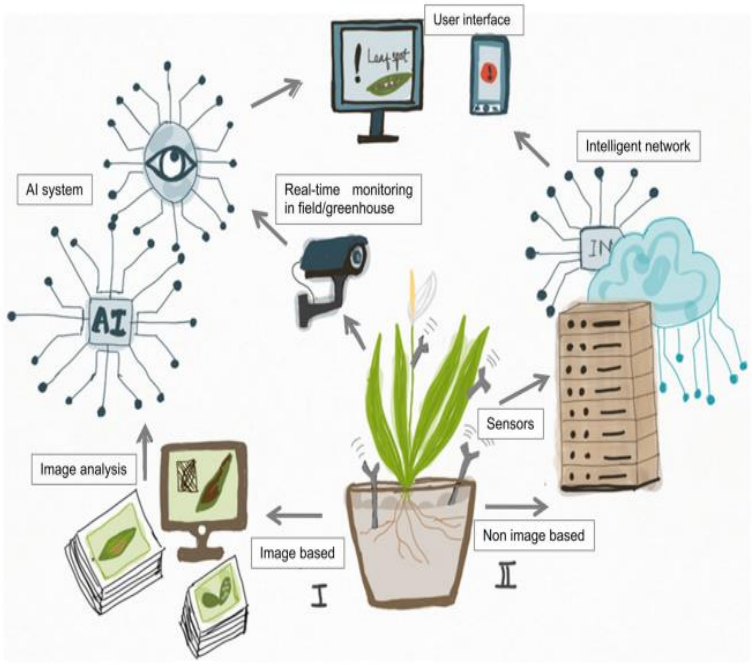


Fig. 3 Diagrammatic representation of AI enabled diagnostics of plant diseases. I—Computer vision and AI enabled identification of disease. II—Various Internets of things (IoTs) like sensors.

Conclusion

Plant disease diagnosis could be handled better with crop-created sections by applying a number of AI algorithms. The reason is that in order to determine the best course of action under these circumstances, it is essential to diagnose when the plant is infected and recognise the disease. Some research studies focused on more portable devices, such mobiles, and implemented their models there. Real-time model implementation can be beneficial for farmers, especially in poor nations where technology is lacking. Appropriate equipment for disease diagnosis. Therefore, the lightest model that can be used entirely on portable devices is the best choice. According to the literature, artificial intelligence is an excellent instrument for a country's agronomics.Hence, future researchers should organize a proper dataset covering all arena of agriculture and enhance the available technologies to increase the productivity of primary sectors.

References

Cardinale B J, Matulich K L, Hooper D U, Byrnes J E, Duffy E, Gamfeldt L, Balvanera P, O'Connor M I and Gonzalez A, 2011, The functional role of producer diversity in ecosystems. American Journal of Botany, 98(3):572–592.

Kamdar J H, Jasani M D, Jasani J D, JebaPraba J and John J G, 2021, 11 Artificial intelligence for plant disease detection: past, present, and future. Internet of Things and Machine Learning in Agriculture, 1276-86.

Sujawata G S and Chouhan J S, 2021, Application of Artificial Intelligence in detection of diseases in plants: A Survey. *Turkish Journal of Computer and Mathematics Education*, 3: 3301-3305.

12. AGRICULTURE

Barnyard Millet to Manage Lifestyle Diseases

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Diseases such as cardiovascular diseases, stroke, diabetes, and certain forms of cancer are often known as lifestyle diseases as they occur due to unhealthy dietary practices and a lack of physical activity. Consumption of nutritious foods with low calories, low glycemic index and high dietary fiber can prevent and manage lifestyle diseases.Barnyard millet (*Echinochloa*species) is a minor millet that can be easily grown in marginal lands and does not require much care. It is loaded with nutrients and phytochemicals that promote normal growth and prevent diseases. The grain contains more protein, vitamins and minerals compared to that of rice and wheat. It has a low glycemic index and high dietary fiber that makes it an ideal diet for people with lifestyle diseases.

Nutritional Benefits

Barnyard millet contains significant amounts of carbohydrate (56.88%), protein (10.76%) and fat (3.53%) with a calorific value of about 300 Kcal/100g which makes it a suitable food for all age groups. It is also a good source of minerals and has significantly higher ash content than rice, wheat and other millets with comparatively high iron, calcium and zinc contents. Minerals are required in sufficient quantities for normal growth and development of human body. Calcium in the diet will keep bones and teeth strong and maintain proper functions of muscles and blood vessels. Iron is required for synthesis of oxygen transporting proteins, haemoglobin and myoglobin. Zinc can boost the immune system and is an important trace element to support childhood growth, wound healing and for sense of taste and smell. Adequate intake of vitamins and minerals from natural food sources will keep us healthy and free from diseases.

