

Ethnobotanical plants used for sustainable agriculture of Paddy and Groundnut crops

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Abstract- Paddy is the important food crop of the world. It is rich in fibre, protein, vitamin B, iron and manganese. Groundnut is also nutritious and healthy food crop. To achieve sustainable agriculture of these crops biofertilizers and biopesticides play an important role. Biofertilizers and biopesticides are the best option for sustainable agriculture as they enhance crop production. Addition of organic biofertilizers and biopesticides to increase soil fertility may be an easy and useful method to improve productivity in tropical regions. Many ethnobotanically important plants have been used for medical and therapeutic uses but in this paper, we have focused on ethnobotanical plants usage in sustainable agriculture. In olden days farmers used different plants in agricultural fields which increased the soil fertility. To attain sustainable agriculture, we can harness important ethnobotanical plants used by the farmers in olden days. Ethnobotanical plants can act as the important components of integrated nutrient managementsystem due to their significant role in soil sustainability. 10 ethnobotanical plants were identified which can be used as Biofertilizers and biopesticides. Sustainable agriculture can prevent adverse effects to soil, water and biodiversity which bestow sustainability of human population.

Index Terms- Ethnobotanical plants, biofertilizers, biopesticides, sustainable agriculture.

INTRODUCTION

Paddy is the important food crop of the world. It is rich in fibre, protein, vitamin B, iron and manganese. Groundnut is also nutritious and healthy food crop. To achieve sustainable agriculture of these crops biofertilizers and biopesticides play an important role. Biofertilizers and biopesticides are the best option for sustainable agriculture as they enhance crop production. Most biofertilizers include microorganisms and they colonize the rhizosphere and help to increase the availability of primary nutrients to the host plant. They are very useful to promote plant growth. The bio-fertilizers add nutrients to the soil through nitrogen fixation and increase phosphorus content which increase plant growth. So biofertilizer can be a complementary source to chemical fertilizer to achieve Sustainable crop Production and reduce Environmental Pollution. Addition of farmer-friendlyorganic biofertilizers and biopesticides to increase soil fertility may be an easy and useful method to improve productivity in tropical regions. Ethnobotany deals with the study of relationship between human societies and plants. Many ethnobotanically important plants have been used for medical and therapeutic uses but in this paper we have focused on ethnobotanical plants usage in sustainable agriculture. In olden days farmers used different plants in agricultural fields which increased the soil fertility. To attain sustainable agriculture we can harness important ethnobotanical plants used by the farmers in olden days. Ethnobotanical plants can act as the important components of integrated nutrient managementsystem due to their significant role in soil sustainability. Sustainable agriculture can prevent adverse effects to soil, water and biodiversity which bestow sustainability of human population.

METHODS

The study was carried out during May 2021 to June 2023 to determine the wild and native plants used as biofertilizers in olden days (before 30 years) by villagers of Pydiwada, Askapalli, Gollapalem villages of sabbavaram mandal of Anakapalle district in the Andhrapradesh state of India. During the study, information was obtained from middle aged and older farmers. They have 40 years' experience in agriculture. They cultivated many crops like paddy and ground nut. Nowadays most of the farmers are using chemical fertilizers but these people used many plants as biofertilizers during their agricultural practices. For each crop at least 20-30 people were interviewed. We asked for his or her knowledge concerning the common names of the plants, their usage in agriculture practices. Before the broadcasting of rice seeds they used to bring plant parts of the following plants and distributed throughout the field. Then it was incubated for 2-3 days in water. Later soil was ploughed due to which soil was nourished well. Here we can observe that, not only the soil but also the plant material was ploughed giving nourishment to soil. By these practices good soil bacteria increase in those soils and they acted as good biofertilizers.

The following plants were used as biofertilizers in rice fields.

1. Scientific name: *Borassus flabellifer* Linn.

Common name: wine palm, tati
Family: Arecaceae



Fig-1 *Borassus flabellifer* Linn

Habit : Tree

Distribution: The wine palm is distributed in South Asia and Southeast Asia.

