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KBS for Diagnosing Pineapple Diseases

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Abstract: ***Background****: The pineapple (A nanas comosus) is a tropical plant with an edible multiple fruit consisting of coalesced berries, also called pineapples, and the most economically significant plant in the Bromeliaceae family. Pineapples may be cultivated from a crown cutting of the fruit, possibly flowering in five to ten months and fruiting in the following six months.[5][6] Pineapples do not ripen significantly after harvest. In 2016, Costa Rica, Brazil, and the Philippines accounted for nearly one-third of the world's production of pineapples.[8] Pineapple damage is not taken quickly, it can lead to damage in the Pineapple.* ***Objectives****: The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment.* ***Method****s: In this paper the design of the proposed Expert System which was produced to help Fruits Agricultural Specialist in diagnosing many of the Pineapple diseases such as : Phytophthora heart (top) rot, Base (butt) rot or Fruit let core rot (green eye, Pineapple Sprain, Turf Toe, Pineapple disease , Plantar Fasciitis, Warts, Bunion, Rheumatoid Arthritis, Gout, Heel Spur, Athlete's Pineapple , The proposed expert system presents an overview about Pineapple diseases are given, the cause of diseases are outlined and the treatment of disease whenever possible is given out. CLIPS Expert System language was used for designing and implementing the proposed expert system.* ***Results****: The proposed Pineapple diseases diagnosis expert system was evaluated by Agricultural students and they were satisfied with its performance.* ***Conclusions****: The Proposed expert system is very useful for Fruits Agricultural Specialist, patients with Pineapple problem and newly graduated Agricultural Specialist.*

Keywords: Artificial Intelligence, Expert Systems, CLIPS, Pineapple diseases, Language.

1. INTRODUCTION

Pineapple (A nanas comosus) is a herbaceous perennial, which grows to 1.0 to 1.5 m (3.3 to 4.9 ft) tall, although sometimes it can be taller. In appearance, the plant has a short, stocky stem with tough, waxy leaves. When creating its fruit, it usually produces up to 200 flowers, although some large-fruited cultivars can exceed this. Once it flowers, the individual fruits of the flowers join together to create what are commonly referred to as a pineapple. After the first fruit is produced, side shoots (called 'suckers' by commercial growers) are produced in the leaf axils of the main stem. These may be removed for propagation, or left to produce additional fruits on the original plant.[5] Commercially, suckers that appear around the base are cultivated. It has 30 or more long, narrow, fleshy, trough-shaped leaves with sharp spines along the margins that are 30 to 100 cm (1.0 to 3.3 ft) long, surrounding a thick stem. In the first year of growth, the axis lengthens and thickens, bearing numerous leaves in close spirals. After 12 to 20 months, the stem grows into a spike-like inflorescence up to 15 cm (6 in) long with over 100 spirally arranged, trimerous flowers, each subtended The pineapple bulb is rich in phosphorus, calcium and carbohydrates. The pineapples in the pineapples return to a pilot oil known as alginsulphide. The Pineapples are two types: Figure 1. The figure presents the pineapple [a] [b]:

Figure1a: The pineapples are shaped like green leaves

Figure 1b: The pineapple shaped bulb

Pineapple is a common fruit plant that is a rich source of many plant nutrients recognized as important components of the Mediterranean diet but also used to treat and prevent a number of diseases, including cancer, coronary heart disease, obesity, hypercalcemia, type 2 diabetes, high blood pressure, cataracts Eye and gastrointestinal disorders (e.g. colic pain, vaginal colic and indigestion). Pineapple is an important crop on all continents with a global production of about 25 million tons. There was a gradual increase in pineapple production. Specialists in agriculture do not treat pineapple diseases in many places. In fact, the presence of specialists and specialized centers for the treatment of pineapple diseases is rare in most parts of the world. Pineapple diseases are very common these days. Diagnosis of pineapple diseases is very complex. So they need specialists with extensive experience in pineapple diseases. For all the above reasons, we have developed this expert system to help specialists and farmers diagnose many oncology diseases, in order to prescribe appropriate treatment .The expert system is a computer application of Artificial Intelligence (AI) [2,4,6]; which contains knowledge base and inference engine; the components and key details are represented in Figure 2.

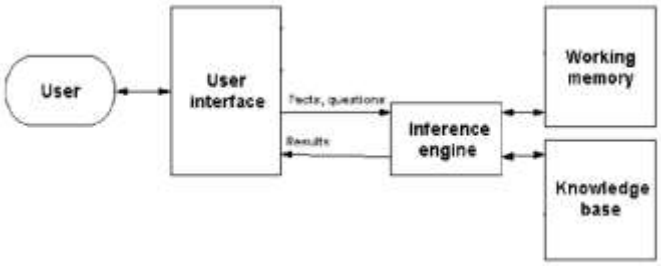

Figure 2: The figure presents the Main Components of an Expert System [20].