Anti-Diabetic

India is second highest in the world in the

prevalence of diabetes. More than 77 million people in India are affected by diabetes (Pradeepa and Mohan, 2021). The reason for increase in diabetes in Indians is due to genetic factor coupled with insulin resistance associated with urbanization. One way to prevent diabetes is consuming healthy foods with low glycemic index (GI). Barnyard millet has been reported to be beneficial for type 2 diabetics as the glycemic index for dehulled and heat treated millet are 50.0 and 41.7 respectively (Ugare et al., 2014). The low glycemic index in barnyard millet is attributed to slow digestibility of starch and presence of high dietary fiber content. Significant levels of magnesium present in barnyard millet can increase the efficiency of insulin and glucose receptors in the body and help in lowering blood glucose levels. Many complications in diabetes mellitus arise due to accumulation of glycated biomolecules. Glycation process (glucose reacting with proteins) can be interrupted by phenolic compounds present in barnyard millet. Regular consumption of barnyard millet can thus reduce the risk of diabetes.

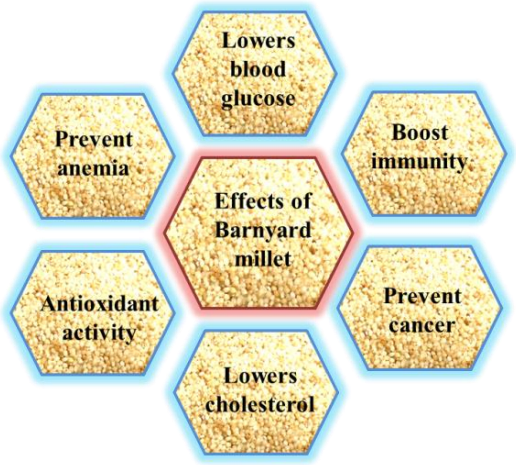

Figure.Health benefits of Barnyard millet

Obesity Management

Obesity often results from intake of high calorific food and sedentary lifestyle. The mainstay of treatment is lifestyle changes such as regular exercise, intake of high dietary fibre and diet low in energy and fat. Barnyard millet is an excellent source of dietary fiber (12.6%). High dietary fibre delays gastric emptying and increases satiety which helps to keep the stomach feeling full. Thus, it stops the urge to consume more food, which leads to a decrease in total energy intake. Those looking for weight loss can include this millet in their regular diet.

Prevents Colorectal Cancer

The dietary fiber in barnyard millet can prevent colorectal cancer.It protects by binding to carcinogenic substances directly and causing its excretion or by increasing stool bulk, thus diluting the carcinogenic substances. The transit time through the bowel is decreased and the soluble fraction of dietary fiber gets fermented by the microbes in the intestine with production of short chain fatty acids (SCFAs) like acetate, propionate and butyrate. These SCFAs have antitumour activities and promote apoptosis, inhibit cell proliferation and reduce tumour cell invasion.

Reduces Cardiovascular Disease

Cardiovascular diseases (CVDs) are the leading cause of death globally. In India, the rates of CVD are highest in Kerala, Punjab and Tamil Nadu. Moreover, these states also have the highest prevalence of raised cholesterol levels and blood pressure (Kumarand Sinha, 2020). Having high dietary fiber, barnyard millet is capable of inhibiting cholesterol biosynthesis and also decreases cholesterol absorption from the intestine. Barnyard millet contains lesssaturatedand more unsaturated fatty acids which is favourable to reduce CVD. Major unsaturated fatty acids in barnyard millet are oleic acid (53.8%) and linoleic acid (34.9%). The saturated palmitic acid accounts to only 10.8%.

Conclusion

Barnyard millet is nutritionally superior to cereals and other minor millets, but its utilization is limited. Since, it is a storehouse of nutrients that prevent several lifestyle disorders, infectious and deficiency diseases, it can be included routinely in our dietary preparations. Several value added food preparations have been standardized with this millet. The health benefits of barnyard millet make it essential for nutritional security and

in management of lifestyle diseases for the present day consumers.

Reference

Pradeepa, R. and Mohan, V., 2021.Epidemiology of type 2 diabetes in India.*Indian Journal of Ophthalmology*, 69(11), p.2932.

Ugare, R., Chimmad, B., Naik, R., Bharati, P. and Itagi, S., 2014. Glycemic index and significance of barnyard millet (Echinochloafrumentacae) in type II diabetics. *Journal of food science and technology*, *51*(2), pp.392-395.