Ethnobotanical importance: The *Borassus flabellifer* Linn leaves considered as good sources of natural antioxidants and antimicrobials.

2. Scientific name: *Senna occidentalis* (L.) Link

Common name: Kasinda

Family: Caesalpiniaceae



Fig-2 *Senna occidentalis* (L.) Link

Habit: Herb

Distribution: *Senna occidentalis* (L.) Link is native to Americas.

Ethnobotanical importance: This ayurvedic plant possess antibacterial, antifungal, antidiabetic, anti-inflammatory, anticancerous, antimutagenic and hepatoprotective activities.

Varied chemical compounds such as achosin, aloe-emodin, emodin, anthraquinones, anthrones, apigenin, aurantiobtusin, campesterol, cassiollin, chryso-obtusin, chrysophanic acid, chrysarobin, chrysophanol, chrysoeriol etc..were reported from this plant species.

3. Scientific name: *Crotalaria juncea* L.

Common name: Sunn hemp

Family: Fabaceae



Fig-3 *Crotalaria juncea* L.

Habit: Shrub

Distribution: *Crotalaria juncea* L. is native to tropical Asia and originated in India.

Ethnobotanical importance: The leaves of the plant contain carbohydrates, steroids, triterpenes, phenolics, flavonoids, alkaloids, aminoacids, saponins, glycosides, tannins and volatile oils. The plant possess hypolipidemic, reproductive, antioxidant, antibacterial, antifungal, antidiarrhoeal, anti-inflammatory, hepatoprotective, and many other pharmacological effects (Ali Esmail Al-Snafi 2016).

4. Scientific name: *Crotan bonplandianus* Baill.

Common name: Ban Tulsi

Family: Euphorbiaceae



Fig-4 *Crotan bonplandianus* Baill.

Habit: Herb

Distribution: *Crotan bonplandianus* Baill. is native to central South America.

Ethnobotanical importance: This wild plant has been used in traditional medicine for a wide range of ailments like jaundice, acute constipation, abdominal dropsy, dysentery, external wounds, hypercholesterolemia, hypertension and infectious disorders. Bioactive compounds like diterpenes, alkaloids, flavonoids, steroid glycosides, volatile components were isolated from this wild plant. It exhibits hepatoprotective, anti-inflammatory, antifungal, wound healing, antimicrobial, antioxidant and antitumor properties (Rachana Lodhi 2021).

5. Scientific name: *Tephrosia purpurea* (L.) Pers.

Common name: Wild Indigo

Family : Fabaceae

Habit : Herb

Distribution : *Tephrosia purpurea* (L.) Pers. is used as green manure in many areas and shows pantropical distribution.

Ethnobotanical importance : According to Ayurveda this plant shows antihelmintic, alexiteric, restorative and antipyretic properties. It is useful in the treatment of leprosy, ulcers, asthma and tumors. It can cure diseases of the liver, spleen, heart and blood.



Fig-5 *Tephrosia purpurea* (L.) Pers.

6. Scientific name: *Wrightia tinctoria* R.Br
 Common name: dyer's oleander
 Family : Apocyanaceae



Fig-6 *Wrightia tinctoria* R.Br

Habit : Tree

Distribution : It is distributed in India,, Southeast Asia and Australia.

Ethnobotanical importance : *Wrightia tinctoria* R.Br is a traditional medicinal plant in Ayurveda, Unani and Siddha medicinal systems having several medicinal properties to treat diseases like Jaundice, malaria, psoriasis and other ailments. The plant contains a wide range of compounds like alkaloids, saponins, indoxy o-glycoside(s), phenolics, flavonoids, isatin tryptanthrin, anthranillate, rutin, β isatin, tryptophan, indigotin, indirubin, wrightial and sterols.