The proposed expert system for the diagnosis of pineapple diseases has been applied using CLIPS language and Delphi 10.2. It is a forward chaining which can draw conclusions about the realities of the world using rules and things and take appropriate action as a result. CLIPS performs any expert system through the interfaces. It is easy for a knowledge engineer to build an expert system for end users.

2. MATERIALS AND METHODS

The proposed expert system will diagnose 8 pineapple diseases by presenting all symptoms. The proposed expert system will ask the user to choose the type of problem symptoms. At the end of the dialogue session, the proposed expert system provides diagnosis and recommendations for the user. Figure 3 shows the main interface of the system and the user system. Figure 4 shows symptoms disease, Figure 5 Obtain diagnosis and recommendation.

3. LITERATURE REVIEW

There are many expert systems designed to diagnose agricultural diseases such as potatoes, tomatoes and other diseases [9-13,17,21-54]. However, there is no expert system for diagnosing pineapple diseases available for free. The current expert system specializes in the diagnosis of pineapple diseases: damping, purple staining, stemphylium, coliform / lymphatose / cyclone, basal fungus / root rot, white rot (rotting of bridges), rotary root rot, black mold Soft, yellowish iris disease, yellow dwarf pineapple disease, moldy dooney and green mold, and bacterial brown rot .

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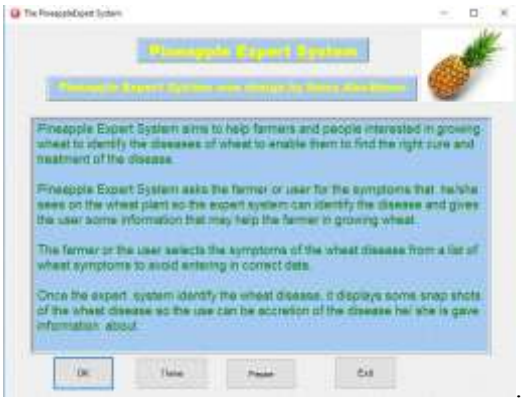

Figure 3: Displays the main interface of the system.

Figure 4: Displays the disease interface.

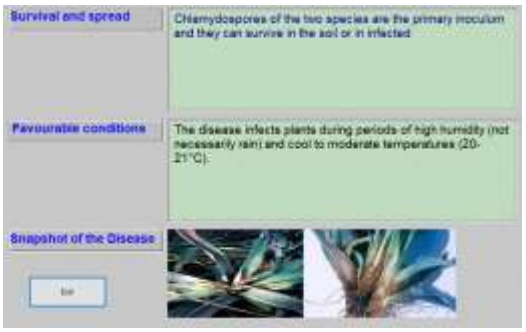

Figure 5: Displays the diagnostic interface and recommendations.

4. KNOWLEDGE REPRESENTATION

The main sources of knowledge for this expert system are vikaspedia and a specialized site for agricultural diseases. The captured knowledge was converted to the structure of the Clips database (rules and object rules). The expert system currently contains 41 bases covering 14 pineapple diseases:

Phytophthora heart (top) rot

Caused mainly by *Fusarium oxysporum* fungus, this is very common in almost all pineapple-growing pockets. *Pythium* sp. has also been reported to cause damping off disease in some pockets. The disease is more prevalent in Northern and Eastern parts of the country during *kharif* season, causing 60-75% damage. Two types of symptoms are observed.**Pre-emergence damping off :** The fungus kills the radicle and plumule of seed before emergence from soil.**Post-emergence damping off :** The pathogen attacks the collar region of seedlings on the surface of soil. The collar portion rots and ultimately the seedlings collapse and die. Figure 5 shows the disease of damping off.

Figure 6***: shows the disease of Phytophthora heart (top) rot***

Base (butt) rot

The initial symptoms of purple blotch are small, water-soaked lesions with white centers that appear usually on older leaves. As the disease progresses, the lesions enlarge (individual lesions can be as long as 1–2 inches) and become purplish with light yellow concentric rings on the margins. As severity increases, leaves turn yellow brown, lose erectness, and wilt. Windborne conidia from previous crop debris intiate infection, which is favored by high temperatures and humid conditions. Prolonged leaf wetness increases the probability of further infection.Figure 7: shows the disease of Purple Blotch.