Kumar, A.S. and Sinha, N., 2020. Cardiovascular disease in India: a 360 degree overview.*Medical Journal, Armed Forces India*,*76*(1), p.1.

13. MCQS

This section, in the magazine has been specially introduced with the intention that the students and readers, who are planning to appear for the competitive exams, may get benefit. As the readers are aware that the exams are held by various Government departments and recruiters every year and the agriculture and allied subjects remain key subjects in some exams which are related to agriculture stream. We hope the students and readers will certainly like this and we invite the subscribers to send MCQs for publication in the magazine. We are dedicating A page, in this issue*, for this purose and hope this will be advantageous to the readers community.*

****

1. Which enzyme is used bythe biscuit manufacturers to lower the protein level of flour.(ICAR JRF 2021)
   a. Amylase
   b. Protease
   c. Cellulase
   d. Xylanase

   Ans.(b)
2. The gas used in gas delinting of cotton seeds is (ICAR JRF)
   a. Dry CO_2
   b. Nitric Oxide
   c. Sulphur Di Oxide
   d. Dry Hydrochloric Acid

   Ans. (d)
3. Zabo an Indian farming system is mainly practised in.(ICAR JRF)
   a. Sikkim
   b. Nagaland
   c. Meghalaya
   d. Arunachal Pradesh

   Ans. (b)
4. Red ring disease of coconut palm is caused by
   a. Bursaphelenchus/Radinaphelenchusc ocophilus
   b. Aphelenchusavenae
   c. Ditylenchusdipsaci
   d. Bursaphelenchusbicaudatus

   Ans. (a)
5. Colour of seed tag used in Foundation seed is
   a. Azure Blue
   b. White
   c. Golden Yellow
   d. Red

   Ans. (b)
6. Pure line breed refers to
   a. Hetrozygosity
   b. Homozygosity
   c. Homozygosity and self assortment
   d. Heterozygosity and linkage.

   Ans. (b)
7. Inflorescence of Sugarcane is known as
   a. Arrow
   b. Anther
   c. Silk
   d. Flower

   Ans.(a)
8. Equational Division occurs in
   a. Mitosis
   b. Meiosis I
   c. Meiosis II
   d. Apomeiosis

   Ans.(c)
9. Ultra structural evidence for the existence of sperm nuclei in pollen grain was done by.
   a. Jensen and Fisher
   b. Robert and Fisher

c. Leonard and Copland
d. Russell and Southworth

Ans. (a)

10. The organic seed dormancy classification was given by

a. Nikolaeva,1977
b. JM Baskin,1989
c. C. Baskin,1981
d. Visser,1977

Ans. (a)

14. AGRICULTURE

Strategies for EnhancingCropProductivityinDrylandAreas

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Water stress is a major problem in reducingagriculturalproductivityespecially,insemi-aridandaridregion. Water deficits result from low and erratic rainfall, poor soil waterstorageandwhentherateofwatertranspirationexceedswateruptake. To mitigate the water stress in dry land areas, certain resource conserving techniques are found to be effective and ultimately enhancing the crop productivity. Followings are some of the resource conservation strategies

1. **Selection of Crops and Varieties:** The crops and varieties suitable for dry land condition should have following characteristics:
   a. Varieties should be well adapted to particular region.
   b. Short duration and early vigour,
   c. having deep root system,
   d. resistances to biotic and abiotic stress,
   e. high yielding varieties are selected,
   f. low transpiration rate
2. **Tillage:**Tillage is mainly done for weed control, seed bed preparation and soil and water conservation. Proper and deep tillage results in soil and moisture conservations through higher infiltration reduced runoff and increased depth of soil for moisture storage.
3. **Sowing time and sowing method:**In dryland condition, moisture is the crucial input for crop production. Sowing date is an important determinate of crop yield. Sowing date depends on the onset of monsoon, amount and distribution of rainfall to the region. If sowing is delay then initial rain is not utilized for crop production. Ridge and furrow method is mainly adopted in dry land area.
4. **Seed rate:**Choosing the normal or higher plant seed rate and then go for thinning to maintain optimum plant population. At using higher seed rate, crop yields are reduced because too much of soil water is used up to vegetative growth early in the season, while using lowerseed rate so there is problems of less emergence of seedlings.
5. **Mulching:**It is any material applied on the soil surface to check evaporationlosses, to conserve soil and water.

