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Onion Rule Based System for Disorders Diagnosis and Treatment

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Abstract: *This research included the design of an initial expert system which helps farmers and specialists to diagnose and provide appropriate advice on onion plant diseases; furthermore, the management of knowledge used in the expert system was discussed. One of the key elements of this research was to find the appropriate language to diagnose the onion disease and the current situation in the knowledge base. Expert systems to be able to effectively implement the consultation, production rules were used to capture knowledge. The expert system was developed using CLIPS with the Delphi language interface. The expert system has produced good results in the analysis of onion disease cases that have been tested and enable the system to determine the correct diagnosis in all cases.*

Keysowrds: Rule Based, Onion, CLIPS, Delphi

1. INTRODUCTION

Onion [4] is an important seasoning that is widely used in all homes throughout the year. Green leaves are eaten and used in preparing vegetables. The onion is used in soups, sauces and spicy foods. One small bulb mixed in vinegar. Recent research has suggested that onion in the diet may play a role in the prevention of diseases of heat and other diseases. Onions are two types: Fig 1a and 1b shows the two onion shapes:

Figure1a: The onions are shaped like green leaves

Figure1b: The onion shaped bulb

Onion is an important crop in all continents with a global production of about 40 million tons. There has been a gradual increase in onion production. Internationalists in agriculture do not treat onion diseases in many places. In fact, the presence of specialists and specialized centers for the treatment of onion diseases is rare in most parts of the world. Onion diseases are very common these days. Diagnosis of onion diseases is very complex. So they need specialists with extensive experience in onion diseases. For all the above reasons, we have developed this expert system to help specialists and farmers diagnose many of the onion diseases, in order to prescribe appropriate treatment. An expert system is an artificial intelligence computer application; which contains a knowledge base and a conclusion engine; the components and basic details are represented in Figure 2.

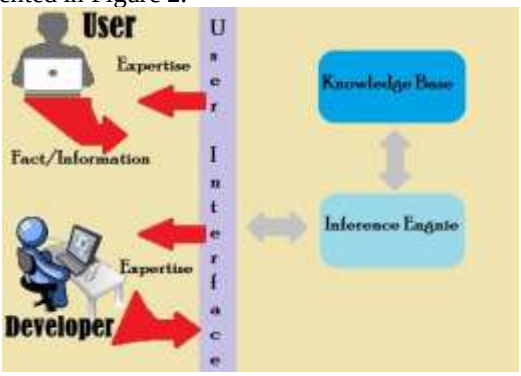

Figure 2: The figure presents the Main Components of an Expert System [22].

The proposed expert system for the diagnosis of onion diseases has been applied using CLIPS language. It is a system of forward-chaining thinking that can draw conclusions about the realities of the world using rules and things and take appropriate action as a result. CLIPS perform any expert system through the interfaces. It is easy for a knowledge engineer to build a system of experts and end users when they use the system.

2. MATERIALS AND METHODS

The proposed system of experts will diagnose 14 onion diseases by presenting all problems. The proposed system of experts will ask the user to choose the type of problem. 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 disease, Figure 5 Obtain diagnosis and recommendation.

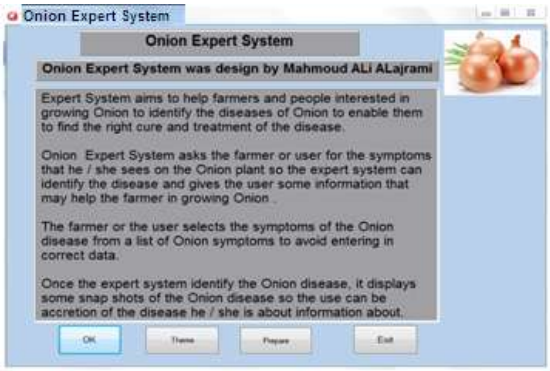

Figure 3: Displays the main interface of the system.

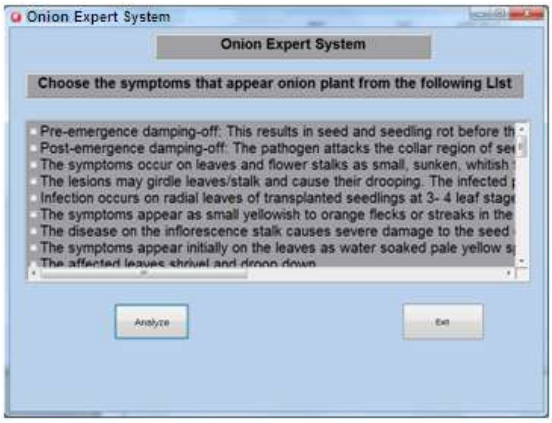

Figure 4: Displays the disease interface.

