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AgriGate

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An International Multidisciplinary Monthly e-Magazine

Safer food, better health

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AgriGate

contents





From the Desk of Editor-in-chief

June 2022 | Volume 02 | Special Issue

I would like to introduce the launch of **"AgriGate - An International Multidisciplinary Monthly e-Magazine Volume 02 Issue No. 05 – May 2022"** with immense pleasure. Our team is privileged to dedicate this issue to draw attention and inspire action to help prevent, detect and manage foodborne risks, contributing to food security and improve human health.

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

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

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

Dr R Shiv Ramakrishnan
Editor-in-chief
AgriGate Magazine

Volume: 02 Special Issue

MINOR MILLETS – CLIMATE SMART CROP

Article ID: AG-V02-SI-01

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Introduction

A small coarse of grains belonging to the group of forage grass called as minor millets which belong to the family Poaceae.Minor millets comprise of proso millet or panivaragu(*Panicummiliaceum*), foxtail millet or thenai (*Setariaitalica)*, little millet or samai (*Panicumsumatrense*), barnyard millet or sanwa millet (*Echinochloacolona)* and kodo millet or varagu (*Paspalumscrobiculatum*). Minor millets can grown well in adverse soil and climatic condition, shorter crop duration, suitable for contingency plan. Compare to major cereals, it is more nutritious. Finger millet is highly tolerant to alkalinity, even more than pH 11. Foxtail millet, proso millet and little millet is suitable for both drought and water logging condition. Kodo millet and proso millet is highly drought resistant.

Importance of small millets

Newly acquired life-styles has now given us diabetes, hypertension and cardiovascular disease running rampant. For the above diseases millets have returned as a viable option to live healthy life without consuming loads of anti-diabetic and anti-hypertension medicines that are not only very expansive but also have serious side-effects in the long run. Minor millets also act as a prebiotic feeding micro-flora in our inner ecosystem. Minor millets will hydrate human colon to keep us from being constipated. The high levels of tryptophan in minor millet produce serotonin, which is calming to our moods. Magnesium in minor millet can help reduce the effects of migraines and heart attacks. Niacin (vitamin B3) in millet can help lower cholesterol. Minor millet consumption decreases Triglycerides and C-reactive protein, thereby preventing cardiovascular

disease. All millet varieties show high antioxidant activity.

Millet is gluten free and non allergenic.Millets contribute towards balanced diet, and can hence ensure nutritional security more easily through regular consumption along with keeping the environment safe as they are low input crops mostly adapted to marginal lands. Declining small millets cultivation has resulted in reduced availability of these nutritious grains to needy population and also the traditional consumers have gradually switched over to more easily available fine cereals due to Government policies. This is a disturbing trend and needs urgent focus by the agricultural experts and policy makers. Immediate policy and market support, value addition and promotional activity are necessary for arresting the further decline not only in cultivation but also consumption. Improving productivity and enhancing demand should be the twin approaches

Finger millet – *Eleusinecoracana* (2n=36)

- Finger milltet/African millet/Keppai/Mutthair/Thamida/Nacheni/Crow footed millet.The genus *Elusine* consists of eleven species
- Finger millet is an important staple food in parts of East and Central Africa and India particularly in Karnataka.
- It is a gluten free variant of Millet, rich in proteins and amino acids. In growing children, finger millet is intended to facilitate brain growth. It is also high in calcium and has healthy concentrations of iron and other minerals as well.

Foxtail millet – *Setariaitalica* (2n =18)

- Dwarf Setaria/Foxtail bristle grass/Giant Setaria/Green foxtail/Italian millet/German millet/Hungaraian millet
- Second most widely planted species of millet and the most important in East Asia. Place of origin is China. It can tolerate water logging
- It is rich in carbohydrates that help in balancing blood sugar levels in the body. These millets have a high Iron content. Foxtail Millet can improve overall immunity.

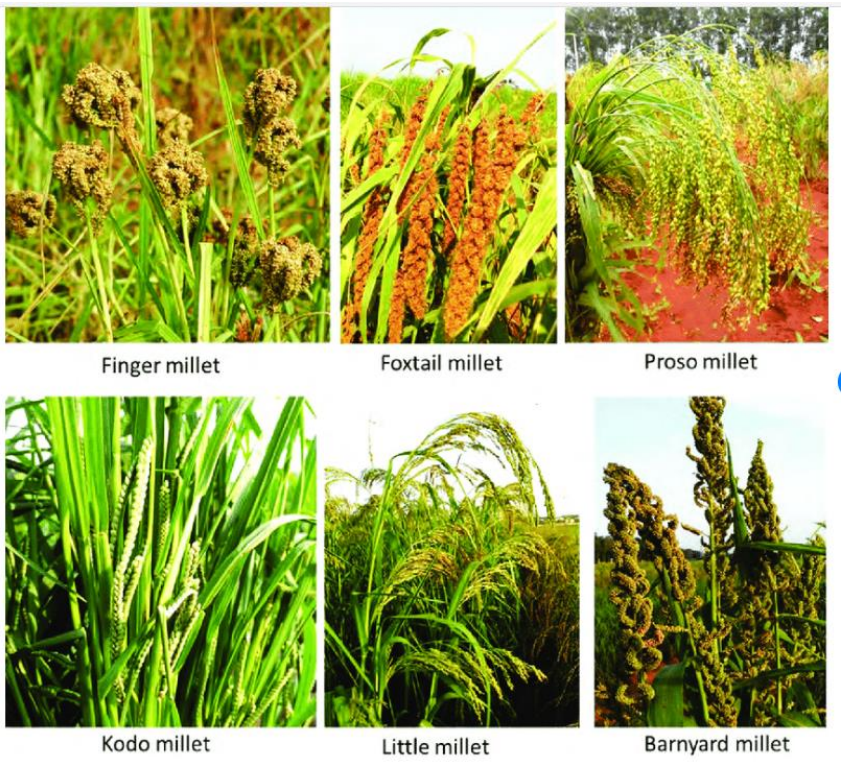
Proso millet – *Panicummiliaceum* (2n=36)

- Boom corn millet/ Common millet/Broom tail millet/Hog millet/Kashfi millet/ Red millet/ White millet

- Short duration millet is widely grown in India. Mostly adapted to hot summers in tropics and high altitudes.
    - It is a good option for diabetics to be incorporated into a daily diet. Switching to a diet with Millet can be a good transformation as far as nutrition is concerned. One can shop for Millets online and get a hand on the organic options available from different brands.

Barnyard millet – *Echinochloafrumentacea* (2n=54)

- Kuthiravaali/Udalu and Kodisama (telgu), Shamul (marathi), Sama (gujarati), Shamula (bengali) and Swank (punjabi)
- In India, barnyard millet is developed in the Himalayan area from the north to the Deccan region in the south.
- It is ideal foods for the patient suffer from diabetes mellitus.
- Barnyard millet is recommended to patient who suffers from Cardiovascular diseases and diabetes. They are also most effective to reduce the blood glucose level and lipid level.



Little millet or samai - *Panicumsumatrense* (2n=36)

- It is native to India and is called as Indian millet. The species name is based on a specimen collected from Sumatra (Indonesia).
- It is mainly cultivated I Caucasus, China, east Asia, India and Malaysia. It is adapted to both temperate and tropical climates. It can withstand both drought and water logging.
- It is loaded with vitamin B and essential minerals such as Calcium, Iron, Zinc, and Potassium. Little Millet is largely used in Southern states of India in numerous traditional dishes. It is a healthier alternative to rice and does not cause weight gain.

Kodo millet or varagu – *Paspalumscorbiculatum* (2n=40)

- It is an annual grain that is grown primarily in Nepal and also in India, Philippines, Indonesia, Vietnam, Thailand and in West Africa from where it originated.
- It has large potential to provide nourishing food to subsistence farmers in Africa and elsewhere.
- Kodo is a fantastic source of B vitamins, especially niacin, B6, and folic acid, among other vitamins and minerals. It contains calcium, iron, potassium, magnesium, and zinc minerals. Being a gluten-free millet, it is great for gluten-intolerant individuals. It can relieve cardiovascular disorders such as high blood pressure and cholesterol levels when eaten regularly by postmenopausal women.

Promotion of small millets for better nutrition

Cultivation and consumption of small millets can be promoted by

(1) supporting production and improving productivity (through research and developments to enhance yield and nutritional qualities, cultivation as pure crops as well as intercrop with other main crops, cultivation as fail-safe crops – late sowing when monsoon fails, particularly early-maturing cultivars that yield considerably even under constrained environments);

(2) providing on-farm support and linking farmers to value chains;

(3) undertaking campaigns to build consumer awareness;

(4) ensuring products in demand are available and accessible;

(5) supporting processors, food service, health/medical and industrial sectors to

incorporate millets (for example, development of modern readyto-eat and ready-to-cook products, post-harvest processing technology development, nutrition investigation, methods for extending shelf life, etc.); and

(6) policy support (including small millets and value-added products in the public distribution systems, minimum support price and mid-day meal/school feeding schemes, etc.).

Future challenges and prospects

Small millets have the potential to serve as an alternate/ supplement to major cereal staples because of their ability to be used/cooked in similar ways, diverse adaptation to adverse conditions and nutritional qualities. Small millets can fit very well into multiple cropping systems both under irrigated and rainfed conditions. Their storability under normal storage conditions has made them 'famine reserves'. They can provide nutritious grains as well as valuable fodder in a short span of time. Therefore, there is an urgent need for Indian policy makers to refocus their attention towards millet farming systems and enact policies that create an enabling environment for millet farmers.

