

Manage diseases of jute

with cheap and easy input

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*Among fungal diseases of jute, stem rot caused by *Macrophomina phaseolina* is economically most important. Other major diseases of jute are anthracnose, black band, soft rot, tip blight, root knot nematode, Hooghly wilt and jute mosaic. Management of fungal diseases of jute involves manipulation of soil condition for soil borne diseases, treatment of seed with fungicides for seed borne diseases and foliar spraying of fungicides to check the air borne spores, or judicious combination of one or more approaches. Integrated crop management is not a singular approach but encompasses all good agricultural practices from sowing to harvesting in a judicious manner. It emphasizes the coexistence of crop and pests and pathogens at below economic threshold level and no chemical harmful to environment is used for sustainability.*

Key words: Fungicides, Jute diseases, *Macrophomina phaseolina*, Management, Stem rot

JUTE (*Corchorus olitorius* L. and *C. capsularis* L.), better known as 'golden fibre' crop, is grown mostly in eastern region of India with an area of 0.77 million hectares and production of 10 million bales (one bale = 180 kgs) and dry fibres productivity of 2,329 kg/ha. It is cultivated as pre-*kharif* crop mainly in the states of West Bengal, Bihar and Asom with 81.29, 11.63 and 6.25% contributions respectively, to national production of jute fibres. There is hue and cry that jute is a dying crop with its declining popularity among growers and business community and its area is shrinking every year all over India. In spite of stiff competition from synthetic fibres, lush green jute crop is still prominently visible during April to July on the road side fields of almost all districts of West Bengal beginning from Coochbehar in the north to Jalpaiguri, North and South Dinajpur, Malda to Murshidabad, Burdwan (mainly Katwa and Kalna region), Nadia, Hooghly, North 24 Parganas in the south. The typical smell of jute retting is felt till today

during August to October showing extensive presence of this 'golden fibre' crop in these districts. To circumvent its declining popularity, jute would emerge soon with stronger positive attributes of eco-friendliness with more oxygen producing, carbon dioxide absorbing and higher fuel wood producing capabilities, apart from its biodegradable and diversified quality products.

Among biotic constraint of raw jute production, diseases are the economically most important factors affecting both yield and quality of fibre in all jute growing areas in India and other countries. On an average 15 to 20% yield loss has been estimated in different jute growing regions of India. Owing to their devastating nature, the diseases of jute causes nightmare for researchers and farmers as well. At times, this disease threatens both fibre and seed crops and is considered the major constraint in certain jute growing belts. Frequent epiphytotics occur in almost all jute growing areas and farmers at times fail to harvest their

crops. Both the cultivated species of jute are almost equally affected by the diseases (with exceptions of anthracnose and mosaic) showing no difference. Rainfall pattern, soil temperature, soil moisture and relative humidity determine out break and extent of damage.

Among fungal diseases of jute, stem rot is economically most important. Other major diseases of jute are anthracnose, black band, soft rot, jute mosaic, root knot nematode and Hooghly wilt. Management of fungal diseases of jute and allied fibres involves manipulation of soil condition for soil borne diseases, treatment of seed with fungicides for seed borne diseases and foliar spraying of fungicides to check the air borne spores, or judicious combination of one or more approaches. Roguing of diseased plants and spraying of insecticides to check vectors could prevent the spread of the viral diseases.

Jute is a unique crop in the sense that almost 90% of total area grown belongs to single ruling variety. JRO 524 (Naveen) is so popularly

