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Rule Based System for Diagnosing Lablab Problems

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ABSTRACT: Background*: Lablab is a summer-growing annual or occasionally short-lived perennial forage legume. It is a twining, climbing, trailing or upright herbaceous plant that can grow to a length of 3-6 m. It has a deep taproot and vigorous, glabrous or pubescent trailing stems. Lablab leaves are alternate and trifoliolate. The leaflets are rhomboid in shape, 7.5-15 cm long x 8-14 cm broad, acute at the apex. The upper surface is smooth while the underside has short hairs. Inflorescences are many-flowered racemes borne on elongated peduncles. The flowers are white to blue or purple in colour, about 1.5 cm long, typically papillonaceous in shape. Lablab fruits are linear, 4-15 cm long x 1-4 cm broad, smooth and beaked pods that contain between 2 and 8 seeds.* ***Objectives:*** *The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment.* ***Methods:*** *In this paper, the design of the proposed Expert System was produced to help Farmers and those interested in agriculture in diagnosing many of the Lablab diseases such as Anthracnose, Rust, Powdery mildew, Bacterial leaf spot, Lablab bean Mosaic virus, Ashy stem blight. The proposed expert system presents an overview of Lablab diseases are given, the cause of diseases 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 Lablab diseases diagnosis expert system was evaluated by Agricultural Students at AL Azhar University and some friends interested in agriculture and they were satisfied with its performance.* ***Conclusions:*** *The proposed expert system is very useful for Farmers and those interested in agriculture.*

INTRODUCTION:

In our home garden, there are many plants, both beneficial and harmful, some of which we plant for shade and for decoration, others we plant to smell the fragrance of their flowers and enjoy their bright colors, and some of them we grow to enjoy their shade and bright colors, including Lablab.

Lablab has many names according to the place of its presence and the culture of that country. It is a herbaceous plant of the family called Fashgia. It climbs frequently on the facades of houses and is found throughout Europe, Asia and North Africa. There are about 15 species of it and it can be a shade and sun plant.
The presence of specialists in the treatment of Lablab plant diseases is a rare occurrence in various regions of the world, so we thought of writing this expert system to help people treat Lablab diseases, as plant diseases in general, including Lablab plant, are very common these days due to the industrial revolution, climate changes and human activities Miscellaneous.

An expert system is a computer application of Artificial Intelligence (AI); which contains a knowledge base and an inference engine; the main components and details are represented in figure 1.

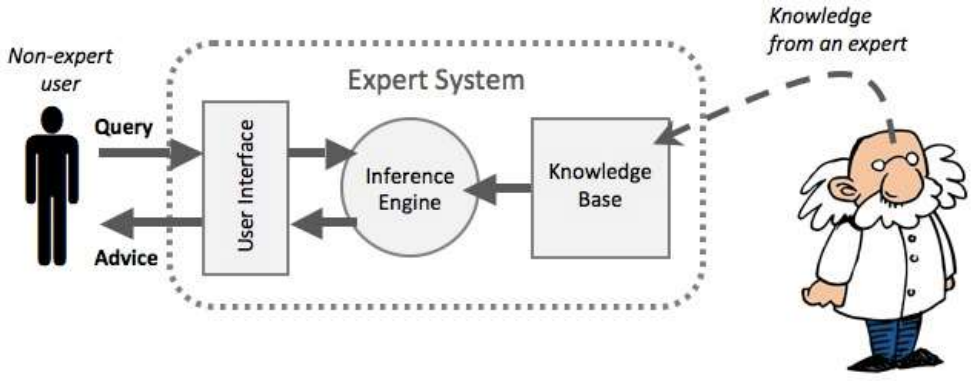

Figure 1: The figure presents the Main Components of an Expert System, Designed by the authors

The proposed Expert System for mint Diseases Diagnosis was implemented using, CLIPS Rule-Based Programming Language. It is a forward chinning reasoning expert system that can make inferences about facts of the world using rules, objects and take appropriate actions as a result.