These plants were made to decompose in water to form biocompost which acts as biofertilizer to that agricultural field. Neem (*Azadirachta indica* A.Juss.) seed oil was used as biopesticide. To achieve eco-friendly management strategies for the control of paddy sheath blight, neem oil from the seeds of *Azadirachta indica*, lemon grass oil from the leaves of *Cymbopogon flexuosus*, mahua oil from *Madhuca longifolia*, tree tea oil from the leaves of *Melaleuca alternifolia* at 5% concentration were used and was found effective (Nikhil Raman K).

The following plants were used as biofertilizers in groundnut fields.

1. Scientific name: *Sorghum bicolor* (L.) Moench
 Common name: Jowar
 Family : Poaceae

Habit : Herb



Fig-7 *Sorghum bicolor* (L.) Moench

Distribution : Sorghum originated in Africa and distributed in tropical and subtropical regions.

Ethnobotanical importance: Generally this plant is used as animal feed and it is also human food. In traditional medicine it is used to cure anemia and Jaundice (Fofie Yvette Bra N'guessan 2015).

2. Scientific name: *Zea mays* L.
Common name: Corn
Family Poaceae



Fig-8 *Zea mays* L.

Habit : Herb

Distribution : *Zea mays* L. is cultivated throughout the world.

Ethnobotanical importance : It is a food crop and farmers use corn waste as cattle feed, firewood and fertilizers (Jati Batoro).

3. Scientific name: *Oryza sativa* L.
Common name: Rice
Family : Poaceae

Habit : Herb

Distribution : *Oryza sativa* L. is distributed in Asia, North and South America.



Fig-9 *Oryza sativa* L.

Ethnobotanical importance : Rice is an important staple food. In Ayurveda the rice is considered to be acrid, oleaginous, tonic, aphrodisiac, fattening, diuretic and useful in biliousness (Rosa Mia F.Cabanting 2016).

The above plants were grass plants. These grasses along with cow dung, *Neem (Azadirachta indica A.Juss.)* paste were given to the agricultural fields of ground nut to increase their crop yield.

4. Scientific name: *Azadirachta indica* A.Juss.

Common name: Neem

Family : Meliaceae



Fig-10 *Azadirachta indica* A.Juss.

Habit : Tree

Distribution: *Azadirachta indica* A.Juss. is native to India and distributed to South and Southeast Asia.

Ethnobotanical importance: In ayurveda, neem is used to balance vata disorders and it is having antibacterial and antiviral properties. The cold pressed seed oil of Neem is used as insecticide and is accustomed in cosmetic, medicinal and agricultural uses (Wawan Sujarwo et al. 2016). Well decomposed FYM and Groundnut oil cake inhibited fungal mycelial outgrowth of *S. rolfsii* by 100 percent followed by Mustard oil cake (88.88%), Sesamum (83.33%), Cotton (72.22%), Neem cake (70.36%), Karanj (60.74%), Vermicompost (60.00%) and Castor (55.55%) which were considerable higher than control (Sandhya Deepika D). The seed treatment with *T. harzianum* @ 5g kg⁻¹ 298 + soil application of 299 neem cake @ 1.3t/ha) was superior to all the treatments (Narendra babu G) to control stem rot of ground nut caused by *Sclerotium Rolfsii*.