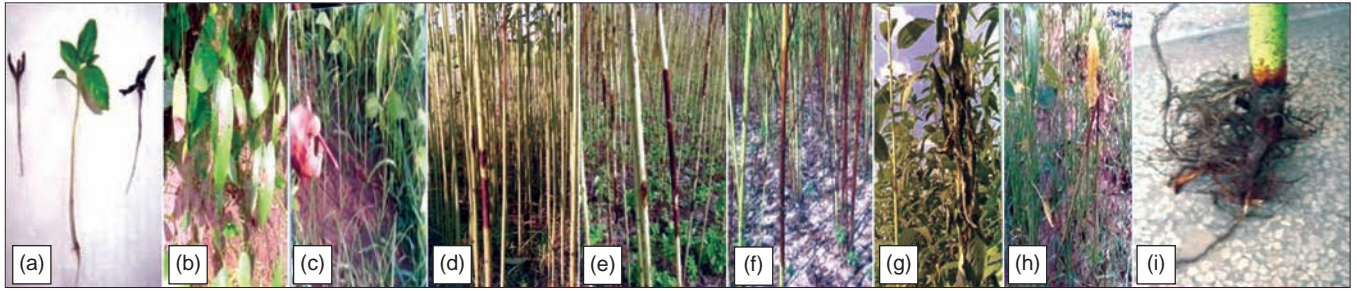


Fig. 1. Although common name is stem rot of jute, other symptoms are (from left) a. damping-off, b. leaf blight, c-f. stem rot, g. wilting, h. stem break and i. Root rot.

established among the farmers of both India and Bangladesh that newly released ones (mostly restricted to Government subsidized crop) are unable to substitute it. Threat of appearance of any virulent strain of the pathogen(s) of jute is always a probability and may endanger the crop itself, unless remedial measures are not taken up.

Stem rot caused by *Macrophomina phaseolina* (Tassi) Goid.

Although stem rot is common but the pathogen attacks any part of the plant at any stage of growth right from germination to harvest, producing various symptoms in both fibre and seed crops. The disease damages the crop in all jute growing areas in India and other countries starting from germination to maturity. Stem rot is more prevalent in acid soil with pH below 5.8 and potassium deficiency. Seed yield also declines both quantitatively and

qualitatively due to this disease.

Macrophomina phaseolina is a highly destructive fungal plant pathogen causing enormous loss to crop production worldwide affecting a large number of agricultural crops grown under high temperatures and water stress. Its management is becoming more and more difficult due to its versatility of three different forms, namely, *Rhizoctonia bataticola* as sclerotial stage, *Orbilia obscura* as teleomorph (not observed in jute) and most common and damaging phase in jute being *M. phaseolina* as pycnidial stage. Its host range includes crops belonging to family *Poaceae* (like, rice, corn), *Leguminosae* (like, chickpea, lentil, field pea, urdbean, mungbean), *Solanaceae* (like, brinjal, tomato, potato, chili) and many other ornamental plants.

Symptoms

The common name of this disease is stem rot because the major damage

caused by it is due to rotting of the main stem and making it unfit for any commercial use. The pathogen may infect any part of the plant producing various symptoms, like, damping-off, seedling blight, leaf blight, stem rot, collar rot, root rot and spot on pod especially in seed crop. In damping off, newly emerged seedlings rot above and below soil level. In seedling blight, cotyledons turn brown to black and die. Brown spots on leaves appear as a result of stem rot infection during June – August due to prevailing high temperature and humidity. Dark brown lesion on green stem may extend vertically or horizontally, up to 10-15 cm or higher. Plants wilt with drooping of leaves or break in high speed wind. Infected stem dries up and turns dark brown to black. Collar region of the plants becomes brown and rot creating collar rot symptom. In root rot phase, plants wilt, defoliate, turn brown and later black and stand as naked stem and finally die (Figure 1). In seed crop of jute, apart from above, it also causes dark brown to black spots on pods and consequent seed infection.

Factors affecting jute stem rot

Environmental and soil factors, viz., soil moisture, relative humidity and air temperature influence the development of stem rot of jute. Average rainfall, host and pathogen factors have also profound influence on disease development. Susceptibility of jute plants to stem rot increases with age irrespective of varieties and maximum disease is observed at the time of harvest. Early (March) sown and dense crop is more prone to stem rot and later sown crop is less damaged. Overcast cloudy condition, heavy rainfall resulting in

Table 1. Diseases of jute crop (*Corchorus olitorius* L. and *C. capsularis* L.) and their causal organisms.