MATERIALS AND METHODS

The proposed expert system performs diagnosis for six Mint diseases by Diagnosis of symptoms. The proposed expert system will ask the user to choose Symptoms on each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user According to the user's choices. Figure 3 shows a sample dialogue between the expert system and the user. Figure 4 shows how the users get the diagnosis and recommendation.

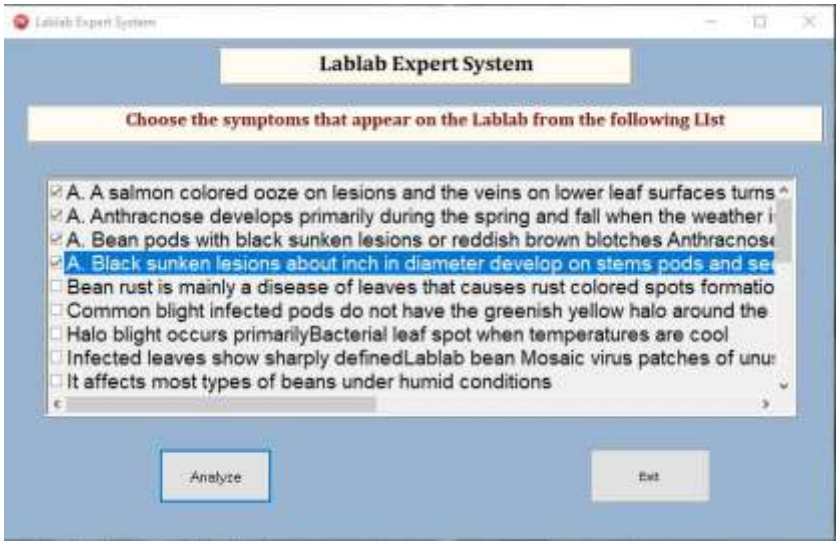

Figure 2: The figure shows symptoms of diseases the user.

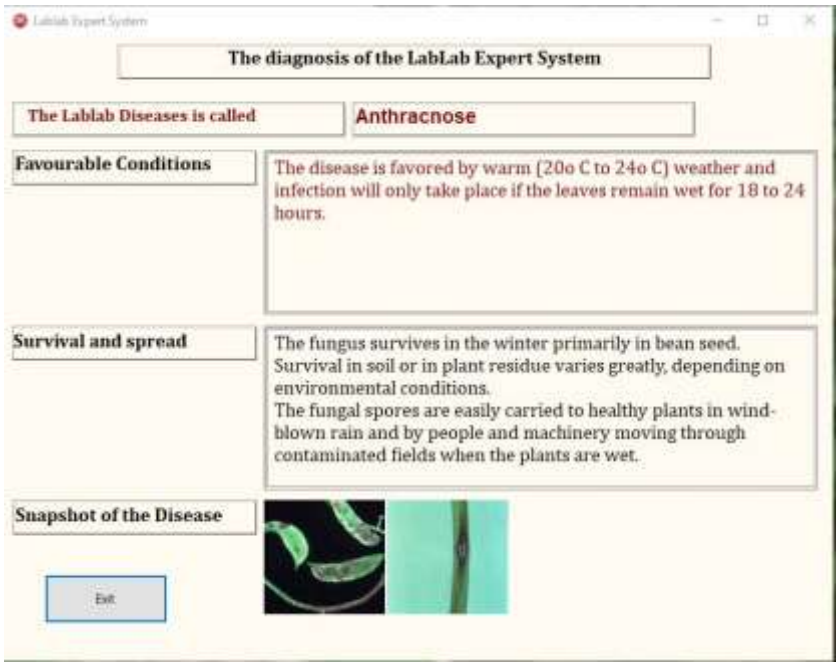

Figure 3: The figure shows diagnosis and recommendation of the expert system.