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AGRICULTURAL DROUGHT IN INDIA AND ITS CLASSIFICATION

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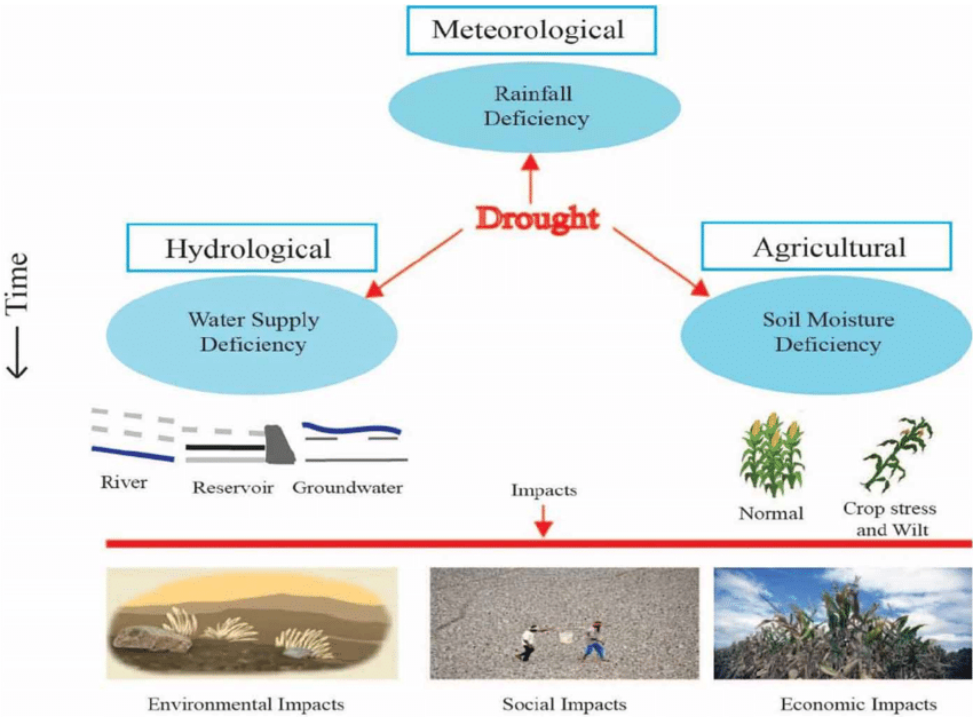
Introduction

Drought is a temporary aberration, unlike aridity or even seasonal aridity, which is a permanent feature of climate. Drought in contrast is a recurrent, yet sporadic feature of climate, known to occur under all climatic regimes and is usually characterized by variability in terms of its spatial expanse, intensity and duration. Conditions of drought appear primarily, though not solely, on account of substantial rainfall deviation from the normal and or the skewed nature of the spatial or temporal distribution to a degree that inflicts an adverse impact on crops over an agricultural season or successive seasons. Drought is universally accepted which stems from a deficiency or erratic distribution in rainfall but the spread and intensity of the calamity is contingent on several factors, including the status of surface and ground water resources, agro-climatic features, cropping choices and patterns, socio-economic vulnerabilities of the local population.



Drought incidence in India

The drought years has defined based on the All India Summer Monsoon Rainfall which has less than one standard deviation below the mean.During 1871 to 2015, there were 25 major drought years which are occurred during 1873, 1877, 1899, 1901, 1904, 1905, 1911, 1918, 1920, 1941, 1951, 1965, 1966, 1968, 1972, 1974, 1979, 1982, 1985, 1986, 1987, 2002, 2009, 2014 and 2015. The frequency of drought has varied over the decades. From 1899 to 1920, there were seven drought years. The incidence of drought came down between 1941 and 1965 when the country witnessed just three drought years. However, during the period between 1965 and 1987, there were 10 drought years which was attributed to the El Nino Southern Oscillation (ENSO).

Occurrence of Severe droughts in India

The occurrence of droughts during the colonial period tended to degenerate into severe famines and caused massive human losses. According to an estimate during the latter half of the 19th century, there were approximately 25 major famines across India, which killed 30 to 40 million people. The first Bengal famine of 1770 is estimated to have wiped out nearly one third of the population. The famines continued until Independence in 1947, with the Bengal famine of 1943 which affected 3 to 4 million people, being among the most devastating.

Among the many drought events since Independence, the one in 1987 was one of the worst, with an overall rainfall deficiency of 19 percent which affected 60 percent of the normal cropped area and a population of 285 million people. This was repeated in 2002 with the overall rainfall deficiency for the country as a whole was 19 percent which affected 300 million people and 150 million cattle. Food grains production registered an unprecedented steep fall of 29 million tonnes. In 2009, the overall rainfall deficiency in India was 22 percent, which resulted in decrease of food grain production by 16 million tonnes.During 2015 and 2016, large parts of the country were affected by drought causing widespread hardships to the affected population since the calamity encompassed major agricultural States in the country.

Classification of Drought:

A. On the basis of source of water availability

Drought is classified into three types on the basis of water availability.

1. Meteorological drought

Meteorological drought mainly indicate based on the deficit rainfall of different quantum. The Indian Meteorological Department (IMD)has classified this drought as follows based on the amount of rainfall departure.

Slight drought	:	When rainfall is 11 to 25% less from the normal rainfall
Moderate drought	:	When rainfall is 26 to 50% less than the normal rainfall
Severe drought	:	When rainfall is more than 50% less than the normal rainfall

2. Hydrological drought

It is defined as the situation of deficit rainfall when the hydrological sources like streams, rivers, lakes, wells dry up and ground water level depletes. This affects industry and power generation**.**

3. Agricultural drought

This is the situation resulted from inadequate rainfall, when soil moisture falls short to meet the water demands of the crop during growth. This affects the crop due to soil moisture stress resulting into reduction of yield.

B. On the basis of time of occurrence

Drought differs in time and period of their occurrence and classified as follows.

1. Permanent drought

This is the area generally of permanent dry, arid desert regions. Crop production due to inadequate rainfall is not possible without irrigation. In these areas vegetation like cactus, thorny shrubs, xerophytes etc. are generally observed.

2. Seasonal drought

It occurs in the regions with clearly defined as rainy (wet) and dry climates. Seasonal drought may occur due to large scale seasonal circulation. This happens in monsoon areas.

3. Contingent drought

Thisis due to irregular and variability in rainfall, especially in humid and sub humid regions. The occurrence of such droughts may coincide with growth periods of the crops when the water needs are critical and greatest resulting into severity of the effects i.e. yield reduction.

C. On the basis of medium

On the basis of medium in which drought occurs and it has divided the drought into two types.

1. Soil drought

It is the condition when soil moisture depletes and falls short to meet Potential Evapotranspiration of the crop.

2. Atmospheric drought

This results from low humidity, dry and hot winds and causes desiccation of plants. This may occur even when the rainfall and moisture supply is adequate.

Conclusion

The country has witnessed the severe drought and its impact on human and cattle population during the pre-independence period. The situation improved remarkably in post-independent India. Investment in irrigation works, promotion and availability of quality inputs, focus on research & extension led to increased agricultural productivity and greater resilience among the farming communities. This development not only render self-sufficient in food production but also for famine proof to a considerable extentin the country. Though population quadrupled since Independence, the country did not witness a famine in the past 72 years and in fact, India has become a major exporter of agricultural produce in the world.

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SOCIO-ECONOMICS OF EUCALYPTUS CULTIVATION IN MARGINAL LANDS

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Introduction

In Indian subcontinent, severe ecological degradation has taken place due to the uncontrolled clearance of vegetation both for agriculture and for use of wood as fuel. The traditional trees, which sustained the health, agricultural practices and rural economy, have ended up as firewood. Floods and physiological droughts are the consequences of this denudation.

Firewood has always been regarded as a free good by the rural poor in developing countries. It is freely gathered from government forests and communal lands. As long as commercial sale of wood did not occur, such removals from communal areas were accepted by the community. With the conversion of the sites into plantations, restrictions come into force. Eucalyptus plantations raised on communal land are reported to have caused this type of problems in those regions.

Once the plantation is established, leaf fall could serve to meet the some biomass needs - a social benefit, which however may be opposed to silvi-cultural needs (FAO 2007 and FAO 2002). Eucalyptus plantation becomes increasing from time to time in India. Among the trees planted by the farmers in India, Eucalypts constituted 85 per cent of them. Planting was undertaken both on uncultivated land, privately owned, marginal land and on agricultural lands and half of the area was found to have been under rained agriculture prior to the planting.

Ecological impacts of eucalyptus plantation

Eucalyptus is not good tree for erosion control. Under dry condition ground vegetation is suppressed by root competition. In areas, where eucalyptus tree are inter cropped with other trees, the problem is minimal and absent, whereas in areas covered with only eucalyptus woodlots there is more soil erosion and gully formation (Zerga 2015). Most eucalypts are not good trees for erosion control.

When young, they are very susceptible to grass competition, and to obtain good growth clean weeding is necessary during the establishment period, which is undesirable on steep or eroding terrain. In eucalyptus plantation area, understory development and litter build-up were insufficient to prevent surface run-off. It is a fast growing, heavy crowned tree which casts a dense shade but little litter. In closed plantations it has a great water demand and an exceptionally extensive and dense root system which enable it to compete successfully for available soil moisture, especially with smaller, shallow rooted plants (FAO 1985).

Economic Impact of Eucalyptus

The increasing requirement must largely be met from plantations of fast growing species or there will be further loss of natural tree cover. Eucalypts will necessarily have a major role to play, particularly in the private sector.

In the social issues that have been raised in India, the profitability of eucalyptus growing is itself sometimes a charge against it. Eucalypts can be raised economically for production of medicinal/perfumery oil or for honey. In the foreseeable future, eucalyptus might be raised for producing methanol, industrial oil, or as a replacement for petroleum. But today their use in plantations is limited to the production of firewood, poles, timber and as industrial raw material, mainly for the production of pulp and paper.

The economics of *Eucalyptus* is complicated. The eucalypts are sensitive to site quality and yield can vary in the order of 15:1 for any particular species within a region, depending on provenance and site. With a water use of 750 mm per annum in a rainfall region of 800 mm in South India, the increment of *E. tereticornis* is 4.5 m^3 ha/yr; in South Africa and Kenya, with a water use of 1500 mm in a rainfall region of 1800 mm, the increment of *E. grandis* is 45 m^3/ha/yr; that is, with double the water use, ten times the yield is obtained, albeit with different species.

Under favourable market conditions, given the necessary capital and

proper management, eucalypt tree crops generate much more income than agricultural crops. Hence the 2.5 million ha of block plantations of *Eucalyptus* spp. in Gujarat, Haryana, Punjab and Western U.P were raised on either agricultural land or old fallow. The land value of sites suitable for eucalypt in the plateau belt of Ethiopia is higher than for those suited for agriculture.

Economics of *Eucalyptus* as fuel wood

In regions where firewood is scarce and where it has to be paid for, eucalypt fuelwood plantations have been economically successful. These are generally close to townships or in regions totally devoid of natural forests. In clay soils, returns from *Prosopis juliflora* may be better. The economics however, improves considerably, if, in addition, there is demand for pulpwood or poles/small timber, which is why eucalypts score over *Prosopis juliflora*. Multiple uses provide better overall returns. Even in the case of plantations established by pulp based industries, branches, lops and tops are used for electricity generation.