S. No.	Name of disease	Nature	Causal organism
1.	Stem rot	Fungal	<i>Macrophomina phaseolina</i>
2.	Hooghly wilt	Bacterial	<i>Ralstonia (=Pseudomonas) solanacearum</i> (<i>Macrophomina phaseolina</i> and <i>Meloidogyne incognita</i> may facilitate entry of bacteria by making injury).
3.	Anthracnose	Fungal	<i>Colletotrichum corchorum</i> ; <i>C. gloeosporioides</i>
4.	Black band	Fungal	<i>Botryodiplodia theobromae</i>
5.	Soft rot	Fungal	<i>Sclerotium rolfsii</i>
6.	Tip blight	Fungal	<i>Curvularia subulata</i>
7.	Stem gall	Fungal	<i>Physoderma corchori</i>
8.	Mildew	Fungal	<i>Oidium</i> sp.
9.	Sooty mould of pods	Fungal	<i>Cercospora corchori</i> , <i>Corynespora cassicola</i> , <i>Alternaria</i> spp.
10.	Root knot nematode	Nematode	<i>Meloidogyne incognita</i> , <i>M. javanica</i>
11.	Jute mosaic	Viral	A Begomo virus under family <i>Gemini viridae</i> , vector: whitefly (<i>Bemisia tabaci</i> Genn.)
12.	Jute Chlorosis	Viral	A member of Tobravirusgenus
13.	Yellow vein disease	Viral	A bipartite Begomo virus, vector: whitefly (<i>Bemisia tabaci</i> Genn.)

near field capacity soil moisture, high atmospheric humidity, air temperature 34 + 1°C and soil temperature below 30° C favour disease. Application of more nitrogenous fertilizer enhances stem rot, But increase in phosphatic and potassic fertilizers reduces it.

Disease cycle of jute stem rot

Jute stem rot is seed, soil as well as air borne. The pathogen survives in soil and/ or in infected crop residues or root stubbles for long time in absence of host crop. It had very wide host range with more than 500 plant species belonging to more than 50 different families. Seeds collected from infected crop produce infected seeds which upon germination produce diseased plants. Besides, abundant sporulation is often observed on infected seeds and stems with pycnidia with an ostiole. Presence of airborne conidia during crop season may cause secondary infection and may be responsible for epiphytotic outbreak of stem rot on susceptible variety. Disease cycle of stem rot of jute is presented in Fig. 2.

Anthracnose caused by *Colletotrichum corchori* in *Corchorus capsularis* jute and *Colletotrichum gloeosporioides* in *Corchorus olitorius* jute

Jute anthracnose is of regular occurrence in the *C.capsularis* belt of India, viz., Asom, North Bengal, Bihar and Uttar Pradesh. The disease is prevalent in Bangladesh also. In all probability, anthracnose caused by *Colletotrichum corchorum* entered India unknowingly during thirties along with jute germplasm from Southeast Asia, particularly Taiwan. It was first observed on 'Jap-Red' (*C.capsularis*) at Dacca farm in Bangladesh. Then from Dhaka it spread to other parts of Bangladesh. It later entered India through Assam. In recent years in India, the disease is appearing in very severe form in *C.capsularis* at Bahraich areas in Uttar Pradesh and also in some places in North Bengal, Bihar and Asom. Continuous rain, high relative humidity and temperature around 35°C are congenial for jute anthracnose.

Symptoms

Irregular spots appear on stem that may coalesce, cause deep

necrosis, girdle stem, crack and expose the fibre. They slowly turn to brownish depressed spots (on pods also). Infected seeds are lighter in colour, shrunken and germination is poor.

It is more serious in *C. capsularis* jute. In *C.capsularis*, numerous spots appear on the stem and the plants die in many cases. In case where the plants survive, the fibre is specky or knotty leading to the 'cross bottom' fibre. *C.olitorius* jute is rarely affected. In case, it is affected, it occurs at the very late stage of plant growth when the plants are at harvest stage and lesions are not deep enough to affect the fibre.

Black band caused by *Botryodiplodia theobromae*

This was a minor disease in the past, but now gradually increasing with change in climate, cropping pattern and introduction of new varieties of jute. Often no fibre and seed may be obtained from infected plant. It attacks both the species of jute in all the jute growing areas and requires attention due to the fact that there is gradual increase in intensity over the years.

Symptoms

Dark black spots appear on the stem initially. It is often confused with stem rot because of similarity in symptom. On rubbing with finger on the spots profuse black sooty powdery mass of spores adhere to the finger, which is not found in the case of stem rot. Diseased stem may break at the point of infection and the plants die. Crops raised from infected seeds show seedling blight symptoms. Seed infection takes place at pod formation stage followed by flowering.