Advantages of Mulching

- Conservationofmoisture.
- Reductionofsoiltemperature.
- Protectionofsoilfromerosion.
- Reductioninthegrowthofweeds.
- Reduceevaporationandincreasesinfiltrationrate.
- Soilmulchingpreventsdeepcrackingofsoil.
- Increasedsoilfertilityoverthelongterm.

6. **Hydrogel**: Hydrogel are water absorbing polymers, these polymers are cross linkedstructuresandformathreedimensionalnetwork.

Advantages of hydrogel

- Increased water use efficiency.
- It helps the plants withstand in moisture stress.
- It reduced irrigation and fertigation requirements of crops.
- Reduced fertilizers leaching and soil erosion.

- Increased water holding capacity of soil.

Types of Hydrogels:

- Pusa Hydrogels
- Super absorbent polymers (Water Absorbent Polymers)
- Water retention polymers and potassium polyacrylate

7. **Contour Bunding:**Contour bunding is defined as series of mechanical barriers across the land slope. Each contour bund acts as a barrier to the flow of water. Thus, the water flow is restricted and the resists possibility of impounding water which infiltrate over time in the soil profile.
8. **Nutrient Management:**Lower doses of fertilizers used as compared to irriagated condition because in dryland area moisture is limited factors so nutrient uptake by plant is less and reduced plant growth. Use of organic manure which ultimately increase water holding capacity of soil.
9. **Weed Control:**Weeds always compete with crops for the use of water. Hence, destruction of weeds through proper methods is essential for the proper growth of crops
10. **Anti-Transparent:** Any material applied for reducing water loss from the plant is known as Antitranspirant.Hardly1%water is utilized in physiological activities of plant and remaining water lost through transpiration, it may help maintenance of favorable water balance in plant system. It have been observed that best anti-transparent reduce transpiration 30-40 % at the most. Anti-transparent reduce photosynthesis. Hence, their use should be limited to save the crop under severe moisture stress.
    - **StomatalClosing Types:** Spray material which cause closure of stomata and thereby reduce transpiration. e.g. Atrazine, PMA.
    - **Film forming types:** Plastic and waxy material reduce water loss through formation of thick film which act as physical barrier. e.g. oil, waxes, silicone.
    - **Increasing Leaf Reflectance:** Reflecting materials reflect radiation and reduce leaf temperature. e.g. Kaoline.
    - **Growth Retardants:** Like cycocel there is increase in root growth and reduced shoot growth and thus enable the plants to resist drought.
11. **Seed Hardening:**Seed hardening ensures high germination. The seeds are pre-soaked in 2% potassium dihydrogen phosphate solution for 6 hours in equal volume and then dried back to its original moisture content in shade and are used for sowing.

Advantages of Seed Hardening

- It increases germination percentage and seeding vigour.
- The uniformity of seedling emergence.
- Increases the root growth.
- Flowering occurs 2-3 days earlier.
- Uniform seed set and maturity.
- Increases the yield.

12. **Wind Breakers and Shelter Belts:**Wind breakers are such structures which break the wind flow and reduced wind speed. While shelters belts are rows of trees planted across wind direction for protection of crop against wind.

References

HimanshuTiwari and AkashSunaratiya (2022).Role of hyrogelin agriculturalfarming.Times ofAgriculture.Issue 24, page 48.

RamanjitKaur, SusamaSudhishri, S L MeenaManpreetJaidka and Anchal Das (2018).Technologies for Enhancing the Crop Productivity in Dryland Areas.Indian farmer's digest.51 (3).8-15.

Randy creswell and Franklin w. Martin (1998).Dryland farming: crops & techniques for arid regions.1-22.

Fundamental of agriculture by Arunkatyayan book.

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15. PLANT PROTECTION

Neem Oil Extraction Process

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Introduction

Neem is one of the very few trees known in the Indian sub-continent. Neem seed is a part of neem tree which has high concentration of oil. Neem oil is widely used as insecticides, lubricant, drugs for variety of diseases such as diabetes and tuberculosis. There are several methods to obtain neem oil from the seeds like mechanical pressing, supercritical fluid extraction, and solvent extraction. Neem oil is generally light to dark brown in color. It has a bitter taste and an offensive odor similar to the combined odors of garlic and peanut. It comprises mainly of triglycerides (esters formed from a molecule of glycerol and three molecules of fatty acids), and is very rich in azadirachtin- the key component acting as insect repellent, anti-feedant, anti-fungal and anti-viral, among others, it is perhaps the most important commercial product of neem for organic farming and medicines.