The use of eucalypts for firewood is remunerative where soils are unsuitable for sustainable agriculture, as in arid and semi-arid regions; where soils are heavily acidic; and in saline and alkaline areas of India when plantations of *Eucalyptus* spp. for firewood have been raised on a large scale.

Economics of *Eucalyptus* as poles

Poles of *Eucalyptus* spp. of different sizes are used in the construction of huts, for scaffolding, as mine props and in power and telecommunication lines. In the dry zone in India, it has been a common practice to collect small sized poles from natural forests and transport them over long distances for use in the construction of huts.

Economics of *Eucalyptus* as pulpwood

Many species of eucalypts are ideal for production of pulp with suitable fibre quality, density, colour and homogeneity. Countries which have profited from this are Argentina, Brazil, Chile, Portugal and Spain. An encouraging factor concerning eucalyptus is its suitability for pulp production at a very young age, when the rate of growth is the highest. Also species suitable for paper production (in admixture with long fibred pulp) are also ideal for rayon grade pulp.

Economics of *Eucalyptus* for other industrial uses

In India *E. tereticornis* has been found unsuitable for particle boards, but is good for fibre and cement bonded boards. *E. tereticornis* and *E. citriodora* are also used in the production of compressed wood. *E. tereticornis* raised in

some regions, can be used directly for production of veneers, while in other cases it needs resin modifiers. Seasoned *E. tereticornis* has been successfully used for manufacturing furniture. It can be given a walnut or rosewood finish by appropriate treatment with ammonia vapour. The value of eucalypts in this sector is in the context of reduced availability of timber from the natural forests.

Social Impacts of eucalyptus

When employment opportunity is the main thing in the economy of a country, according to some authors eucalyptus can reduce the number of employment opportunity, with the direct effect on the well-being of the community. Rain fed agricultural in the tropics require 150-180 man days of labour per year, but the requirement of labour for raising and tending of an Eucalyptus plantation would be 350-400 man days in the establishment and about 40 man days per year thereafter. Tree felling and debarking are done by skilled labour moving from site to site, rather than by local people. Thus, if eucalypt planting is taken up only in erstwhile agricultural areas, it results in loss of employment (Deshpande and Chandrashekar 1984).

It has been contended that the economic benefits accruing to landowners in the rural areas through cultivation of eucalypts has widened the gap between the rich and the poor, disrupting the social fabric. The rich have become richer. Eucalyptus was the most dominant genus that will be used in plantation and woodlot forestry, with different controversies. The introduction was due to the scarcity of fuel wood and their easy adaptation of the crop in any climatic and soil character.

It is usually the tree of alternatives for smallholder, because plantation can be established cheaply, it can be cultivated easily, it has reliable markets and the products earn good prices all of which continue to encourage the expansion of the tree and make it one of the most widely planted exotic trees in the region. There are so many importance of the tree regarding social value, alternatives for fuel wood and minimization of the clearance of native forest for fuel wood. But there is also some impact on the community and the biodiversity which facilitate biodiversity loss, secretion of allelo-chemicals with a direct effect on the adjacent crop, The other criticisms on Eucalyptus was mainly on the deep rooted types, that drain water resources and short crop rotations, are primarily responsible for depletion of the soil's nutrients, increased soil erosion, and suppression of the undergrowth and also depletes ground water resources.

Social and economic problems arising from insensitive plantation establishment or unwise management are real, in most developing countries in the tropics, ecological degradation - due to clearance of trees for agriculture on marginal lands and for meeting firewood needs- contribute to environmental degradation. It also has a positive impact on bio diversity conservation and fostering of native vegetation, control soil erosion, but monoculture plantation is the last alternative, pharmacological importance by containing volatile oils and source of antioxidant effect, it serves as a food and habitat for wildlife especially birds and draining of swampy areas.

Conclusion

Eucalyptus is neither good nor bad, and therefore a careful analysis of the ecological and social implications should be undertaken before planting. Growing a crop is a matter of choice. The costs and benefits of planting fast-growing trees including Eucalyptus need careful assessment based on detailed site studies with due consideration to both environmental and socio-economic needs. Decisions such as what, where, why and how to grow and how to manage it have to be made, and the social and ecological implications of each decision, as well as the economic implications, have to be weighted up. Some of the perceived problems with eucalypts can be avoided by applying sensible management practices. If the adverse effects of the trees are intolerably great, then other crops should be considered.

References

Deshpande, R. S. and H. Chandrashekar. 1984. Is eucalypts farming really uneconomic? Workshop on Eucalyptus Plantation, Indian Statistical Institute, Bangalore. India.

FAO. 1985. The ecological effects of eucalyptus. FAO forestry paper. FAO, Rome.

FAO. 2002. Annotated bibliography on environmental, social and economic impacts of Eucalypts. Forest Plantations Working Papers, Forest Resources Development Service, Forest Resources Division. FAO, Rome.

FAO. 2007. The ecological, economic and social effects of eucalyptus FAO corporate document repository. Regional office for Asia and the pacific.

Zerga, B. (2015). Rangeland degradation and restoration: A global perspective. Point J. Agric. Biotechnol. Res. 1 (2): 037-054

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MULBERRY: AN IDEAL PLANT FOR SUSTAINABLE DEVELOPMENT

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Introduction

Mulberry is derived from Latin word Morus and the cultivation of mulberry leaves of rearing of silk worms is called as Moriculture. Mulberry plant belonging to the family Moraceae and genus Morus. It is the main food for silkworm Bombyx mori.L. Mulberry plant is perennial, various pathogens like fungi, bacteria, viruses and nematodes cause diseases in mulberry. Mulberry leaf is a major economic component in sericulture since the quality and quantity of leaf produced per unit area has a direct bearing on cocoon harvest. Mulberry cultivation is the agriculture part of sericulture which constitutes not only the rearing of silk worms but also silk reeling. Cultivation of mulberry plays a significant role in determine the production cost of cocoons and silk as it is estimated that 60-70% of the cost of cocoons goes to mulberry. It is the chief food for Bombyx mori. Mulberry leaves protein is the source for silk worm to biosynthesize the silk, which is made up of two proteins i.e., fibroin and sericin and its leaf and cell wall together contains with structural carbohydrates and which is highly digestible. So mulberry is the main food source for silk worms.

Species and varieties under cultivation in india

There are about 68 species of the genus Morus, the majority of them occur in Asia, especially in China (24 species) and Japan (19). Continental America is also rich in its Morus species. The genus is poorly represented in Africa, Europe and Middle East, and it is not present in Australia. In India, there are many species of Morus, of which Morus alba, M. indica. M. serrata and M. laevigata grow wild in the Himalayas. Several varieties have been introduced belonging to M. multicaulis, M. nigra, M. sinensis and M.

phillippinensis. Most of the Indian varieties of mulberry belong to M. indica.

Climate

Mulberry thrives under various climatic conditions ranging from temperate to tropic located north of equator between 28° N to 55°N latitude. The ideal range of temperature is from 24-28°C. It grows well in places with annual rainfall ranging from 600mm to 2500mm. Sunshine is one of the important factors controlling growth and leaf quality. In tropics, mulberry grows with a sunshine range of 9.0 to 13.00 hours a day.

Soil Condition

Mulberry flourishes well in soils which are flat, deep, fertile, well drained, loamy to clayey, porous with good moisture holding capacity. The ideal range of soil pH is 6.2 to 6.8. The optimum pH required for mulberry is 6.5 to 6.8. : The powdered gypsum/lime is mixed well with soil with soil of the garden and irrigated to stagnation for 48-72h. Later the water is leached out by drainage and dried.

Propagation of mulberry

- Mulberry is mostly propagated through cuttings.
- Cuttings may be planted straight away in the main field itself or nursery may be raised and the sprouted and rooted saplings may be planted in the main field.
- The latter method is advisable because of its easy establishment in the main field.

Selection of planting material

- Generally, the mulberry plants are raised from semi-hardwood cuttings.
- Cuttings are selected from well-established garden of 8-12 months old.
- Only full grown thick main stems, free from insect and disease damages having a diameter of 10-12mm are chosen for preparation of cuttings.
- The cuttings should be of 15-20 cm with 3-4 active buds and should have 45o slanting cut at the bottom end.
- Care should be taken to make a sharp clean cut at both the ends of cuttings without splitting the bark.
- Manually/power operated mulberry cutter (stem cutting machine) is available for quick cutting of propagation material.

Fig. 2. Mulberry Fruit

Mulberry in environmental safety approach

Mulberry leaves has good absorption ability to absorb the air pollutants like carbon dioxide, carbon monoxide, hydrogen fluoride, sulphur dioxide and chlorine from atmosphere. Roots have high ability to uptake the carbon pollutants, heavy metal pollutants from the soil. As per the report, one mulberry tree can absorb 4162 kg of carbon dioxide and release 3064 kg of oxygen every year. Mulberry plants have resistance against towards chlorine and it was noticed as undamaged even at higher levels of chlorine pollution.

Mulberry plants when cultivated as tree crop conserve water and soil. The rate of reduction of runoff during flooding can be upto 10-20 %.The annual runoff in mulberry plantation sites of plains can be reduced by 38% under 5 years old. Among the different tree species, mulberry with wider, deeper, and better rooting system has greater potential to remediate heavy metals from the contaminated soils. Heavy metals like chromium, lead, copper, nickel, cadmium, zinc, manganese and mercury are being remediated by using different species of mulberry.

Mulberry in human health

Plants are the natural sources of biologically active compounds. Among the different plants, mulberry has been known world-wide for their biologically active biomolecules like phenols, alkaloids, terpenoids, amino sugars, stilbenoids etc. Mulberry fruits has high athocyanin content and antioxidant activities. Berries provide potential health benefits to human being such as delay in ageing, protection from cardiovascular diseases,antidiabetic activity and reducing risk of cancer. It involved in protection of liver and kidney damage. Mulberry fruits is rich in polyphenols like flavones, flavonols,

isoflavanols, stilnenes, lignans, tannins, anthocyanins and catechins.

