# An Expert System for Diagnosing Tobacco Diseases Using CLIPS

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*Abstract:* ***Background****: Tobacco, is an herbaceous annual or perennial plant in the family Solanaceae grown for its leaves. The tobacco plant has a thick, hairy stem and large, simple leaves which are oval in shape. The tobacco plant produces white, cream, pink or red flowers which grow in large clusters, are tubular in appearance and can reach 3.5-5.5 cm (1,25-2 in) in length. Tobacco may reach 1.2-1.8 m (4-6 ft) in height, Tobacco is one of the most widely abused substances in the world. It is highly addictive. The Centers for Disease Control and Prevention estimates that tobacco causes 6 million deaths per year. This makes tobacco the leading cause of preventable death, Nicotine is the main addictive chemical in tobacco. It causes a rush of adrenaline when absorbed in the bloodstream or inhaled via cigarette smoke. Nicotine also triggers an increase in dopamine. This is sometimes referred to as the brain's "happy" chemical.* ***Objectives****: The main goal of this expert system is to get the appropriate diagnosis of disease.* ***Methods****: In this paper the design of the proposed Expert System which was produced to help Doctor in diagnosing many of the tobacco diseases such as : Damping off, Frog eye leaf spot, Leaf blight / black shank, Anthracnose, Sore shin, Fusarium wilt, Brown spot, Tobacco mosaic disease, Tobacco ring spot disease, Cucumber mosaic disease, Tobacco leaf curl disease. The proposed expert system presents an overview about tobacco diseases are given, the cause of diseases are outlined. CLIPS and Delphi languages were used for designing and implementing the proposed expert system.* ***Results****: The proposed tobacco diseases diagnosis expert system was evaluated by engineering students and found to be positive.*

**Keywords**: Artificial Intelligence, Expert Systems, Clips, Tobacco diseases**.**

## 1. INTRODUCTION

Tobacco smoke contains numerous compounds emitted as gases and condensed tar particles. The side stream smoke emissions, which constitute the major part of environmental tobacco smoke (ETS), are generally larger than the mainstream smoke emissions. Many of the organic compounds, belonging to a variety of chemical classes, are known to be genotoxic and carcinogenic. These include the known constituents, alkenes, nitrosamines, aromatic and heterocyclic hydrocarbons and amines. Emission of side stream smoke in indoor environments with relatively low ventilation rates can result in pollutant concentrations above those generally encountered in ambient air in urban areas. The chemical characteristics of ETS thus support the indications that exposure to ETS can be causally associated with the induction of several types of cancer.



**Figure 1**: General form of tobacco

## 2. EXPERT SYSTEM

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if–then rules rather than through conventional procedural code. The first expert systems were created in the 1970s and then proliferated in the 1980s.Expert systems were among the first truly successful forms of artificial intelligence (AI) software. An expert system is divided into two subsystems: the inference engine and the knowledge base. The knowledge base represents facts and rules. The inference engine applies the rules to the known facts to deduce new facts. Inference engines can also include explanation and debugging abilities.
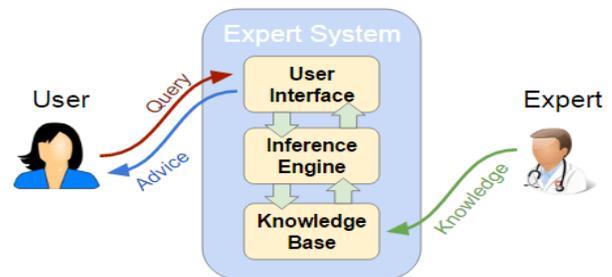


**Figure 2**: General form of expert system

## 3. LITERATURE REVIEW

There are many expert systems that are developed for diagnosing human medical problems like [33-38, 40, 42-44, 46], plant and trees problem like: general plant [4], mango [5], Black pepper [6], banana [7, 39] onion [17], potato [31], Pineapple [41], watermelon [45] and other

kinds of diseases. But there is no specialized expert system for diagnosing tobacco diseases available free. Although many plant diseases have common symptoms. The proposed expert system was designed and developed specifically to aid farmers in diagnosing tobacco diseases.