Figure 7: ***shows the disease of Purple*** Blotch***.***

Fruitlet core rot (green eye)

Is caused by the fungus Stemphyliumvesicarium. Small, light yellow to brown and water-soaked lesions develop on leaves. These small lesions grow into elongated spots that frequently coalesce resulting in blighted leaves. Lesions usually turn light brown to tan at the center and later dark olive brown to black as the spores of this pathogen develop. S. vesicarium normally invades dead and dying pineapple tissue, such as leaf tips, purple blotch and downy mildew lesions, injured tissue, and senescent tissue. Infection usually remains restricted to leaves and does not extend into the bulb scales. Lesions generally occur on the side of the leaf facing the prevailing wind. Long periods of warm wet conditions encourage disease development.Figure 8: shows the disease of Stemphylium leaf blight.

Figure 8: ***shows the disease*** *Fruitlet core rot (green eye)*

Fusariosis

The symptoms appear initially on the leaves as water soaked pale yellow spots, which spread lengthwise covering entire leaf blade.The affected leaves shrivel and droop down.Survival and spread The fungus can survive for many years as sclerotia in the soil or for shorter periods in infected plant debris .Favourable conditions Disease is most severe in warm [25-30°C], moist soils that are high in organic matter Fungal growth rapidly decreases below 15°C, resulting in little disease development.Figure 9: shows the disease of Colletotrichum blight.

*Figure 9****: shows the disease of*** *Fusariosis*

Water blister

Pineapple plants begin yellowing at the leaf tips, and gradually die back until only the neck remains. If you pull up an affected plant, many small roots will be missing, and those present may be brown and rotted or pink. Just above the roots, the base of the pineapple will appear corky. This disease is most common in summer when soil temperatures are above 80F (27C). Plants that

have been damaged by pineapple root maggots often become infected, because the fungi can enter pineapple roots easily through the feeding wounds.

Damage**:**As pineapple fusarium fungi destroy pineapple roots, the plants cannot make new growth. Bulbs may be small and immature. Bulb pineapples infected with fusarium quickly rot in storage.Figure 10: shows the disease of Fusarium basal rot/basal rot.

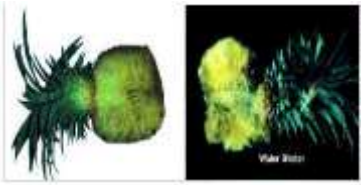

Figure 10: shows the disease of Fusarium basal rot/basal rot

Fruit rot by yeast and candida species

White rot is the number-one threat to pineapple family crops worldwide. It's so severe that, in some areas, it has destroyed the allium growing industry. Alarming? Certainly. Treatable? No – not currently, anyway.Pineapple white rot can affect all alliums, so pineapples, garlic, leeks and shallots, as well as ornamental alliums, are at risk. I've found garlic to be the most susceptible, closely followed by pineapples. My shallots haven't yet been affected, and I've only ever had one leek show signs of the disease, but I may have just been lucky – if any aspect of having a white rot-infested garden can be considered to be lucky! .Figure 11**:**shows the disease of White rot (Sclerotial rot).

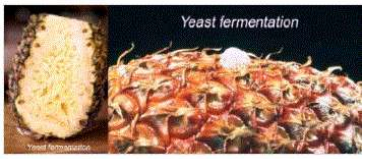

Figure 11: shows the disease of Fruit rot by yeast and candida species

Nematodes associated diseases*:*

The most striking symptom of pink root is, as the name indicates, pink roots. Infected roots first turn light pink, then darken through red and purple, shrivel, turn black, and die. The pinkish red discoloration may extend up into the scales of the bulb. New roots also may become infected. If infection continues, plants become stunted. The disease seldom results in plant death. Infection is confined to roots and outer scales of the bulb. Many weak *Fusarium* species can also cause pink roots, particularly on old roots; diagnosis of pink root can be accurately accomplished only on actively growing plants. Figure 12**:** shows the disease of Pink root rot.

Figure 12: shows the disease of Pink root rot.

EVALUATION SYSTEM

As an initial development, the students at the Faculty of Agriculture at Al-Quds Open University tested this proposed system and were satisfied with its performance, efficiency, user interface and ease of use.

5. CONCLUSION

In this paper, a proposed expert system was introduced to help farmers, specialists and students diagnose pineapple disease. Farmers, specialists and students can get a faster and more accurate diagnosis than traditional diagnosis. This expert system does not require much training to use; it is easy to use and has an easy-to-use interface. It was developed using the languages of the CLIPS and Delphi.

6. FUTURE WORK

This expert system is a basis for the future. It is planned to add more pineapple diseases and make it easier for users from anywhere and at any time.

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