Soft rot caused by *Sclerotium rolfsii*

This is a minor disease, but has gradually increased. The disease occurs in all the jute growing areas though in low intensity, it certainly demands a caution for the jute growers due to its devastating nature. High rainfall, low sun shine, high plant density favours soft rot. This is primarily a soil borne fungus. The fungus has a very wide host range

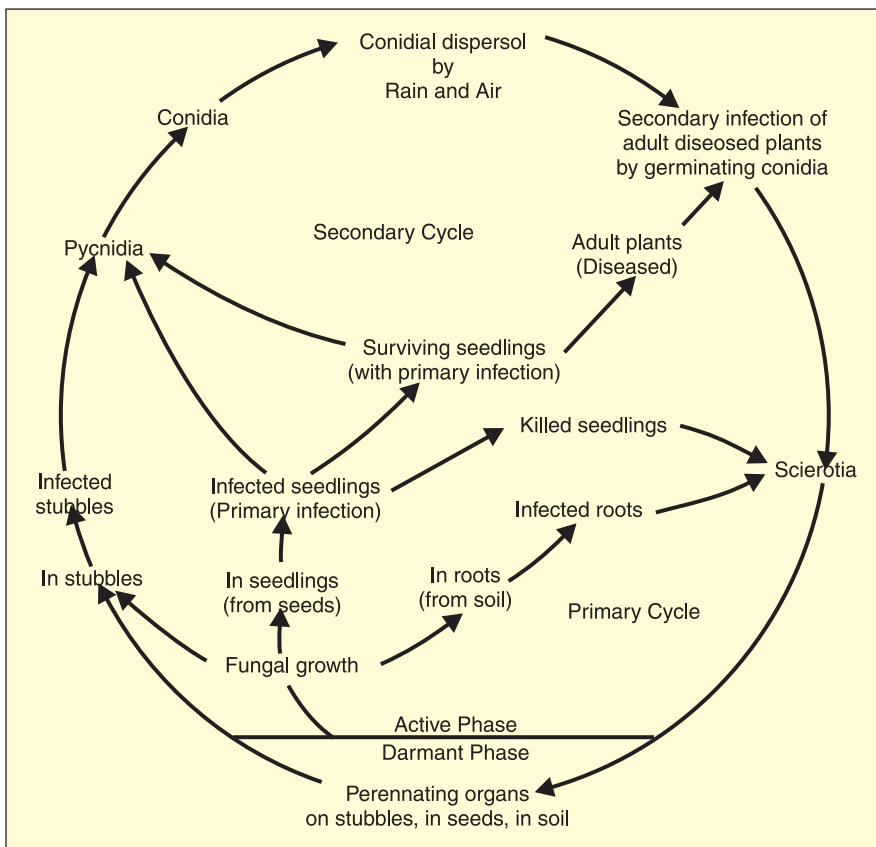


Fig. 2. Disease cycle of stem rot disease of jute

and majority of crop plants are attacked by this pathogen with different degree of intensity and assumes severe form in certain cases. Both *C.capsularis* and *C.olitorius* jute are affected.

Symptoms

As the plants grow old and mature

leaves are shed, the fungus first grows on the litter of fallen jute leaves. From there it infects the stem base. The pathogen attack begins when the crop is 80–90 days old. When the weather is hot and the soil is wet, pathogen grows and initiates infection in the collar region.

Soft, brown wet patch appears on

the stem base. Skin peels off and exposed fibre layers turns rusty brown and plants wilt. White cottony mycellial growth and brown mustard seed like sclerotia are seen at the site of infection. Soft rot decreases if fallen leaves are destroyed quickly from plant base.