Agricultural use of Neem oil

Neem oil is found to be useful for protecting crops against pests, as it provides natural pestcidal properties. Among its active compounds, azadirachtin affects insect the most, causing 90 percent of the pesticidal cause on most pests. It helps alter the development, inhibits feeding, hinders reproduction and suppresses the fertility of pests. It interferes with insect harmone systems, making it harder for insects to grow and lay eggs .Azadirachtin can repel and decrease the feeding of nematodes. Other components of neem oil kill insects by hindering their capability to feed.

Properties of Neem oil

Neem oil contains at least 100 biologically active compounds. Among them, the major constituents are triterpenes known as limonoids, the most important being azadirachtin, which appears to cause 90% of the effect on most pests. The compound has a melting point of 160°C and molecular weight of 720 g/mol. Other components present include meliantriol, nimbin, nimbidin, nimbinin, nimbolides, fatty acids (oleic, stearic, and palmitic), and salannin. The main neem product is the oil extracted from the seeds by different techniques. The other parts of the neem tree contain less azadirachtin, but are also used for oil extraction.

Mode of Action

Neem acts as a biopesticide at different levels and in various ways. Primarily it acts as antifeedant,when an insect larva is hungry and it wants to feed on the leaf but if the leaf is treated with neem product, because of the presence of azadirachtin, salaninandmelandriol there is an antiperistalitic wave in the alimentary canal and this produces something similar to vomiting sensation in the insect. Because of this sensation the insect does not feed on the neem treated surface and ability to swallow is also blocked. Secondly it acts as Agricultural applications of neem products oviposition deterrent by not allowing the female to deposits eggs comes in very handy when the seeds in storage are coated with neem kernel powder and/or neem oil. It also acts as insect growth regulator. It is a very interesting property of neem product and unique in nature, it works on juvenile harmone.

Different types of Neem oil extraction process

- Mechanical pressing
- Steam Distillation Extraction
- Solvent Extraction
- Super Critical Extraction and
- Aqueous Extraction.

Mechanical Pressing

Neem seeds are placed in a tub or container and a form of press or screw is used to squeeze the seeds until the oil is pressed out.

This process performs using hydraulic pressing equipment. Untreated seed particles to be pressed with different pressures to determine the optimum pressure. The pressure was started at 138 Bar as the oil started to flow out of the seed bed, and closed at 412 bars since the oil yield relatively constant at the pressure above 413bars.Neem oil yield measurement was conducted using the mass balance.

Neem seeds kernals are placed into a vessel and either a screw or some of form of press is used to squeeze the kernals under pressure until the neem oil is pressed out and collected. The neem oil gets by pressing it mechanically and collected in a drum. This filtration is done to remove the various unwanted particles left in the extracted oil in order to get pure neem oil.

Steam Distillation Extraction

This method uses steam and high pressure to extract the neem oil. The kernals are heated with steam to increase the Neem oil flow, then squeeze under high pressure. Most of the neem oil is extracted from the kernals. This procedure makes the extraction process easier. As for the steam distillation process, the dried neem seeds are put into the steam boiler. Then they get swollen by steaming, thus neem oil in squeezing becomes very easy. This steaming process is accompanied by increasing pressure in the boiler which drives the oil out of neem seeds.

Steam distillation is a separation method which is used for separating mixture of components which are heat sensitive by using steam. The principle is based on variation in the boiling point of reducing the partial pressure of volatile components. The oil is extracted from the entire plant using a distillation element consisting of a distillation tank, a condenser, and a separator. Freshly harvested grass as such or after cutting into little pieces is loaded into the distillation tank. After closing the lid tightly, steam is entering into the tank. Steam and the oil vapor condense into liquid in condenser are collected in the separator.

Solvent Extraction

In the solvent extraction process, the solvent, usually hexane is mixed with neem seeds after oven drying. Added neem seeds can be pressed if wanted. The solvent extraction process is working on the principle of countercurrent and moving bed, permitting excellent penetration and percolation of solvent for absolute neem oil extraction. The extracted Neem oil is collected by vaporizing solvent out for later recovery.

Super Critical Extraction

The supercritical fluid extraction process is the most effective and efficient way to extract valuable constituent botanicals. This is the process of separating one component or the extractant from another or the matrix using supercritical fluids that is carbon dioxide as the extracting solvent. Carbon dioxide solvent is the king of extraction solvents for botanicals. Extraction conditions for supercritical CO_2 are above the critical temperature of 31^o C and pressure of 74 bar. Supercritical fluids are extremely compressed gases, which have combined properties of gases and liquids in an intriguing manner. Supercritical fluids can lead to reactions, which are difficult or impossible to achieve in conventional solvents. It is a fast procedure completed in 10 to 60 minutes .A supercritical extraction fluid can be separated from analyte by simply releasing pressure, leaving almost no trace and yields a pure residue.