Fresh fruits of mulberry contains higher content of proteins 1.44g/100 g than strawberries, blue berries and raspberries. Mulberry is the best plant which contains all the required essential nutrients in its leaf and fruits. It was recently reported that mulberry fruit contains almost all the essential amino acids (valine, tyrosine, phenylalanine, tryptophan,methionine, isoleucine, leucine, lysine, cysteine, histidine and threonine). This fruits also possess important minerals of iron, copper, zinc, potassium, sodium, magnesium, calcium and manganese. Mulberry fruits contain Vitamin-A (beta-carotene), Vitamin-B1 (thiamine), Vitamin-B2 (riboflavin), Vitamin-B3 (niacin), Vitamin-B6, Folate, Vitamin-C (ascorbic acid), Vitamin-E (alpha-tocopherol) and Vitamin-K (phylloquinone). Mulberry fruits also possess various types of polysaccharides which involved a significant role in physiological activities of human beings. Polysaccharides in mulberry fruits has bioactivities such as antioxidant activity.

Mulberry in economic empowerment

Mulberry cultivation engenders direct or indirect employment to the farmers. Other than sericultural practices, mulberry is also utilized in other sectors providing employment and in revenue generation.Mulberry by products produced by pharmaceutical, food, beverage, herbal and cosmetic industries across the world. Industrial utilization of leaf and fruits has enabled additional income generation to mulberry farmers and also availability of processed mulberry products to the people throughout the year.Mulberry leaf powder is also used for the treatment of hypertension, cancers, hyperlipidaemia, arteriosclerosis, liver and kidney damage, neuro protective agent. Mulberry tea made form young shoots and leaves contains 15 types of essential amino acids which required for optimum metabolism of human body. Mulberry tea is rich in gama-aminobutyric acid which reduces the blood pressure. Mulberry tea suitable for all age groups and used to overcome the problems of liver, improving eye sight and other health benefits of humans.

Conclusions and Future prospectives

From hundreds of years, mulberry plant was mainly recognised as food plant for silkworms. But now it is considered as multipurpose plant by utilizing in environmental safety approach, promotion of human health and promoting animal husbandry through quality milk production and

enhanced meat production. It did huge role in environmental cleanup through bioremediation of polluted sites and carbon sequestration. Researchers and industrialists given more importance to exploit the mulberry at large scale for the health benefits of humans, economic generation and for environmental protection. Hence mulberry plants involved in human health, economic generation, environmental protection, bioremediation, carbon sequestration, animal husbandary, nano particle systhesis, industrial utilization, it can be considered as a most suitable and beneficial plant for sustainable future.

Refernces

Rohela, G.K., Pawan Shukla, Muttanna, Rajesh kumar, Sukhen Roy Choedry. 2020. Mulberry (Morus spp): An ideal plant for sustainable development.Science Direct.2:100011

Volume: 02 Special Issue

SHUTTLE BREEDING IN ONION UNDER INDIAN SCENARIO

Article ID: AG-V02-SI-05

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Abstract

Onion is cultivated in the northern regions of India in two seasons: *kharif* (transplanting occurs in the first fortnight of August) and *rabi* (transplanting occurs in the middle of December and the beginning of January).A novel "seed to seed" technique that allows generation progression in one year has been developed to speed up the breeding process.The main problem with these approaches is that we never get the chance to view the bulbs, making it impossible to pick for certain bulb qualities. When our goal is just generation progression, like in very early generations like F1, it is helpful.To take advantage of India's varied climate, bulbs can also be grown during the kharif season in Northern or Central India. These bulbs can then be transported to higher hills in HP or J&K, where they can blossom and be utilized for breeding. The onion life cycle is finished in a single season in this manner.

Keywords: Onion, crop improvement, seed to seed, seed to bulb to seed, generation advancement

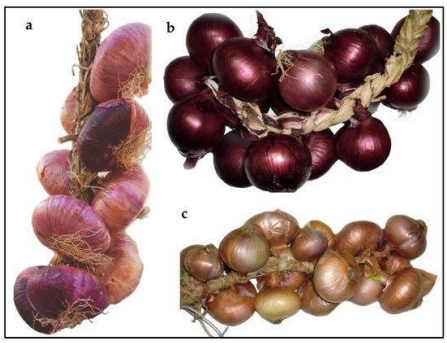
Introduction

Except in the Himalayan regions of Himachal Pradesh, J&K, and Ladakh, where it is cultivated under long-day conditions, onion is primarily grown as a short-day crop in India. Onion is cultivated in the northern regions of India in two seasons: kharif (transplanting occurs in the first fortnight of August) and rabi (transplanting occurs in the middle of December and the beginning of January). In November–December, growers obtain bulbs for the kharif season, and in May–June, you can buy bulbs for the rabi season. Onion seedlings are transported onto higher hills in HP and J&K in October, grown while covered in snow

from December through January, and then the bulbs are harvested in June and July. Onion is transplanted in April–May and harvested in October in the dry, arid desert of Ladakh. The multiplier onion (*Allium cepa* var. *aggregatum*) is mostly cultivated in southern India.

Strategies to speed up breeding cycle in onion

Due to onion's 2-year life cycle, onions are considered a biannual crop. This is a significant disadvantage since it takes longer to breed new onion types. A novel "seed to seed" technique that allows generation progression in one year has been developed to speed up the breeding process. With this technique, the seeds are sown in the middle of August, plants remain in the vegetative stage until flowering begins in the middle of March, and we may harvest seeds by the end of May the following year without actually harvesting and assessing bulbs. In another method, bulblets can also be grown from February to May and then stored until the first week of October. Depending on the subject genotypes' bolting requirements, bulblets can be transplanted in lowlands or in the hills. The main problem with these approaches is that we never get the chance to view the bulbs, making it impossible to pick certain bulb qualities. When our goal is just generation progression, like in very early generations like F1, it is helpful. Third method: bulbs are collected in November in Pune or Bangalore after seeds are sown in June, and transplanted in July–August. The bulbs are then collected and sent to colder regions like Srinagar (J&K), Kullu, or Solan (HP) for seed production. We may employ this technique, termed "seed to bulb to seed," for breeding purposes by using many sites. Before transplanting in the field to obtain seed, we have the chance to observe bulb characteristics here. The generation advancement can be used for generation advancement past F1 and is accomplished in a year.



To take advantage of India's varied climate, bulbs can also be grown

during the Kharif season in Northern or Central India. These bulbs can then be transported to higher hills in HP or J&K, where they can blossom and be utilized for breeding. The onion life cycle is finished in a single season in this manner. According to D'Angelo and Goldman (2019), overcoming bulb dormancy and choosing the right length of vernalization are two elements for annualizing the long-day breeding scheme. Long-day onions were able to start blooming with a treatment of 20% hydrogen peroxide (2–4 hours) and an ideal chilling of 10 °C for 14 weeks.

Conclusion

The hybrid development process in onions will be sped up by using doubled haploid production for inbred development, followed by the application of PCR markers for cytoplasm type and Mslocus identification. The assessment of diversity, population structure, and heterotic combinations will also be aided by genomic and EST markers. Identification of markers, QTLs, connected to biotic and abiotic stress will aid fast breeding programs with the development of genomics and next-generation sequencing.

References

D'Angelo, C. J. and Goldman, I. L. 2019. Annualization of the long day onion breeding cycle through threshold vernalization and dormancy disruption. Crop Breed Genet Genom. 1:e190009. https://doi.org/10.20900/cbgg20190009

Khar, A. and Singh, H. 2020. Rapid methods for onion breeding. Gosal, S. S., and Wani, S. H. (eds.), Accelerated Plant Breeding, Vol. 2, Vegetable crops, Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-47298-6_4

Volume: 02 Special Issue

Overview of Cashew Nut Industry, Cultivation and its Value Chains in Tamil Nadu

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Introduction

India is the largest producer, processor, exporter and second largest consumer of cashew kernels.Tamil Nadu is one of the largest producers of cashew nut in India. The production and processing of cashew nuts are complex and facing various problems. In the marketing stage also the farmers may face many problems relating to price fluctuation**.** In Tamil Nadu, cashews are cultivated 1,41,580 ha and the state produces 71030 tonnes annually (CEPCI, 63rdannual report – 2017). As per the 2017 – 2018 Advance estimates Pudukottai district alone has a cultivated area of 91058 ha, accounting 64 per cent of the state cultivated area and the production to the tune of 57988 MT which is around 82 per cent of the state production. Thus Pudukkottai is the major cashew producing district in Tamilnadu along with Cuddalore and Perambalur districts.

The term ‘cashew’ has originated from the Brazilian name ‘acajaiba’ and the Tupi name ‘acaju’, which the Portuguese converted into ‘caju’ and is commonly known as ‘kaju’ in India. It is known as ‘Paragi Andi’ in Kerala meaning foreign nut, ‘Lanka Beeja’ in Orissa assuming its introduction from Sri Lanka, and ‘Mundiri’ indicating the shape of the nut in Tamil Nadu. Cashew is cultivated mainly in the Asian, African and Latin American zones. The Asiatic zone includes India and Vietnam as the major producers, besides Indonesia, Philippines, Malaysia, Thailand and Sri Lanka. In the African zone, Nigeria, Côte d’Ivoire and Tanzania are the major producers, besides other countries like

Benin, Guinea Bissau, Mozambique, Ghana, Senegal and Madagascar.

Economic use of cashew products

Cashew kernel has a unique place in all functions and celebrations of both developed and developing countries. It is offered at wedding ceremonies as a token of fertility. In fact, it is considered as having aphrodisiac properties. Its place is very prominent at social and religious celebrations. It is offered to the guests and visitors and very important persons in educational, social, religions and political field.

Three main cashew products are traded at the international market: raw cashew nuts, cashew kernel and cashew nut shell liquid. Cashew apple is another product which is generally processed and consumed locally. The raw cashew nut and cashew kernel are the main commercial products. Raw nuts are exported and imported before or after processing the cashew kernel. Cashew nut shell liquid is an important commercial byproduct released from raw nuts at the time of processing. It has industrial and medical applications. Moreover, the skin of the nut is high in tannins and can be recovered and used in the tanning of hides.

From Cashew apple or fruit, juice is extracted which has high vitamin content and it could be fermented to give a high proof. In fact cashew nut shell liquid is a valuable raw material for the preparation of oil paints, varnishes, pigments of gums, type writer rolls, automobile, break lining and lubricant in air craft. It is estimated that 60 per cent of the cashew kernel is consumed in the form of snacks and the remaining 40 per cent included in confectionery. It contains protein, fat, carbohydrates and all the fat soluble vitamins A, D and K. The alcoholic produce 'Fenny' has laxative properties. Cashew apple is eaten as a remedy for scurvy.