Schedule of ICM in jute

- **Land preparation:** Deep ploughing and exposure of the soil to sun as long as possible and preparation of the land to a moderate tilth. Based on soil test report, apply lime or gypsum @ 2 – 4 tonnes /ha one month in advance, if the soil pH is below 5.8. Soil application of bleaching powder [$\text{Ca}(\text{OCl})_2$] at the rate of 25 – 30 kg per hectare 7 days ahead of sowing is a new option for areas with record of high stem rot occurrence. Jute should be grown in medium to upland situation, as in low lying land jute performs poorly. In problematic areas, soil solarization may be practiced.
- **Seed treatment:** With carbendazim 50 WP @ 1.0 g kg⁻¹ or *Trichoderma viride* (formulated product on talc) @ 10 g kg⁻¹. It is cheap, easy and the best method.
- **Fertilizer application:** 60 (30 basal + 15 top dressing after first weeding + 15 top dressing after second weeding): 30: 30 = NPK kg ha⁻¹ along with FYM compost @ 5 t ha⁻¹
- Sow jute in middle of March to middle of April, preferably, in line with CRIJAF multi row jute seed drill (30 cm row spacing), as early sowing invites more stem rot disease.
- **Weeding:** Twice either manually at 15 and 30 days after sowing or by pre-emergence and/or post-emergence herbicides.
- **Thinning** to desired plant population (5 – 6 lakh ha⁻¹ i.e. 5 – 6 cm plant to plant and 50 – 60 plants per square m). Dense plant population brings more diseases. Thin out the weak plants.
- **Visit fields regularly** for close monitoring of insect and disease incidence.
- **Foliar spraying of fungicides:** If the diseased plants exceed 2 %, foliar spray is advisable all over the field. Spray carbendazim 50 WP @ 1.0 g Litre⁻¹ of water or copper oxychloride 50 WP @ 3.0 - 4.0 g Litre⁻¹ of water or mancozeb @ 5 g Litre⁻¹ of water. Spraying of newer fungicides, namely, tebuconazole @ 1.5 – 2.0 ml or hexaconazole @ 1.5 – 2.0 ml or propiconazole @ 1.5 – 2.0 ml per Litre of water are also very effective. Avoid repeated spraying of same pesticides in the same crop season, preferably systemic ones, to overcome development of resistance. Spray mixture of 400 – 600 litres/ ha is advised (for hand sprayer) depending on crop canopy.
- Spray suitable **insecticides** for managing insect pests when their level goes above ETL of 10 % infestation.
- Use **biological control** agent, namely, *Trichoderma viride* or *T. harzianum* or *T. virens* or *Pseudomonas fluorescens* or *Bacillus subtilis* or *Aspergillus niger* AN 27 as soil application or seed treatment formulations either alone or in compatible combinations.
- **Harvest** jute at 110 – 120 days for better fibre yield and quality, as older crop produces more fibre yield but of poorer quality.
- Remove **stubbles** of older crops and preferably, burn or bury them.
- Follow **crop rotation** with non-host crop with paddy as the second crop.
- **Roguing** out of infected plants with burning or burying under soil when the disease is in low proportion is very important.

Tip blight of jute caused by *Curvularia subulata*

Tip blight was earlier minor disease but now is increasing and establishing in newly released varieties, e.g. JRO 8432. First report of tip blight came from Chakchaka, near Coochbehar (West Bengal). Epiphytic tip blight occurred in 1981 on a single variety JRC 5854. This disease is more prevalent in jute crop grown in hot and very high humid areas.

Symptoms

Blighting of newly emerged and tender folded leaf tissue at the tip of jute plants is observed initially. Rotting of growing tips occurs as brown mass of rotten tender folded leaves which later turn black after drying. Varieties from South East Asia, namely, Jap Red, Jap G, Halmahera, etc. are highly susceptible. Top leaves may also turn brown to black and water soaked. The infected tip of the plants may often recover with further new growth with unfavourable dry weather conditions.

Root knot nematode of jute caused by *Meloidogyne incognita*, *M. javanica*

Root knot nematode has wide range of hosts and can survive many years. Sometimes infection by root knot nematode may predispose the jute plant to root rot and wilt infection. Root knot nematode facilitates entry of other bacterial pathogen *R. solanacearum* and fungal pathogen *M. phaseolina* by creating injury on plant roots and cause heavy damage upon combined inoculation and /or infection. Both *C.olitorius* and *C.capsularis* were susceptible to it. Population of *Meloidogyne* gradually increases with growth of jute plant but decreases during winter in absence of suitable host plant, as they are endoparasitic in nature.

Symptoms

Root knot nematodes produce small to medium sized and round to elongated galls in the infected roots. The galls are white globular swellings in roots due to penetration of larvae. Trans location of water and nutrients is blocked resulting in yellowing and stunted growth.