Aqueous Extraction

The aqueous extraction is the simplest method and most used is the extraction of water. It consists of crushing or grinding the seed or neem leaves, put in water, strain into the thin fabric and collect the neem extract. This neem oil extract can be used in a spray for the control of pests without modification.

Soxhlet Extraction Method

100 g of neem powder was placed into the thimble and placed in the soxhlet chamber .500 ml of selected solvents were placed in a round bottom flask and assembled for soxhlet extractor then the distillation process was begin. After completed the extraction process, the solvent and extractor were placed on water bath to evaporate the solvent.

Plant Protection Measures

Brown plant hopper - Nilaparvatalugens	**Neem oil 3% Neem seed kernel extract 5 % or soil application @ 2 5 k g /h a**

Black bug - Scotinophoralurida	Spray Neem seed kernel extract 5 % or soil application @ 25 kg/ha
Ear head bug – Leptocorisaacuta Sheath rot - Saroclodiumoryzae Sheath blight - Rhizoctoniasolani	Neem seed kernel extract 5 % or soil application @ 25 kg /ha NSKE (5 %) or Neem oil 3 % Foliar spray with Neem oil at 3 %
Bacterial leaf blight - Xanthomonasoryzae p v . oryzae	Spray neem oil 3 % or NSKE 5 %

Advantages of neem oil as organic pesticide

Besides the numerous uses and benefits associated with neem tree products which include its anti-fungal and pesticide properties, neem organic pesticide has the following advantages:

- They are readily available in most localities in the tropics
- Less expensive to prepare
- Easy to prepare and apply
- Less toxic to non-target (more environment friendly)
- Handling and application does not require high level training
- Required simple application equipment and techniques

Conclusion

A major challenge of agriculture is to increase food production to meet the needs of the growing world population, without damaging the environment. In current agricultural practices, the control of pests is often accomplished by means of the excessive use of agrochemicals, which can result in environmental pollution and the development of resistant pests.There has recently been increased interest in the application of plant-based materials (botanical insecticides), such as neem oil, in pest control. Although these products are safer for the management of pests, compared to synthetic chemicals, their effects in IPM must be evaluated.

Dear Readers

We have received, in the past, some complaints from the readers that they did not receive the hard copies of the magazine for few months in which their articles were published specially from January 2022 onward.

We have done our best to find out the solution and contacted the postal department too. We have also sent the hard copies separately to some of the subscribers but since we did not have the number of copies needed (at par with the complaints received) so we could not dispatch the magazines to all separately. Therefore, we decided, looking to the need and demand of the subscribers, to reconsider those articles once again and republish the same in the coming issues. We are doing this for all the articles received after November 2021 onwards till August 2022. The number of articles every month to be considered has not been fixed yet we shall include those articles one by one.

It is therefore, requested all those who have not received hard copies to keep the track of their articles once again as the same would be there in the magazine in any issue coming down the line.

16. AGRICULTURAL EXTENSION

Indigenous Technical Knowledge in Agriculture: An Overview

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Introduction

Indigenous Technical Knowledge (ITK)is specifically concerned with actual application of the thinking of the local people in various operations of agriculture and allied areas. Indigenous knowledge is the local knowledge - knowledge that is unique to a given culture or society. Talukdar*et al.*,(2012) stated that ITK's will be helpful in technology blending programme to generate eco-friendly, location specific, economically viable and socially acceptable technologies. The term indigenous technical knowledge is often camouflaged with the belief that is associated with forthcoming happenings and the innovations made by the farmers to solve specific problems. In many cases, traditional knowledge has been orally passed for generations from person to person. Some forms of traditional knowledge are expressed through stories, legends, folklore, rituals, songs, and even laws.. Indigenous knowledge systems (IKS) are being examined by academicians, development planners, and contributors to alternative development approaches. Traditional knowledge (TK), also known as indigenous knowledge (IK) or local knowledge (LK) generally refers to the matured long-standing traditions and practices of certain regional, indigenous, or local communities. It also encompasses the wisdom, knowledge, and teachings of these communities.Moreover, unlike formal scientific knowledge, indigenous knowledge is generally transferred as oral wisdom from one generation to the other, and is seldom, if ever, documented. Combining all forms of knowledge other than the formal ones as 'indigenous knowledge' would lead to its generalization and oversimplification, and may negate the outstanding contribution local knowledge can make to sustainable development.Indigenous people can provide valuable input about the local environment and how to effectively manage its natural resources. Outside interest in indigenous knowledge systems has been fuelled by the recent worldwide ecological crisis and the realization that its causes lie partly in the overexploitation of natural resources based on inappropriate attitudes and technologies.