Figure 5: Displays the diagnostic interface and recommendations.

3. LITERATURE REVIEW

There are many expert systems designed to diagnose agricultural diseases such as potatoes, tomatoes and other diseases. However, there is no expert system for diagnosing onion diseases available for free. A few authors developed an expert system to help farmers and specialists diagnose diseases using CLIPS [18, 19]. The current expert system specializes in the diagnosis of onion diseases: damping, purple coloring, stemphylium, coliform / lymphatose / cyclone, basal fungus / root rot, white rot (rotting bridges), rotary root rot, yellow dwarf onion disease, moldy dooney and green mold, bacterial brown rot.

4. KNOWLEDGE REPRESENTATION

The main sources of knowledge for this expert system are vikaspedia [19] 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 rules covering 14 onion diseases[14]:

a) Damping off: Inhibitory: mainly causes fungus, this is very common in all pockets of onion cultivation. Disease is more prevalent in autumn, causing damage. Two types of symptoms are observed: Refractive inhibition: Mushrooms kill roots and seeds from seeds before they leave the soil. Effectiveness: The pathogen attacks the seedling area on the soil surface. The clavicle part is damaged and the seedlings eventually end up and die. Figure 5 shows damping disease.

Figure 6: shows the disease of damping off

b) **Purple Blotch:** The initial symptoms of purple blotch[5] 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 initiate 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

c) **Stemphylium leaf blight :** Is caused by the fungus Stemphylium vesicarium[6]. 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 onion 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.

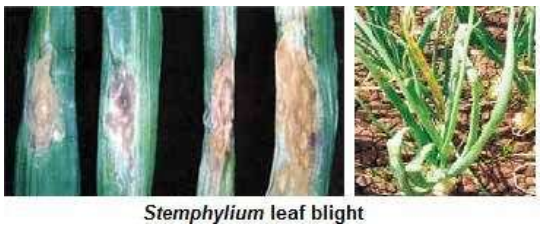

Figure 8: shows the disease of Stemphylium leaf blight

d) **Colletotrichumblight/anthracnose/twister disease:** 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[19]. 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[19].

Figure 9: shows the disease of Colletotrichum blight.

e) **Fusarium basal rot/basal rot :** Onion 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 onion will appear corky. This disease is most common in summer when soil temperatures are above 80F (27C). Plants that have been damaged by onion root maggots often become infected, because the fungi can enter onion roots easily through the feeding wounds.Figure 10: shows the disease of Fusarium basal rot/basal rot.

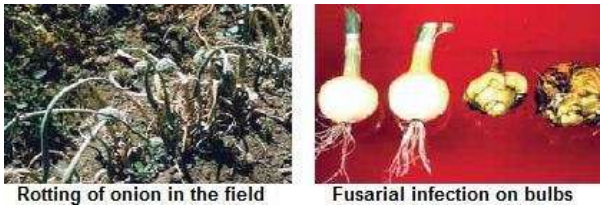

Figure 10: shows the disease of Fusarium basal rot/basal rot

f) **White rot (Sclerotial rot):** White [19] mold is the number one threat to onion crops around the world. It is so severe that in some areas, the onion industry has been destroyed, however. Egg rot can affect all access, so onion is at risk. . Figure 11: White rot disease (rotten rot) appears.

Figure 11: shows the disease of White rot (Sclerotial rot)

g) Pink root rot : The most striking symptom of pink root[11] 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.

h) Black mould :[19]Is caused by aspergillus niger, a common fungus in soil. To discourage mold growth, store onions in the refrigerator up to two months. Rinse off small amounts of the black mold on the outer scales of the onion under cool, running tap water or cut off the affected layers. The unaffected part can be used. Persons known to be allergic to Aspergillus niger should not use onions with black mold.Figure 13: shows the disease of Black mould.

Figure 13: shows the disease of Black mould.

i) **Bacterial soft rot :** [19]It usually happens because of (synonym for Dickeya chrysanthemi). Bacterial pathogens have very broad antigens that generally require wound caused by heavy rain, wind, cold, insects, or neck scraps when harvested. Water spray, aerosol, contaminated equipment, workers, insects spread mild mildew bacteria. Bacteria are usually pathogenic to soft bacteria in irrigation water and can be easily distributed. Erwinia spp. Survival among onion crops in soil, crop debris and pathogens on other crops. the shape. Figure 14: shows the disease of Bacterial soft rot.