## 4. MATERIALS AND METHODS

The proposed system of experts will diagnose eleven tobacco diseases in all stages of human life, from young people to the elderly through an expert system capable of identifying symptoms of the disease. The proposed system of experts will ask the user to determine the symptoms of the disease in the symptoms screen.

Figure 3 illustrates a model for the symptom selection mechanism. Figure 4 shows how to identify the disease.
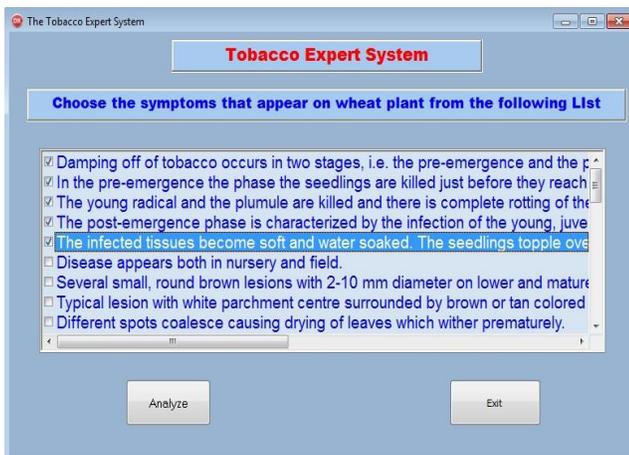


**Figure 3**: Screen selection of symptoms
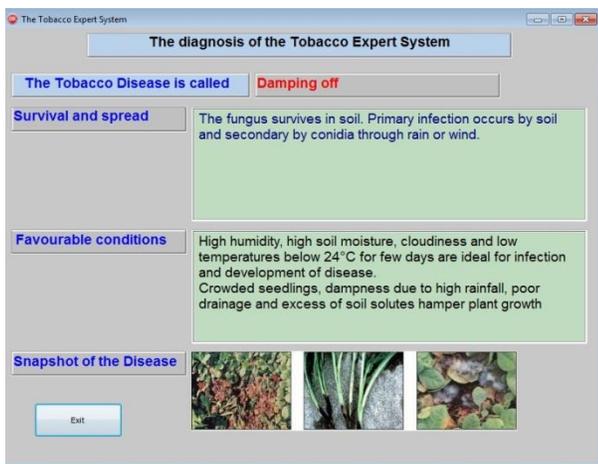


**Figure 4**: Screen Disease Identification

## 5. REPRESENTATION OF KNOWLEDGE

The main sources of knowledge for this expert system for diagnosing tobacco diseases were solicited from human experts. The captured knowledge has been converted into syntax using Clips rules covering eleven tobacco diseases:
**Damping Off:**

**Disease symptoms**
- Damping off of tobacco occurs in two stages, i.e. the pre-emergence and the post-emergence phase.
- In the pre-emergence the phase the seedlings are killed just before they reach the soil surface.
- The young radical and the plumule are killed and there is complete rotting of the seedlings.
- The post-emergence phase is characterized by the infection of the young, juvenile tissues of the collar at the ground level.
- The infected tissues become soft and water soaked. The seedlings topple over or collapse.



**Figure 5**: Damping Off Disease

**Frog Eye Leaf Spot:**
**Disease symptoms**
- Disease appears both in nursery and field.
- Several small, round brown lesions with 2-10 mm diameter on lower and mature leaves occur.
- Typical lesion with white parchment centre surrounded by brown or tan colored margin resembling eye of frog.
- Different spots coalesce causing drying of leaves which wither prematurely.
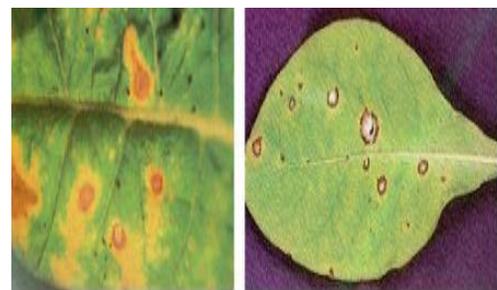


**Figure 6**: Frog Eye Leaf Disease

**Leaf Blight/Black Shank:**
**Disease symptoms**
- The disease is characterized by scattered, rapidly enlarging, irregular, brown, water-soaked lesions with characteristic gray-green borders.
- Symptom development occurs particularly during and immediately following periods of heavy rains and high relative humidity.