World cashew nut scenario

Cashew is predominantly grown in Asia, Africa and South America continents. Asiatic zones mainly include India, Vietnam and Indonesia as the major cashew producing countries followed by Philippines, Malaysia, Thailand and Sri-Lanka. African countries producing cashew are Nigeria, Tanzania, Mozambique, Kenya, Benin, Guinea- Bissau, Mozambique, Ghana, Senegal and Madagascar. The major cashew producing countries in Latin America are Brazil, Columbia, Costa Rica, Honduras and Salvador. Though cashew is native of Brazil, it gained greater importance in countries like India, Vietnam, and other African

countries. In 1960's, India was the major contributor to world cashew nut production followed by Mozambique and Tanzania.

Cashew nut –the India Scenario

India is the largest producer, processer, consumer and exporter of cashew in the world. The current Cashew nut production in India accounts for 45 per cent of the global production. India being the leader in the world in raw Cashew nut production and is also the largest supplier of cashew kernels to the major world markets. A large number of small and marginal farmers, especially living on the coastal belts of India, depend on cashew for their livelihood. Cultivation of cashew in India confines mainly to the peninsular areas. It is grown in Kerala, Karnataka, Goa, and Maharashtra along the West coast and Tamil Nadu, Andhra Pradesh, Odessa and West Bengal along the East-coast, occupies an area of 10.30 lakh hectares in the country with a production of 9.98 lakh metric tonnes.

Cashew production with respect to exports

Numerous cashew nut exporters are there, among which Vietnam and India are the key holders sharing almost 90 per cent share in the European market. Brazil has a 3 per cent market share as the cashew nut exporter. No other cashew nut exporters, except for these shares above 1 per cent market globally. More precise details about the country leading as top quality kernels and raw cashew nut suppliers in the global market are available below. Sub Saharan Africa consists 57 per cent of the cashew nuts grown all around world due to the thriving climatic conditions. African Union is a growing cashew nut export industry facing the single obstacle of lower processing capacity. Democratic Republic of the Congo is a producer of cashew nuts and the export from Central Africa.

In 2011-12, India exported 131,160 metric tonnes of cashew kernels and 13,575 metric tonnes of cashew nut shell liquid (CNSL), generating revenues US$ 915.86 million and US$ 12.40 million respectively The Cashew Export Promotion Council of India (CEPCI) works towards the promotion of the export of cashew kernels and cashew nut shell liquid (CNSL).

The Cashew nut industry in India

The cashew industry faces a shortage of raw cashew, since the domestic production is insufficient to feed the huge number of cashews

processing units in India. The production and processing of cashew nuts are complex and facing various problems. In the marketing stage also the farmers may face many problems relating to price fluctuation.

Even though strong competition from other countries has reduced India's share in the global cashew exports, India's advantage in terms of less percentage of broken kernels has brought European and US buyers to its proximity. To strengthen cashew exports, there is scope for increasing production by developing cashew as plantation crop on commercial basis, exploring new markets, and strengthening non-traditional markets, adding value to the product by introducing innovations in processing and branding them. Among the major states in the country, Maharashtra tops with respect to area, production and productivity of cashew nut. Over the years, the area under cashew cultivation has registered an increase in all the major cashew growing states, except in Kerala. Even though strong competition from other countries has reduced India's share in the global cashew exports, India's advantage in terms of less percentage of broken kernels has brought European and US buyers to its proximity.

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Economics of cashew plantation

The cashew trees start yielding from the 5th year of plantation onwards.

The establishment cost for cashew plantation in north is around Rs. 56,220 per hectare. The maintenance cost of 2nd , 3rd , and 4th year includes Rs. 36,307, Rs. 37,312 and Rs. 38,490 respectively per hectare.

The cost of cultivation (COC) for cashew plantation per hectare is around Rs. 50,000. Yield is realized from the 5th year onwards. The average yield obtained from the plantation per hectare is 1035 kg per month (4 pickings – February, March, April, May). The gross return is estimated at Rs. 1,44,900 per hectare. The marketing cost includes Rs.1950 and the total cost of cultivation is Rs. 51,793 per hectare and the net returns obtained is Rs. 93,107. The BC ratio stood at 2.79 indicating that cashew plantation is profitable enough. (Ref: Data collected from value chain analysis in Goa – University of Agricultural Sciences (UAS)- Dharwad).

Cashew value chains

A value chain or supply chain is a set of value creating activities in the production-distribution process and the explicit structure of linkages among these activities Value chain is associated with quality differentiation and value added from the consumers perspective, while supply chain is a supplier perspective with a focus on efficiency and logistics and coordination aspects of moving products from 'farm to fork'. However, there is a need to integrate both the terms as food systems need to deliver both value and efficiency.

Value chain is a chain of activities in which products pass through all in order and through each activity, the product gains some value. Value Chain Analysis (VCA) deals with the examination of the value chain of an enterprise to ascertain how much and at stage value is added. Value chain improvements reduce inventories, wastage, cost, thus increase efficiency within the firm and in the market channel. Achieving these gains requires mobility and flexibility in the scheduling and location of production, processes, inventories and distribution. This can be achieved through supportive and cooperative supplier-buyer relationships (Porter, 1985). Hence, in the present study, the value chain for cashew nut will be studied tracing the value addition at different stage of the marketing channel of cashew nut.

Cashew passes through several stages and actors as it moves from the farm to the consumer. At each step of the way, value is added to the raw nut. Each person or company involved in the value

chain must contribute something to increase the value: resources, expertise, and taking risks like providing financing. A farmer cannot make money from cashew without a buyer. Likewise a buyer depends on truckers to get the cashew to the port, and an exporter relies on the shipping company to export the raw nuts abroad. Each person in the cashew value chain should make a fair income based on the inputs and services that they contribute to move the cashew to the market.

REFERENCES

Sirela Bharat, Sarawgi A.K., and Yogeshwari Sahu.2018. Economic Analysis of Cashew nut Processing Units in Srikakulam district of Andhra Pradesh, India. Int. J. Curr. Microbiol. App.Sci. 7(11): 195-202.

Soumitra Banerjee and Shrivastava, S.L. 2014. Economic Analysis of Cashew Nut Processing in India. Economic Affairs. 59(3): 429-437

Mehazabeen Acchukatla1, Srinivasan,G. 2019. Economic Analysis of Cashew Value Chain in Cuddalore district of Tamil Nadu. Department of Agricultural Economics, Annamalai University.

Mahantesh Nayak and Manjunatha Paled. 2018. An Economic Analysis of Cashew nut Production in Konkan Region of Maharashtra, India. Int. J. Curr. Microbiol. App.Sci.7(12):3079 – 3087.

S.M.Mundhinamani, 2017. Analysis of Cashew Value Chain in Goa, Final Draft Report, UAS Dharwad.

Volume: 02 Special Issue

Smart Agriculture with Artificial Intelligence – Evolving Trend

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Abstract : AI, machine learning (ML) and the IoT sensors that provide real-time data for algorithms increase agricultural efficiencies, improve crop yields and reduce food production costs. According to the United Nations' prediction data on population and hunger, the world's population will increase by 2 billion people by 2050, requiring a 60% increase in food productivity to feed them. In the U.S. alone, growing, processing and distributing food is a $1.7 trillion business, according to the U.S. Department of Agriculture's Economic Research Service. AI (Artificial Intelligence) and ML (Machine Learning) are already showing the potential to help close the gap in anticipated food needs for an additional 2 billion people worldwide by 2050.

Introduction

Agriculture and farming are one of the oldest and most important professions in the world. It plays an important role in the economic sector. Worldwide, agriculture is a $5 trillion industry. The global population is expected to reach more than nine billion by 2050 which will require an increase in agricultural production by 70% to fulfill the demand. As the world population is increasing due to which land water and resources becoming insufficient to continue the demand-supply chain. So, we need a smarter approach and become more efficient about how we farm and can be most productive. The agricultural ecosystem is a biological, physical, and chemical system. These sciences are all about matching patterns. However, the number of possibilities and factors that affect the system is huge, making it impossible for people to effectively analyze and draw conclusions. Analyzing the data, computer algorithms can also learn and improve their assumptions and calculations in an automatic process, called "machine learning". Machine learning can help in identifying patterns, without really even

knowing what we are looking for. The more data they receive, the better the learning process becomes. Not only individual farmers can benefit from AI and machine learning in agriculture. The immense amount of data which is collected on a global scale can support research.

Artificial Intelligence in Agriculture : Throughout human history, technology has long been used in agriculture to improve efficiency and reduce the amount of intensive human labor involved in farming. From improved plows to irrigation, tractors to modern AI, it's an evolution that humans and agriculture have undergone since the invention of farming. With considerable changes occurring in our climate, environment, and global food needs, AI has the ability to transform 21st century agriculture by:

- Increasing efficiency of time, labor, and resources.
- Improving environmental sustainability.
- Making resource allocation "smarter".
- Providing real-time monitoring to promote greater health and quality of produce.
- Farmers' knowledge of their "field" will need to be translated into AI training, and this will depend on greater technical and educational investments within the agricultural sector.
- Computer vision and agricultural robotics are just the latest way farmers can adopt new technology to meet growing global food demands and increase food security.

Challenges faced by farmers by using traditional methods of farming

- In conventional farming, climatic factors such as rainfall, temperature and humidity play an important role in the agriculture lifecycle. Increasing deforestation and pollution result in climatic changes, so it's difficult for farmers to take decisions to prepare the soil, sow seeds, and harvest.
- Every crop requires specific nutrition in the soil. There are 3 main nutrients nitrogen (N), phosphorous (P) and potassium (K) required in soil. The deficiency of nutrients can lead to poor quality of crops.
- In the agriculture lifecycle, weed protection plays an important

role. If not controlled it can lead to an increase in production cost and also it absorbs nutrients from the soil which can cause nutrition deficiency in the soil.

Applications of Artificial Intelligence in Agriculture

The industry is turning to Artificial Intelligence technologies to help yield healthier crops, control pests, monitor soil, and growing conditions, organize data for farmers, help with the workload, and improve a wide range of agriculture-related tasks in the entire food supply chain.

Use of weather forecasting: With the change in climatic condition and increasing pollution it's difficult for farmers to determine the right time for sowing seed, with help of Artificial Intelligence farmers can analyze weather conditions by using weather forecasting which helps they plan the type of crop can be grown and when should seeds be sown.