Figure 14 : shows the disease of Bacterial soft rot

Iris yellow spot disease : Is caused by the tospovirus Iris yellow spot[10] virus (IYSV), and has recently become widespread in the western U.S. IYSV can also infect leek, Chinese chive, iris, lisianthus, and several other ornamental hosts. IYSV is reportedly vectored only by onion thrips (Thrips tabaci). Tospoviruses are acquired by first larval instars, but only can be transmitted (within 10 minutes of feeding) to plants after circulation and replication in the vector. The thrips becomes viruliferous for its entire life, but the virus is not known to be passed to thrips progeny through eggs. Weed hosts are largely unknown, but approximately 2% of redroot pigweed plants tested were positive for IYSV in Colorado. Onion seed, bulbs, and roots are not known to carry the virus, but volunteer onions are often symptomatic in early spring in Colorado. The virus likely overwinters in perennial and winter annual weeds, over-wintering onion, and adult thrips. Figure 15: shows the disease of Iris yellow spot disease.

Figure 15: shows the disease of Iris yellow spot disease.

j) Onion yellow dwarf disease: The first symptoms of onion yellow dwarf [8] in young onions are yellow streaks at the bases of the first true leaves. All leaves developing after these initial symptoms show symptoms ranging from yellow streaks to complete yellowing of leaves. Leaves are sometimes crinkled

and flattened and tend to fall over. Bulbs are undersized. Figure 16: shows the disease of Iris Onion yellow dwarf disease.

Figure 16: shows the disease of Iris Onion yellow dwarf disease [19].

k) Downy mildew: Is characterized by pale–green, yellowish to brownish areas of irregular size and shape (oval to cylindrical) on infected leaves or seed stalks. These areas may consist of alternating yellow and green layers of tissue. The causal organism of DM produces fruiting bodies and spores called sporangia on the surface of the leaves and seed stalks The masses of spores are at first transparent to greyish, and then rapidly become violet in color . Leaves become girdled in the region where mildew develops and the leaves collapse . This results in dead leaf tips that usually can be seen within defined regions in a field. The dead leaf tissue is rapidly colonized by purple blotch, which is dark in color and obscures DM. DM seldom kills onion plants, but bulb growth may be reduced. Bulb tissue, especially the neck, may become spongy and the bulb may lack keeping quality. Figure 17: shows the disease of Downy mildew [21].

Figure 17: shows the disease of Downy mildew.

l) Green mould :generally appears during harvesting and storage. Initial symptoms include watersoaked areas on the outer surface of scales. Later, a green to blue green, powdery mold may develop on the surface of the lesions. Infected areas of fleshy scales are tan or gray when cut. In advanced stages, infected bulbs may disintegrate into a watery rot. Figure 18: shows the disease of Green mould [13].

Figure 18: shows the disease of Green mould[19].

m) Bacterial brown rot :[21]Is caused by the bacterium Pseudomonas viridiflava. The bacterium efficiently colonizes the leaf surfaces of several weeds, crops, and onion. During cool, wet weather the bacteria infect leaves and progress downward into the bulb where they cause a decay of inner scales. The pathogen survives between onion crops epiphytically and pathogenically on weeds and other crops. Figure 19**:** shows the disease of Bacterial brown rot.

Figure 19: shows the disease of Bacterial brown rot.

5. LIMITATIONS

The current system of experts specializes in diagnosing only the following 18 diseases: Damping off, Purple Blotch,Stemphylium leaf blight, Colletotrichum blight/anthracnose/twister disease, Fusarium basal rot/basal rot, White rot (Sclerotial rot), Pink root rot, Black mould, Bacterial soft rot, Iris yellow spot disease, Onion yellow dwarf disease, Downy mildew, Green mould, Bacterial brown rot.

6. 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.

7. CONCLUSION

In this paper, a proposed expert system was introduced to help farmers and students diagnose onion disease. Farmers and students can get a faster and more accurate diagnosis

than traditional diagnosis. This expert system does not require extensive training to use; it is easy to use and has an easy-to-use interface. The proposed expert system was developed using the languages of CLIPS and Delphi.