**Figure 7**: Leaf Blight/Black Shank Disease

**Anthracnose:**

**Disease symptoms**

- Symptom appears as small water soaked spots with sunken center on leaves.
- Spots become white with brown margin.
- Lesions occur also on midribs, petioles and lateral veins causing distortion and ragged.
- Lesions on stem weaken the stem.



**Figure 8**: Anthracnose Disease

**Sore Shin:**

**Disease symptoms**

1. **Target spot**. Symptoms on leaves begin as small, round, water-soaked spots about 2-3 mm in diameter.
   - Under favorable conditions these lesions enlarge rapidly, becoming light green, almost transparent, with irregular margins and chlorotic halos.
   - In infested areas, lower leaves turn brown and stick to the surface of the tray and the presence of brown spider-like webs (mycelium) may be observed attached to leaves and stems.

2. **Damping-off**. This disease is usually observed at early stages of seedling growth.
   - The first symptom is a small water soaked lesion on the stem close to the soil line that rapidly becomes brown and sunken.
   - Under favorable conditions lesions become very constricted and the stems break-off. The lesions

continue to grow throughout the stem and leaves causing them to turn brown and die.



**Figure 9**: Sore Shin Disease

**Fusarium Wilt:**

**Disease symptoms**

- The first symptom appears as chlorosis of the leaves.
- Wilting of leaves from bottom to top occur.
- Brown vascular discolouration inside infected stem or root leads to the death of plants.



**Figure 10**: Fusarium Wilt Disease

**Brown Spot:**

**Disease symptoms**

- Initially it appears on lower and older leaves as small brown, concentric circular lesions, which spread, to upper leaves, petioles, stalks and capsules even.
- In warm weather under high humidity, the leaf spots enlarge, 1-3 cm in diameter, centers are necroses and turn brown with characteristic marking giving target board appearance with a definite outline.
- In severe infection spots enlarge, coalesce and damage large areas making leaf dark-brown, ragged and worthless.



**Figure 11**: Brown Spot Disease

**Tobacco Mosaic:**
**Disease symptoms**
- Affected plants show leaves with mottling or mosaic pattern of light green and dark-green areas.
- Primary symptoms appear on newly formed young leaves as vein clearing, greenish yellow mottling.
- Infection on young plants results in stunted growth, malformation, distortion and puckering of leaves. Darkgreen blisters and sometime enations (leafy growth) appear on the dorsal side of the leaf.
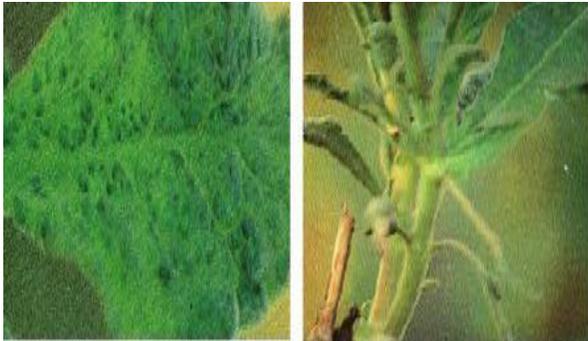


**Figure 12**: Mosaic Disease

**Tobacco Ring Spot:**
**Disease symptoms**
- Infected leaves show mottling veins show shortened internodes with small, distorted leaves.
- In later growth of plant stunted and limited to basal suckers, and the vine eventually dies.
- Dead and dying vines are usually present in a roughly circular pattern in the vineyard. The viruses are introduced into vineyards with infected planting stock or by dispersal of seed from infected weeds. The virus is then spread by dagger nematodes feeding on roots of infected plants.