Soil health evaluation : Evaluating soil requires farmers to dig up samples and bring them to a lab for time- and energy-intensive analysis. Computer vision can characterize soil texture and soil organic matter (SOM). So, not only can computer vision eliminate a large amount of the difficult, manual labor involved in crop and soil monitoring, in many cases it does it more effectively than humans can. The type of soil and nutrition of soil plays an important factor in the type of crop is grown and the quality of the crop. Due to increasing, deforestation soil quality is degrading and it's hard to determine the quality of the soil. A German-based tech start-up PEAT has developed an AI-based application called Plantix that can identify the nutrient deficiencies in soil including plant pests and diseases by which farmers can also get an idea to use fertilizer which helps to improve harvest quality. This app uses image recognition-based technology. The farmer can capture images of plants using smartphones. We can also see soil restoration techniques with tips and other solutions through short videos on this application. Similarly, Trace Genomics is another machine learning-based company that helps farmers to do a soil analysis to farmers. Such type of app helps farmers to monitor soil and crop's health conditions and produce healthy crops with a higher level of productivity.

Crop and soil monitoring : Micro and macronutrients in the soil are critical factors for crop health and both the quantity and quality of yield. Once crops are in the soil, monitoring the stages of

growth is also essential to optimize production efficiency. It's vital to understand interactions between crop growth and the environment in order to make adjustments for improved crop health. Now, traditionally soil quality and crop health were determined by human observation and judgment. But this method is neither accurate nor timely. Instead, we can now use drones (UAVs) to capture aerial image data, and train computer vision models to use this for intelligent monitoring of crop and soil conditions.

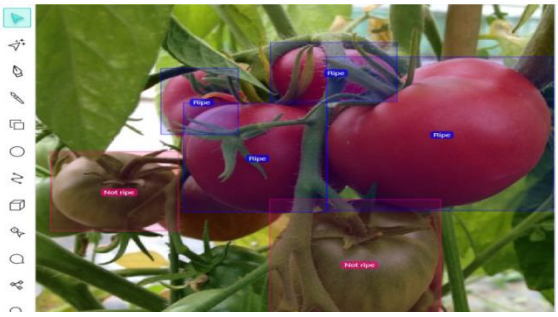
Visual sensing AI can analyze and interpret this data to:

- track crop health
- make accurate yield predictions.
- detect crop malnutrition much faster than humans

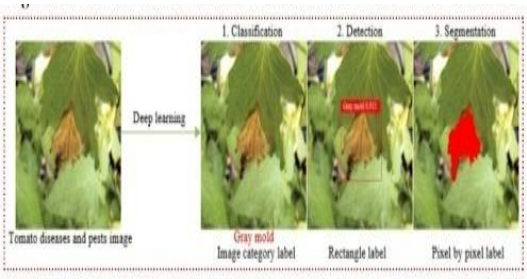
AI models can inform farmers of specific problem areas so that they can take immediate action.

Observing crop maturity :

Observing and estimating crop growth and maturity is hard, labor-intensive work for farmers. But AI is proving capable of handling much of that work with both ease and impressive accuracy. Computer vision can detect maturity in tomatoes. Researchers created an algorithm that analyzed color from five different parts of the tomato, and then made maturity estimates based on this data.



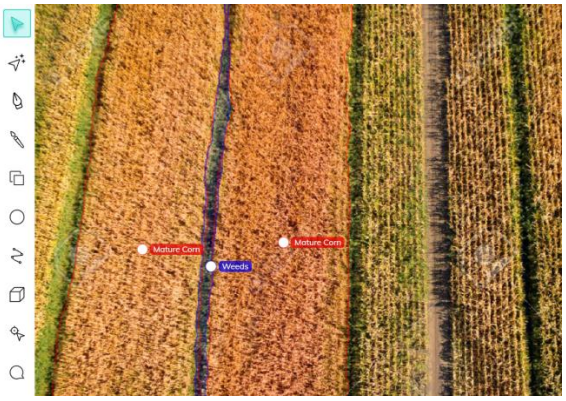
Analyzing crop health by drones: SkySquirrel Technologies has brought drone-based Ariel imaging solutions for monitoring crop health. In this technique, the drone captures data from fields and then data is transferred via a USB drive from the drone to a computer and analyzed by experts. This company uses algorithms to analyze the captured images and provide a detailed report containing the current health of the farm. It helps the farmer to identify pests and bacteria helping farmers to timely use of pest control and other methods to take required action.



Definition of plant diseases and pests detection problem

Precision Farming and Predictive Analytics: AI applications in agriculture have developed applications and tools which help farmers inaccurate and controlled farming by providing them proper guidance to farmers about water management, crop rotation, timely harvesting, type of crop to be grown, optimum planting, pest attacks, nutrition management. While using the machine learning algorithms in connection with images captured by satellites and drones, AI-enabled technologies predict weather conditions, analyze crop sustainability and evaluate farms for the presence of diseases or pests and poor plant nutrition on farms with data like temperature, precipitation, wind speed, and solar radiation. Farmers without connectivity can get AI benefits right now, with tools as simple as an SMS-enabled phone and the Sowing App. Meanwhile, farmers with Wi-Fi access can use AI applications to get a continually AI-customized plan for their lands.

Agricultural Robotics: AI companies are developing robots that can easily perform multiple tasks in farming fields. This type of robot is trained to control weeds and harvest crops at a faster pace with higher volumes compared to humans. These types of robots are trained to check the quality of crops and detect weed with picking and packing of crops at the same time. These robots are also capable to fight with challenges faced by agricultural force labor.



Aerial survey and imaging : AI can analyze imagery from drones and satellites to help farmers monitor crops and herds. That way they can be notified immediately if something looks amiss without having to constantly observe the

fields themselves. Aerial imaging is also useful for boosting the precision and efficiency of pesticide spraying. As mentioned previously, ensuring that pesticides only go where they're intended saves money as well as the surrounding environment.

Produce grading and sorting : AI computer vision can continue to help farmers even once the crops have been harvested. Just as they are able to spot defects, disease, and pests as the plants are growing, imaging algorithms can also be used to sort "good" produce from the defective or just plain ugly. By inspecting fruit and vegetables for size, shape, color, and volume, computer vision can automate the sorting and grading process with accuracy rates and speed much higher than even a trained professional.

Conclusion

Artificial Intelligence in agriculture not only helping farmers to automate their farming but also shifts to precise cultivation for higher crop yield and better quality while using fewer resources. With such IoT- and AI-driven solutions, farmers can meet the world's needs for increased food sustainably growing production and revenues without depleting precious natural resources. In the future, AI will help farmers evolve into agricultural technologists, using data to optimize yields down to individual rows of plants.

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Copyright – An IPR tool to protect the literary and artistic works

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Introduction

Copyright (or author's right) is a legal term used to describe the rights that creators have over their literary and artistic works. Works covered by copyright range from books, music, paintings, sculpture, and films, to computer programs, databases, advertisements, maps, and technical drawings. Copyright is one of the intellectual property rights designed to encourage creativity and is given by law to safeguard, protect and reward the rights of creators of original literary or dramatic or musical or artistic works in their respective creations and productions. Writers, artists, designers, dramatists, musicians, architects, producers of sound recordings, cinematographers, and computer software developers and so on are encouraged to create original works in different fields like literature, art and music by rewarding them with the exclusive right for a limited period of exploit the work for monetary gain. Cinematographic films including sound track and video films and recordings on discs, tapes, perforated roll or other devices are covered by copyrights. Theoretically, copyright acts as an incentive for people to come out with newer and newer copyrightable works, which add to the knowledge stock of mankind. The creator of a work can prohibit or authorize its reproduction in various forms, such as printed publication or sound recording; its public performance, as in a play or musical work; recordings of it, for example, in the form of compact discs, cassettes or videotapes; its broadcasting, by radio, cable or satellite; and its translation into other languages, or its adaptation, such as a novel into a screenplay.

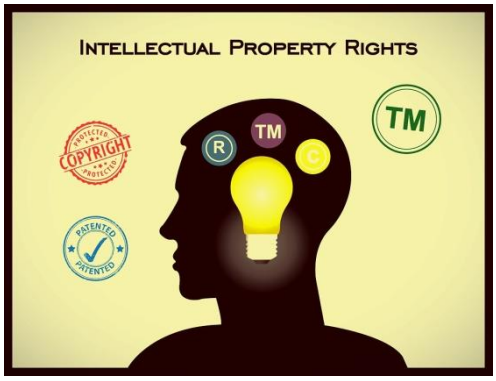
History of Copyright Law

Initially, copyright law only applied to the copying of books. The concept of copyright arose as an

exclusive right of the author to copy the literature produced by him. Actually, it originated not as a shield to protect the author's right but as a sword to prevent unauthorized publication of books that were against the Church and the King during the medieval period in England, which necessitated control. The British Statute of Anne 1709 entitled, "An Act for the Encouragement of Learning, by Vesting the Copies of Printed Books in the Authors or Purchasers of such Copies, during the Times therein mentioned", was the *first copyright statute* and the subsequent *Act of Anne (8 Anne c.19)* in 1710 was the *firstlegislation* on copyright, which declared the author's exclusive right of copying andpublishing for a limited period in the case of books and imposed criminal penalties for violations. Simultaneously, the birth of the printing press led to a manifold increase in the capacity to copy and made authors also conscious of their rights and the profits that could be made. In 1662, Licensing Act of Charles II recognized the rights of the authors for the first time by controlling printing in a major way. With the development of society, the scope of copyright continued to expand by including things like sculpture, art, engravings etc. within its ambit by various enactments.

In 1911, the Imperial Copyright Act was passed, which consolidated the law relating to copyright through bringing different copyrightable subject matters that were governed by different legislation. The Act declared copyright to be a statutory right, settling the confusion hitherto existed as to whether copyright is common law right or statutory right. Subject matters of copyright continued to expand by including newer subject matters like cinematograph films. Copyright Act of 1956 in England substituted the 1911 Act. Copyright now covers a wide range of works, including maps, dramatic works, paintings, photographs, sound recordings, motion pictures and computer programs. Copyright itself does not depend on official procedures. A created work is considered protected by copyright as soon as it exists. According to the Berne Convention for the Protection of Literary and Artistic Works, literary and artistic works are protected without any formalities in the countries party to that Convention. The World Intellectual Property Organization (WIPO) does not offer any kind of copyright registration system. However, many countries have a national copyright office and some

national laws allow for registration of works for the purposes.



Although there are consistencies among nations' copyright laws, each jurisdiction has separate and distinct laws and regulations about copyright. National copyright laws on licensing, transfer and assignment of copyright still vary greatly between countries and copyrighted works are licensed on territorial basis. Some jurisdictions also recognize moral rights of creators, such as the right to be credited for the work. Today, copyright laws have been standardized through international and regional agreements. The main international treaties governing the law of Copyright and Neighbouring rights are: Berne Convention, 1886; Universal Copyright Convention, 1952; Rome convention, 1961; TRIPs Agreement, 1994; WIPO Copyright Treaty, 1996; and WIPO Performance and Phonograms Treaty, 1996.

Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)

Important developments on copyright at international level in the 1990s include the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights, known as TRIPS Agreement. TRIPs was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) and contains a number of provisions on copyright. Compliance with the TRIPS Agreement is required of states wishing to be members of the World Trade Organization (WTO). TRIPS agreement on copyright ensures the following:

- States need to be signatory of the Berne Convention and comply with all its provisions, except for the provision on moral rights (Article 9(1)).
- Copyright protection shall extend to expressions and not to ideas, procedures, and methods of operation or mathematical concepts as such.
- Computer programs will be protected as literary works under the Berne Convention which also outlines how databases should be protected (Article 10).

- States need to provide for rental rights in at least computer programs and films (Article 11). Authors of computer programs and producers of sound recordings must have the right to prohibit the commercial rental of their works to the public. A similar exclusive right applies to films where commercial rental has led to widespread copying, affecting copyright - owners' potential earnings from their films.
- Where copyright term, that is duration of copyright, is calculated other than by reference to the life of a natural person, States need to give a minimum term of 50 years calculated from either the date of authorized publication or the creation of the work.
- Performers must also have the right to prevent unauthorized recording, reproduction and broadcast of live performances (bootlegging) for no less than 50 years.
- Producers of sound recordings must have the right to prevent the unauthorized reproduction of recordings for a period of 50 years.

Indian Law for the Protection of Copyright

In India also, simultaneous developments took place with the Indian Copyright Act of 1847 based on the 1842 Act in England. The Indian Copyright Act, 1914 was an extension of the Copyright Act, 1911, to India with necessary modifications and then in 1957, a new Copyright Act was passed which was modeled along the English Copyright Act of 1956. The Copyright Act, 1957 today is compliant with the most international conventions and treaties in the field of copyrights. This Act protects the works such as 'original' literary, dramatic, musical and artistic works, and cinematograph films and sound recording from unauthorized uses. The Copyright Act, 1957, as amended in the years 1984, 1994 and 1999, to accommodate the obligations under international treaties, governs the present law relating to copyright.

Copyright is a bundle of exclusive rights granted by statute to the author of the works to exploit or authorize the exploitation of the copyright work, based on international norms like Berne Convention, TRIPs Agreement and WIPO Copyright Treaty (WCT). India is a member of the Berne Convention of 1886 (as modified at Paris in 1971), the Universal Copyright Convention of 1951 and TRIPS. Though India is not a member of the Rome Convention of

1961, the Copyright Act, 1957 is fully compliant with the provisions of this Convention.

Copyright owners have the exclusive statutory right to exercise control over copying and other exploitation of the works for a specific period of time, after which the work is said to enter the public domain. Uses which are covered under limitations and exceptions to copyright, such as fair use, do not require permission from the copyright owner. All other uses require permission and copyright owners can license or permanently transfer or assign their exclusive rights to others.

Use of the "©" symbol

When a work is published by authority of the copyright owner, a notice of copyright may be placed on publicly distributed copies. As per the Berne Convention for protection of literary and artistic works, to which India is a signatory, use of copyright notice is optional. It is, however, a good idea to incorporate a copyright notice. Anyone who claims copyrights in a work can use copyright notice to alert the public of the claim. It is not necessary to have a registration to use the designations though it is highly advisable to incorporate a copyright notice like the symbol, Letter "c" in a circle “©” or the word "Copyright" followed by name of copyright owner and year of first publication, e.g., TNAU, 2014.

Copyright Law and Patent Law

Copyright law and patent law provide different types of protection. Copyright protects only to expressions, such as novels, poems, films, musical compositions, paintings etc. whereas a patent is an exclusive right granted for an invention, which is a product or a process. Copyright protection is formality-free in countries party to the Berne Convention for the Protection of Literary and Artistic Works, which means that protection does not depend on compliance with any formalities such as registration or deposit of copies. A patent is granted after completing an examination procedure by a government agency.

Protection of Computer software by copyright

In the 1970s and 1980s, there were extensive discussions on whether the patent system, the copyright system, or a *sui generis* system, should provide protection for computer software. These discussions resulted in the generally accepted principle that computer programs should be protected by copyright, whereas apparatus using

computer software or software-related inventions should be protected by patent. In India, computer software is patentable, if embedded with hardware. Previously, the Intellectual Property Rights (IPR) protections with regard to software are limited to copyrights. According to the Section 14 of the Copyright Act, the computer program is considered to be literary work and protected as such.

Website registration under Copyright

A website may be understood as a webpage or set of interconnected webpages, hosted or stored on a server, and is made available online to members of public. Users can access the information and other underlying work on a website through various means such as scrolling webpages, using internal hypertext links or a search feature. Website usually consists of different rudiments which may be copyrightable subject matter that falls within any one of the classes of works set forth in Section 13 of Copyright Act, 1957. The component parts of website can be in different form of digital files such as text, tables, computer programmes, compilations including computer databases ("literary works"); photographs, paintings, diagram, map, chart or plan ("artistic works"); works consisting of music and including graphical notation of such work ("musical works"); "sound recordings" and "cinematograph films".

Website as a whole is not subject to copyright protection. Generally, non-copyrightable content particular to websites may include but are not limited to ideas or future plans of websites, functional elements of websites, unclaimable material, layout and format or 'look and feel' of a website or its webpage; or other common, unoriginal material such as names, icons or familiar symbols. *Applicant is required to submit a separate application for each component work/content appearing on a website.*

App registration under Copyright

An **App** is a complete, self-contained computer program that is designed to perform specific tasks. Usually called 'Apps' for short, application programs are the most familiar forms of software and come in a very wide variety of types. An App usually has primarily dynamic content and is designed for user interaction. It may be used directly or indirectly in a computer or hand held electronic device. An App may be registered as a computer program under literary works

as provided under Section 2(o) of the Copyright Act, 1957. For this purpose applicant is required to submit an application for registration under software category, accompanied by the source and object code as provided under Rule 70 (5) of the Copyright Rules 2013.

It is important to note that the registration will cover any screen displays generated by that program, provided that the computer program (code) generating the screen display is submitted by the applicant. Mere snapshots of screen displays of an app are not eligible for copyright protection.

Registration procedure

The procedure for registration is as follows:

a) Application for registration is to be made on Form XIV (Including Statement of Particulars and Statement of Further Particulars) as prescribed in the first schedule to the Rules;

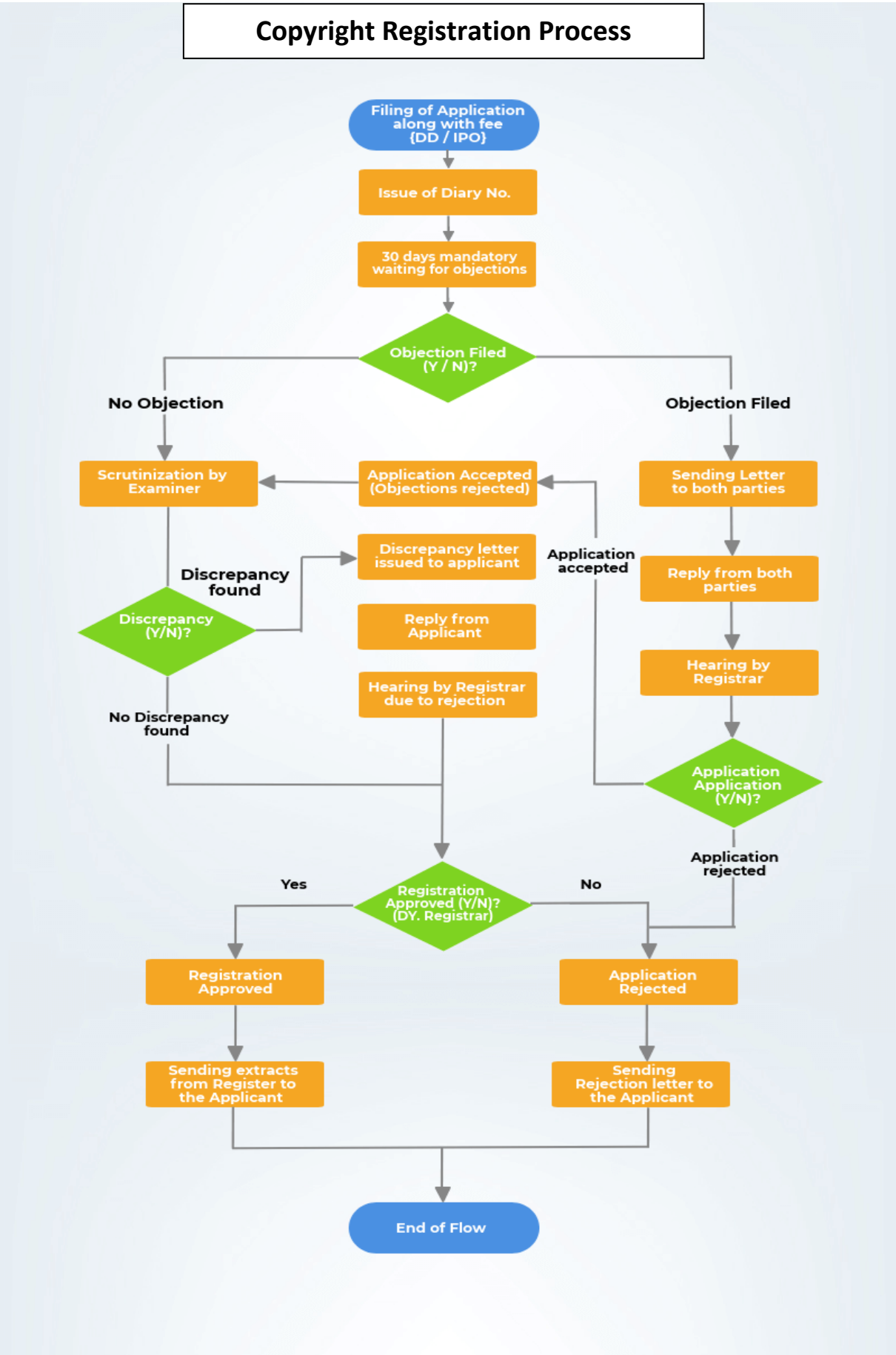
b) Separate applications should be made for registration of each work;

c) Each application should be accompanied by the requisite fee prescribed in the second schedule to the Rules ;

d) The applications should be signed by the applicant. The Power of Attorney signed by the party and accepted by the advocate should also be enclosed, if applicable.

e) The fee is to be paid either in the form of Demand Draft or Indian Postal Order favouring "Registrar Of Copyrights Payable At New Delhi" or through E payment Each and every column of the Statement of Particulars and Statement of Further Particulars should be replied specifically.

e) The fee is either in the form of Demand Draft, Indian Postal Order favoring "Registrar Of Copyright Payable At New Delhi" or through E payment. Each and every column of the Statement of Particulars and Statement of Further Particulars should be replied specifically.