Indigenous Technical Knowledge in Agriculture

Indigenous knowledge is fundamental to local decision-making regarding daily activities like hunting and gathering, fishing, agriculture, animal husbandry, water conservation, health, etc.In the recent years, the role of IK in a range of sectors is being talked about. It includes intercropping techniques, pest control, crop diversity, and seed varieties in agriculture; plant varieties, and fish breeding techniques in biology; traditional medicine in human healthcare; soil conservation, irrigation, and water conservation in natural resource management; and oral traditions and local languages in education. The realization of IK's contribution to these sectors has led to an increasing interest in it by academicians, and policymakers alike. Many government and non-governmental organizations, as well as international organizations such as the World Bank, International Labor Office, UNESCO and FAO are now appreciating the role IK can play in achieving sustainable development in a country. This interest is also apparent in the policies and programmes of various countries. Scientists now recognize that indigenous people have managed the environments in which they have lived for generations, often without significantly damaging local ecologies. Borthakur and Singh (2012) suggested that the appropriate coalition between the traditional and modern knowledge and technology systems has immense potential to benefit the society. Many feel that indigenous knowledge can thus provide a powerful basis from which alternative ways of managing resources can be developed. Indigenous knowledge technologies and know-how have an advantage over Science in that they rely on locally available skills and materials and are thus often more cost-effective than introducing exotic technologies from outside sources. Pokhrel and Laskar (2020)revealed that indigenous technologies are of low cost, easily available and have no deleterious effects on agro-ecosystem. By considering the cost effectiveness, availability and eco-friendly nature of the technologies these can be included in the present day integrated pest management (IPM) programme particularly for the farming communities.Purkait*et al.*, (2018) study

revealed that the fish farmers are discern ITKs as more widely accepted among the rural farmers because of its cost-effectiveness, local availability of materials, less complexity in preparation, compatibility to social and cultural habitats and economic viability.

The following are some of the features of indigenous knowledge, which have relevance to conservation and sustainable development:

- **Locally Appropriate:** Indigenous knowledge represents a way of life that has evolved with the local environment, so it is specifically adapted to the requirements of local conditions.
- **Restraint in Resource Exploitation:** Production is for subsistence needs only; only what is needed for immediate survival is taken from the environment.
- **Diversified Production Systems:** There is no overexploitation of a single resource; risk is often spread out by utilizing a number of subsistence strategies.
- **Respect for Nature:** The land is considered sacred, humans are dependent on nature for survival, and all species are interconnected.
- **Flexible:** Indigenous knowledge is able to adapt to new conditions and incorporate outside knowledge.
- **Social Responsibility:** There are strong family and community ties, and with them feelings of obligation and responsibility to preserve the land for future generations.

Conclusion

The Indigenous Technical Knowledge (ITK) is socially desirable, economically affordable, and sustainable, involves minimum risk and focus on efficient utilization of ecofriendly resources.The indigenous technologies are low cost, easily available and have no deleterious effects on agro-ecosystem. The technologies are practiced by the farming communities. It is also an established fact that the indigenous knowledge varies from region to region and community to community. Considering the cost effectiveness, availability and eco-friendly nature the technologies these may be included in the present day farming. Because the materials that are used in these technologies are available locally and are also socially accepted hence, the indigenous technical knowledge's may not be the only option but may be accommodated as one of the most viable as well as effective tools in farming.

Reference

Anwesha, B. and Pardeep, S. 2012. Indigenous Technical Knowledge (ITK) and their Role in Sustainable Grassroots Innovations: An Illustration in Indian Context. Proceedings of International Conference on Innovation & Research in Technology for Sustainable Development.38-42.

Puran, P. and Nripendra, L. 2020. Indigenous technical knowledge (ITK) based pest management practices for Boro paddy in Northern parts of West Bengal. Journal *of Entomology and Zoology Studies* ; 8**(2)**: 494-98.

Soumyadip, P., Sutanu, K., Anandamoy, M. and Subir, K. P. 2018.Indigenous Technical Knowledge in Fisheries of South 24 Parganas District of West Bengal, India.*Int.J.Curr.Microbiol.App.Sci.* 7**(02)**: 2793-2797.