**Figure 13**: Ring Spot Disease

**Cucumber Mosaic:**
**Disease symptoms**
- Disease plants show leaves with mottling or mosaic pattern of light green and dark-green areas.

- Vein clearing, greenish yellow mottling occur as primary symptoms on newly formed young leaves.
- Infection on young plants results in stunted growth, malformation, distortion and puckering of leaves. Dark-green blisters and sometime enations (leafy growth) appear on the dorsal side of the leaf.



**Figure 14**: Cucumber Mosaic Disease

**Tobacco Leaf Curl:**
**Disease symptoms**
- Disease is characterized by downward curling & rolling of leaves; thickening; dark green in color with vein clearing effect; brittle; enation (cup like or frill like outgrowth), reduction in size.
- Infected plants become stunted due to shortening of internodes and formation of more lateral branches.
- Flowers are deformed; partly or completely sterile.



**Figure 15**: Leaf Curl Disease

Various pictures of the expert system and how to use it:
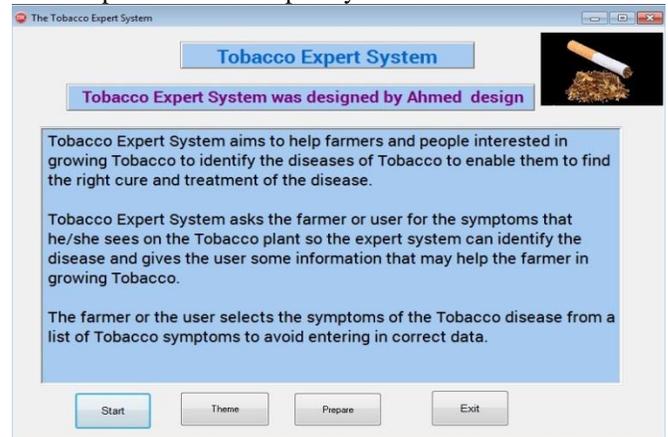


**Figure 16**: Main User Screen
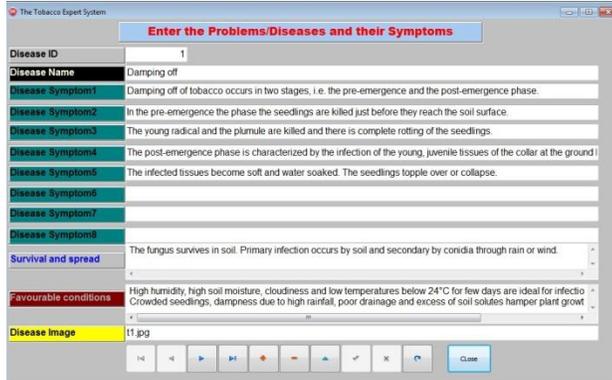
**Figure 17**: Entering Systems of the diseases
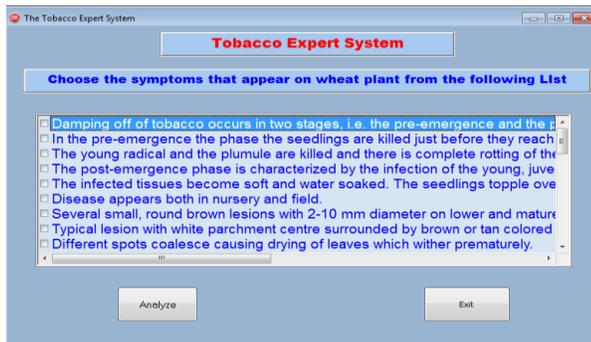


**Figure 18**: Expert system displaying the symptoms for user

## 6. LIMITATIONS

The current system of experts specializes in diagnosing only 11 diseases and being unable to diagnose the disease if more than one symptom of different diseases is selected.

## 7. CONCLUSION

In this paper, a proposed expert system was introduced to assist physicians in diagnosing patients with 11 different tobacco diseases. This expert system does not require extensive training to use; it is easy to use and has an easy-to-use interface. It was developed using Clips language.

## 8. FUTURE WORK

This system of experts is a basis for the future. It is planned to add more tobacco diseases and make them more accessible to users from anywhere and at any time

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