Management of root knot nematode

- **Insecticides and nematicides:** Thiometon, Nematox and Nemagon are effective. Soil application of granular insecticides, e.g., carbofuran 3G, phorate 10 G, etc. at the rate of 1.0 – 2.0 kg active ingredient per hectare reduced nematode population and increased fibre yield. Carbosulfan 6% Gand nimbudin 15% G at the rate of 7.5 kg and 9.0 kg active ingredients per acre, respectively, are also very effective.
- **Organic amendments** namely, soil application of cakes of *karanj*, *mahua*, *neem*, groundnut, sawdust, cow dung, castor, chicken manure, etc. are also very effective.
- **Cultural practices** i.e, removal of stubbles, weeding, thinning, long term crop rotation with non-host crops. i.e. paddy and wheat reduced root knot nematode population in jute field.

Hooghly wilt caused by bacterial pathogen *Ralstoniasolanacearum* (= *Pseudomonas solanacearum*)

C. olitorius jute suffers more from Hooghly wilt. In 1970–80, epiphytotic of Hooghly wilt resulted in heavy crop loss with more than 60 % infection. Stem rot and root knot nematode facilitates infection of Hooghly wilt. *M. phaseolina* and *M. incognita* facilitate entry of the bacteria in the root of jute plants. It was first observed in 1950 in Tarakeswar areas of Hooghly district in West Bengal and later it was spread rapidly in Howrah, Nadia, North 24 Parganas, Burdwan districts. Now, it is causing severe crop loss in Murshidabad and Coochbehar districts also, where jute crop is followed by potato and rotten tubers

are discarded in the field itself.

Symptoms

The first appearance of Hooghly wilt is drooping and wilting of leaves starting from the base upwards. Later, all the leaves of the infected plants defoliate leaving the stem to stand naked and such plant may be diagnosed even from a distance. Affected stems are soft with slimy fluid comes out on slight pressing. Bacterial ooze test with a piece of infected tissue in clear water in a transparent glass is positive, turning the water turbid in a short period of time.

Management of Hooghly wilt

Potato or other solanaceous crops in the rotation are to be avoided as far as possible. The most effective crop rotation against this disease is jute–rice–rice or jute–rice–wheat. Seed treatment with carbendazim 50 WP @ 1.0 g/kg of seed and spraying the same fungicide @ 1.0 g/litre of water helps to reduce Hooghly wilt incidence.

Jute mosaic caused by a Begomovirus under family Geminiviridae, vector: whitefly (*Bemisia tabaci* Genn.)

Jute mosaic is a viral disease and more prevalent in *C. capsularis* jute in Asom and north Bengal. It is transmitted by white flies (*Bemisia tabaci*). Vector control is the only option to manage this viral disease. The geminivirus is graft transmissible and if does not carry through seed.

Symptoms

Gradual mottling of leaves occurs with various patterns of yellow and green. Infected leaves become variegated with yellow and light green patches. Later, crinkling of lamina and stunted growth of plant may occur. In severe case, plant will die.

Management of Jute mosaic

To check the spread of jute mosaic, vector control is the only option left to farmers. Spraying of systemic insecticides, namely, methyl demeton

(Metasystox) @ 1.5 ml per litre of water or phosphamidon (Dimecron) @ 1.0 ml per litre of water or thiomethoxam (Ektara) @ 2.5 – 3.0 gm/10 litres of water or imidachloprid (Confidor) @ 2.0 – 3.0 ml/10 litres of water or acetamiprid (Pound) @ 2.5 – 3.0 gm/10 litres of water are highly effective. Since, white fly is highly floating and flying population, spraying of systemic insecticides in a single patch of field is not useful, as population from neighboring fields will reappear. Spraying over large areas is advisable.

A proverb says, “A stitch in time saves nine.” Pre-sowing seed treatment, timely sowing, optimum plant population, chemical weed management, timely rouging out of infected plants, application of FYM and split doses of fertilizer, spraying of fungicides, etc. are few low cost and easy methods. To make jute crop more profitable, disease management with preventive measures will be cheaper and easier than curative methods.

SUMMARY

Major diseases of jute are stem rot, anthracnose, black band, soft rot, tip blight, root knot nematode, Hooghly wilt and jute mosaic. Of these, stem rot is economically most devastating. Easy management of diseases of jute involves manipulation of soil condition for soil borne diseases, treatment of seed with fungicides for seed borne diseases and foliar spraying of fungicides to check the air borne spores, or judicious combination of all or both. Integrated crop management is now a viable option as it is not a singular approach but encompasses all good agricultural practices from sowing to harvesting in judicious manner with coexistence of crop and pests and pathogens at below economic threshold level and no chemical harmful to environment is used for sustainability.

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