Talukdar, R.K.Barman, S. and Hussain, A. 2012. Documentation and perceived rationale of Indigenous Technical Knowledge (ITK) utilized in Boro rice cultivation by farmers of Kamrup District of Assam. *J. Acad. Indus. Res.* 1**(7)**:412-18.

17. MAIN SUBJECT: AGRICULTURAL SCIENCES

Plant Products and Anti Viral Principles

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Preparation of Plant Extracts, Neem Oil and NSKE

Plants virtually are nature's chemical

factories, providing man with practically unlimited sources of chemicals for possible use as botanical pesticides.These plant products are found to have fungicidal, bactericidal or antiviral principles. Out of 2,000 plant species possessing pesticidal properties, 346 have fungicidal properties, 92 have bactericidal properties and 90 have antiviral principles.Among the plant products neem derivatives are reported to be effective in controlling several diseases.Others include *Mahua* (Iluppai), Pungam (*Karanj*) **Neem Products**

The tree (*Azadirachtaindica*) contains several active principles in various parts.The important active principles present in neem products are azadirachtin, Nimbidin, Nimbinene, Nimbidic acid and Azadirone.Among the various neem products, neem seed kernel extract, neem oil, neem cake and neem cake extract are widely used as they are safe to ecofriendly populations.

Neem Seed Kernel Extract 5% (NSKE)

Neem seed kernel is powdered.Twenty five kg of powdered neem seed kernel is taken in a gunny bag and tied.It is soaked in 100 litres of water for 8 hours.The gunny bag is shaked thoroughly to get the extract and the filtrate was taken.The volume of the filtrate was made 500 litres using water.To this extract 500 ml of sticker like Teepol or Triton AE or 500 g of Khadi soap is mixed. The neem seed kernel extract thus obtained is ready for spraying. It is used to control the green leaf hopper (GLH), the insect vector of Rice Tungro Virus (RTV).Foliar sprays of 5% NSKE at 15 days interval effectively control the vector and reduce the spread of RTV.Foliar spray of NSKE at the time of panicle emergence reduces the sheath rot disease (*Acrocylindriumoryzae)* in rice.In blackgram and greengram two sprays NSKE 5% at 15 days interval controls powdery mildew (*Eryspihepolygoni).*

Neem Oil 3%

In plant disease management, neem oil 3% foliar spray is used.Here Teepol (1ml / litre of water) is mixed first with water to have emulsion and then the neem oil is added.The final solution will be milky white in colour.To get 3% solution 30 ml of neem oil is added to 1 litre of water.For one hectare, 15 litres of neem oil is required to mix in 500 litres of water.

Neem oil 3% is used to control green leaf hopper, the vector of RTV, for which three sprays are given at 15 days interval.For the control of whitefly vector of yellow mosaic in blackgram and greengram neem oil 3% spray is done.Sheath rot of rice is controlled with neem oil 3% when it is sprayed at the time fo panicle initiation.Rice blast is also controlled by neem oil 3%.Rust of groundnut (*Pucciniaarachidis*) and powdery mildew of blackgram (*E.polygoni*) are controlled by two sprays with neem oil 3% at 15 days intervals.

Neem Cake

Neem cake obtained after extraction of oil is used in the control of soil-borne diseases.Neem cake is powdered and directly applied to the field before last ploughing for sowing.Soil application of 150 kg of neem cake per hectare as basal dressing reduces sheath blight (*Rhizoctoniasolani*) and blast.In cotton, pre-emergence, post-emergence and damping off disease (*Rhizoctoniasolani*) reduced by soil application of neem cake at 2.5 and 5.0 tonnes / ha respectively.Soil application of neem cake controlled root rot of blackgram and sesame (150 kg/ha), chickpea wilt (*Fusariumsolani*), basal stem rot of coconut (*Ganodermalucidum*5 kg/ha), betelvine foot rot and leaf rot (*Phytophthoracapsici*) and crossandra wilt (*Fusariumsolani*).

Neem Cake Extract 10%

Neem cake is powdered.Fifty kilogram of neem cake is taken in a gunny bag and is soaked in 500 litres of water for a period of 8 hrs.The gunny bag is removed after a thorough shaking.To the extract, 500 ml of sticker (Teepol or Trition AE) is added and mixed well.This extract is used to control citrus canker (*Xanthomonasaxonopodis*pv. c*itri*).

Besides the above said preparation, some of the commercially available neem formulations are Bioneem, Biosol, Econeem, Field Marshall, Kemissal, Margocide,Neem Mark, Neemax, Neemazal, Nimbicidine, Neemgold, Neemguard, Neemicide, Neem plus, Nimba, Nimbin, Sunneem, Wellgro, etc.

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