8. FUTURE WORK

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

9. EXPERT SYSTEM IMAGES

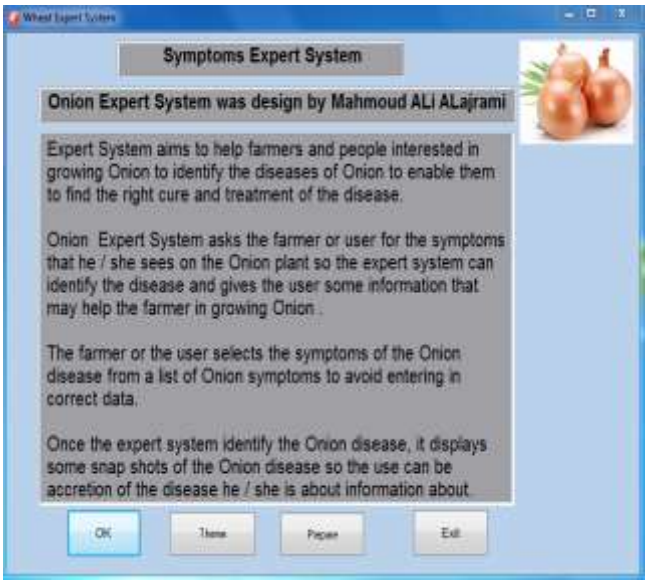

Figure 20: The main screen format of the expert system.

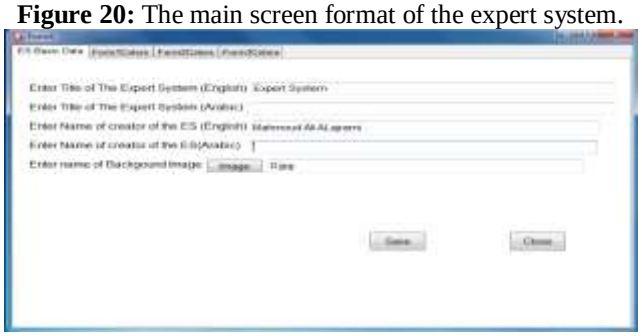

Figure 21: Add Info screen for the main interface

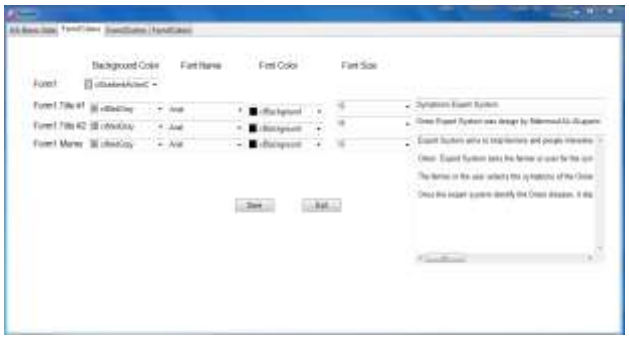

Figure 22: Main interface adjustment screen

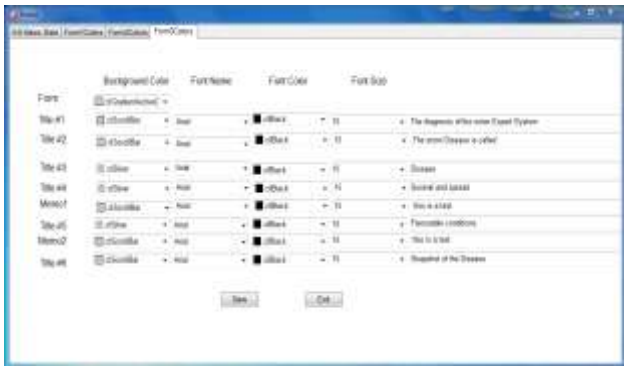

Figure 23: Screen Modifying Interface Results.

Figure 24: Screen Add Disease Interface.

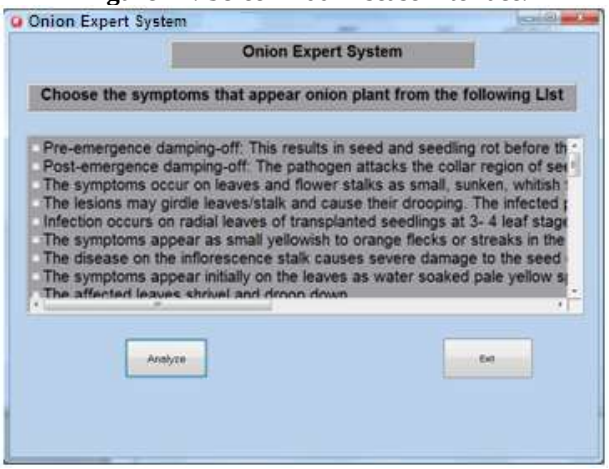

Figure 25: Screen selection symptoms

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