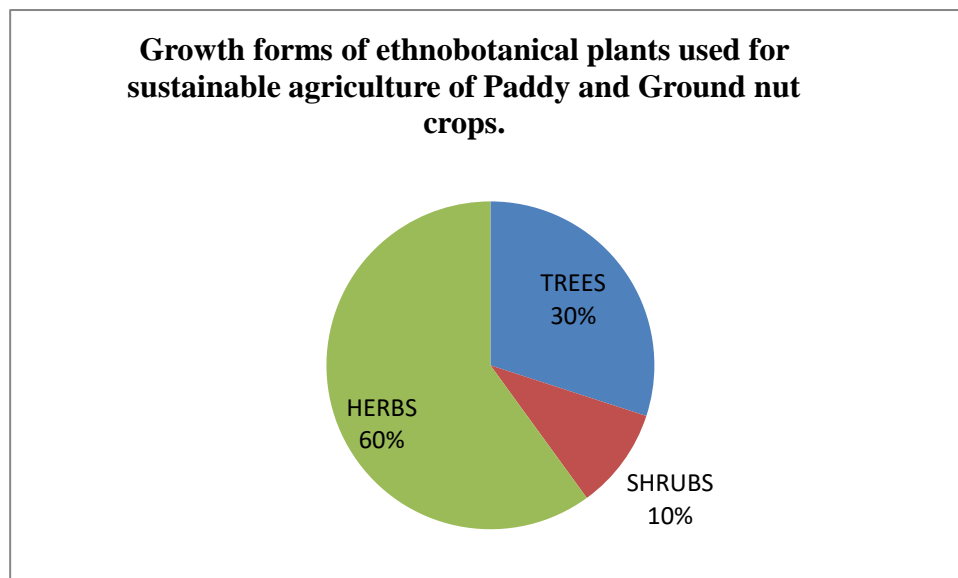


Fig -11 Growth forms used for sustainable agriculture of Paddy and Ground nut crops.

S.No	Name of the plant	Habit	Plant part used	Use of plant in Agriculture
1.	<i>Borassus flabellifer</i> Linn.	Tree	Leaves	Biofertilizer
2.	<i>Senna occidentalis</i> (L.) Link	Herb	Whole plant	Biofertilizer
3.	<i>Crotalaria juncea</i> L.	Shrub	Whole plant	Biofertilizer
4.	<i>Crotan bonplandianus</i> Baill.	Herb	Whole plant	Biofertilizer
5.	<i>Tephrosia purpurea</i> (L.) Pers.	Herb	Whole plant	Biofertilizer
6.	<i>Wrightia tinctoria</i> R.Br	Tree	Leaves	Biofertilizer
7.	<i>Sorghum bicolor</i> (L.) Moench	Herb	Leaves	Biofertilizer
8.	<i>Zea mays</i> L.	Herb	Leaves	Biofertilizer
9.	<i>Oryza sativa</i> L.	Herb	Leaves	Biofertilizer
10.	<i>Azadirachta indica</i> A.Juss.	Tree	Leaves, Seeds	Biopesticide

Table-1 The important ethnobotanical plants used in sustainable agriculture

RESULTS

The leaves, stems, roots of above enumerated plants and whole plants were used as biofertilizers by the farmers in olden days. A total of 7 plants belonging to 7 genera and 6 families were reported for their use in sustainable agriculture in paddy fields. A total of 4 plants belonging to 4 genera and 2 families were reported for their use in sustainable agriculture in groundnut fields. Ethnobotanical importance of these plants has been investigated in the villages of sabbavaram mandal of Anakapalli district in the Andhrapradesh state of India. Fabaceae is the dominant family followed by Arecaceae, Caesalpiniaceae, Euphorbiaceae, Apocyanaceae, Meliaceae and further research is needed for their use in sustainable agriculture of rice (*Oryza sativa* L.) fields. Poaceae is also the dominant family followed by Meliaceae and further research is needed for their use in sustainable agriculture of groundnut (*Arachis hypogaea* L.) fields. *Azadirachta indica* A.Juss. belonging to meliaceae used as best organic biopesticide as well as biofertilizer. Soil fertility is decreased because of over usage of chemical fertilizers so biofertilizers are alternatives to the chemical fertilizers to attain sustainable agriculture. To gain good yield organic biopesticides must be emboldened. Ethnobotany reveals the plant human relationship unlocking the knowledge of plants to achieve sustainable agriculture. Traditional knowledge and associated practices of indigenous people and local communities play a pivotal role to accomplish sustainable development.

Conflict of interest:

The authors declare that they have no conflict of interest.

Ethics Statement :

This research work does not contain any study involving or experimenting on humans and animals.

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