Copyright Registration Process
Filing of Application along with fee {DD / IPO}
Issue of Diary No.
30 days mandatory waiting for objections
Objection Filed (Y / N)?
No Objection
Objection Filed
Scrutinization by Examiner
Application Accepted (Objections rejected)
Sending Letter to both parties
Discrepancy found
Discrepancy (Y/N)?
Discrepancy letter issued to applicant
Reply from Applicant
Application accepted
Reply from both parties
Hearing by Registrar
Hearing by Registrar due to rejection
No Discrepancy found
Application Application (Y/N)?
Application rejected
Yes
Registration Approved (Y/N)? (DY. Registrar)
No
Registration Approved
Application Rejected
Sending extracts from Register to the Applicant
Sending Rejection letter to the Applicant
End of Flow

Volume: 02 Special Issue

Chilli *Cercospora* Leaf Spot Management

Article ID: AG-V02-SI-09

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Introduction

Agriculture has always been back bone of the Indian Economy. Nearly 55 percent of the total population is engaged in agriculture. It provides employment to around 68 percent of the total work force in the country. Increase in agriculture production and productivity leads to increase in the income of the farmers. The significance of agriculture marketing has increased with the introduction of purely commercial crops in most of the villages. Chilly is one of the most important commercial crops the world. Chillies are extensively known as a spice in curried dishes, an ingredient in curry powder and also in seasonings. It contains capsaicin, which gives a strong burning tangy sensation when eaten and the red colour is because of the presence of pigment capsanthin. The extracted capsaicin is used in pain balms, cosmetics, medicines related to heart diseases. **Capsanthin**, a pigment in chilli used for natural colouration to Jams, Jellies and squashes, since it is a natural pigment and no harmful or side effects on human health. Chillies are valued based on their high pungency and colour. The constituents of chillies are important for nutritional value, flavor, aroma, texture and colour. Chillies are low in sodium and cholesterol – free, rich in Vitamin A, Vitamin, Vitamin E, a good source of potassium and folic acid. Because of these reasons chilli is having lot of export potential. When chillies taken with food stimulates our taste buds and thereby increase the flow of saliva which contains the enzyme analyse which inturn helps in the digestion of starchy or cereal foods etc., into the easily assimible sugar namely glucose. India is popularly known as **"Spice bowl of the world"** and is the largest producer, consumer and exporter of chillies in the world. India is the world leader in chillies production followed by china. In Tamil Nadu chilli

is grown in Coimbatore, Ramanathapuram,Tuticorin,Tirunelveli, Virudunagar, Kanayakumari, Madurai, Salem, Tiruchi, Villupuram and Cuddalore districts.

Chilies infected by as many as 26 diseases at various stages of crop growth stages like seedling, vegetative, reproductive. Among that the *Cercospora* leaf spot is one of major disease in seedling stage, also known as frogeye leaf spot. It is caused by the fungal pathogen *Cercospora capsici.Cercospora* diseases are almost always leaf spots. *Cercospora* generally widespread among most cereals and grasses, many field crops, vegetables, ornamentals and trees. Losses from *Cercospora* diseases are usually small, but in some hosts, and occasionally in others, they can be significant.

Symptom:

- During the initial stage of infection, Circular spots with brown margins and grey centre appear on leaves.
- Later the spots enlarge and coalesce with others, up to 1.5cm in size, formed by dark **concentric rings** growing around a **whitish center**.
- A rough dark ring and a **yellow halo** give the spots the characteristic **'frog eye'appearnce**.
- Sometimes central portion of spot drops off gives shot hole effect.
- At later stages the spots also appear on stems, fruit stalk, calyx and twigs as dark brown, irregular lesions with whitish center resulting in stem end rot and exposing fruits to sunscald.
- In severe cases **die-back** of twigs occurs.

Etiology:

- ***Cercospora capsisci*** is a fungus that is particularly resilient in the tropics, affecting plants both in seedbeds and fields.
- It survives from one season to the other in or **on seeds, in the**

soil and also **on infected plant residues.**

- It **spreads through water, rain, wind and leaf to leaf contact on implements, tools and workers**.
- **Foliar infection** occurs by direct penetration of the leaf and is favored by prolonged leaf wetness.

Epidemiology:

- Optimal conditions for infection are warm temperatures around **23°C** and relative humidity (RH) of **77 – 85 %.** If these conditions are met it is very likely to affect yields significantly, particularly if the infection takes place at the beginning of the season.

Management:

- Crop debris should be removed and burnt.
- Seed should be collected from healthy plants.
- Certified seeds should used to avoid infection.
- Proper spacing recommended to allow good aeration and to avoid leaf wetness period.
- Use mulch to create barrier for fungus and plants.
- To reduce the let wetness should use drip irrigation system.
- Removal of susceptible weeds from the field to avoid infection.
- Use crop rotation.
- Do not plant new crops near those with frog-eye disease.
- The fungus is seed borne. Make sure fruits selected for seed do not have stem-end rots.
- Seed treatment with hot water @52°C for 30 mins.
- Seed treatment with Captan 3g/Kg of seeds.
- Foliar application of COC at 10-15 days interval until 3 to 4 weeks before the last harvest
- Spray twice at 10-15 days interval with Mancozeb@0.25% or Chlorothalonil @ 0.1%., Captafol @0. 3% or Triadimefon @0.1%.
- Spray twice at 10-15 days interval with Mancozeb 0.25% or Chlorothalonil (Kavach) 0.1%.

Volume: 02 Special Issue

Arka Rakshak Tomato for more income - A success story

Article ID: AG-V02-SI-10

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Introduction

Sh. Solanki Kirit Bhai is a resident of village – Wata, Tal. - Kalol, Dist. – Panchmahal, Gujarat 389 340. He is having 2.30 ha land, out of which 1.5 ha land is irrigated. He grows maize, pigeon pea, wheat, caster, gram, chilli, tomato, cucurbitaceous vegetables etc with traditional system. He was not satisfied with the income earned from agriculture. The climatic conditions of the area are characterized as hot semi arid. The annual rainfall is mainly confined in the monsoon period (July-September) and actual mean precipitation is about 750-1220 mm, and the total number of rainy days average to about 32.55. The mean summer temperature is 32.9^0 C while the winter temperature is 21.3^0 C indicating that the area falls under hyperthermic soil regime. The mean annual maximum and minimum temperatures vary from 42 - 45^0 C (May) and 6 - 9^0 C (January), respectively. The soil of area is black to loamy sand with available N (142.22-150.65 kg/ha), P (6.35-8.86 kg/ha) and K (142.55-146.25kg/ha) and organic carbon (0.33%), while EC (0.14-0.18 dSm^{-1}) and *pH* (8.40). The soil depth ranged from 0.76 to 1.16 m derived from mixed alluvial basalt, quartzite, granite and layers of limestone. There is lot of variability on quality of available ground water. Some farmers got good quality irrigation water and most of the farmers have poor quality of irrigation water. In this area most of the farmers are tomato with traditional system but that could not get desire income from tomato due poor awareness about hybrids, infestation of pest and diseases.

Plan implement and support:

He was grown cereals, pulses and vegetable *viz*. tomato, chilli, okra, cucurbitaceous. He came in contact with KVK for solving his question how to got higher income from tomato cultivation. He came in various programmes like as

training, meeting, campaigns organized by KVK time to time. Keeping above fact in mind an front line demonstration on Tomato cv. Arka Rakshak (FLD) was implemented at five farmers field. This variety is triple disease resistant (leaf Curl Virus, bacterial wilt and early blight). The seed of Tomato cv. Arka Rakshak procured from IIHR, Bangalore and raised healthy seedlings at KVK. Before implementation of demonstration a training programme was conducted and trained the framers about all aspects of tomato cultivation. The crop was grown under keen supervision of KVK experts and demonstration visited frequently from preparation of land, layout, planting, application of manure and fertilizers, weed management, harvesting, grading and sale of produce. The various programmes *viz*. training, field day, advisory service, telephonic advisory, deliver lectures were carried out by KVK for at horizontal dissemination of the technology.

Output: Among the five farmers, he was got highest production (443.60 q/ha). He is became a key person and have lot of skill of vegetable cultivation especially in tomato. The data on different parameters are given in Table

Table-1 Growth parameters of tomato Arka Rakshak and local check

Parameters	Arka Rakshak	Local Check
Plating distance (cm)	180X120	120X75
Date of transplanting	1Vth week of August	1Vth week of August
Commencement of flowering (DOT)	45-55	55-65
First harvesting	57-61	68-75
Fruit length (cm)	5.70	4.55
Fruit girth (cm)	4.60	4.67
Fruit weight (g.)	86.13	76.18
Average fruit yield /plant (kg)	9.78	2.18

Outcome: All the package and practices were used as per suggestions/ guidelines of KVK experts. The cost of cultivation (57600), production (271950), gross return (214350), net return and cost benefit ratio (4.72) were calculated (table -1). The tomato productivity of district, state and national level are 230.70, 291.25, 250.38 q/ha respectively.

Table 2. Economics of cultivation of tomato Arka Rakshak and local check

Variety	Production (q/ha)	Cost of cultivation (Rs/ ha)	Gross return (Rs/ ha)	Net return (Rs ha)	B:C ratio
Arka Rakshak	443.60	57600	266160	208560	4.62
Local Check	239.80	48650	143880	95230	2.95

Impact: Now he is a key farmer for vegetable cultivation and advised to farmer about cultivation of vegetable for more income. Recently, He got best farmers award. Now innovative farmers of the area are adopting this simple and profitable technology. Some farmers get information from us and procure seed from IIHR, Bangalore.

Healthy seedlings

Training of plants

Over view of crop

Bearing habit of variety

Grading of Produce

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June 2022 | Volume 02 | Special Issue

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