KNOWLEDGE REPRESENTATION:

Based on the knowledge obtained from farmers and websites specialized in plant diseases, this program has been written into CLIPS Rule-Based Programming Language (Facts, Rules, and Object), Currently, the expert system has 6 rules, which cover six Lablab diseases as follows:

- Anthracnose

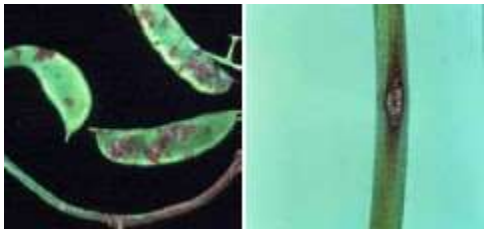

Figure 3: The figure shows Anthracnose disease.

The cause may be for this disease is the presence of these four conditions:

- Bean pods with black, sunken lesions or reddish-brown blotches caused by Colletotrichum lindemuthianum.
- Black, sunken lesions about ½ inch in diameter develop on stems, pods and seedling leaves (cotyledons) but are most prominent on pods.
- A salmon-colored ooze on lesions and the veins on lower leaf surfaces turns black. On lima beans, symptoms are sooty-appearing spots on leaves and pods.
- Anthracnose develops primarily during the spring and fall when the weather is cool and wet, and not during hot, dry summers. Lima beans are particularly susceptib

- Rust

Figure 4: The figure shows Rust disease.

The cause may be for this disease is the presence of these four conditions:

- Bean rust is mainly a disease of leaves that causes rust-colored spots formation on the lower leaf surfaces.
- Severely infected leaves turn yellow, wilt, and drop off the plant.
- Stems and pods may also be infected.
- It affects most types of beans under humid condition

- Powdery mildew

Figure 5: The figure shows Powdery mildew disease.

The cause may be for this disease is the presence of these three conditions:

- Leaves are covered with patches of a whitish to grayish powdery growth.
- New growth appears contorted, curled or dwarfed and may turn yellow and drop. Pods are dwarfed and distorted.
- This is mostly a problem of all beans. Powdery mildew is spread by wind and rain.

❖ Bacterial leaf spot

Figure 6: The figure shows Bacterial leaf spot disease.

The cause may be for this disease is the presence of these six conditions:

- There are two widespread bacterial blights that affect most types of beans, common blight (Xanthomonas campestris pv phaseoli) and halo blight (Pseudomonas syringae pathovar phaseolicola).
- The stems, leaves and fruits of bean plants can be infected by either disease. Rain and damp weather favour disease development.
- Halo blight occurs primarily when temperatures are cool.
- Light greenish-yellow circles that look like halos form around a brown spot or lesion on the plant. With age, the lesions may join together as the leaf turns yellow and slowly dies. Stem lesions appear as long, reddish spots.
- Leaves infected with common blight turn brown and drop quickly from the plant.
- Common blight infected pods do not have the greenish-yellow halo around the infected spot or lesion. Common blight occurs mostly during warm weather.

❖ Lablab bean Mosaic virus

Figure 7: The figure shows Lablab bean Mosaic virus disease.

The cause may be for this disease is the presence of these six conditions:

- Infected leaves show sharply defined patches of unusual coloration.
- The causal agents of these symptoms may be nutrient imbalance or herbicide injury or result from infection by one of several viruses. Southern beans can be infected by Cowpea aphid-borne mosaic virus, Bean common mosaic virus and several others.
- It is not possible to distinguish between the viruses based on symptoms alone.
- Laboratory tests (ELISA) are required to identify the viruses and confirm that they may be responsible for the mosaic symptoms.

- Ashy stem blight

Figure 8: The figure shows Ashy stem blight disease.

The cause may be for this disease is the presence of these four conditions:

- Symptoms may appear after soil-borne mycelia or sclerotia germinate and infect seedling stems near the soil line at the base of developing cotyledons.
- The fungus produced black, sunken, cankers which have a sharp margin and often contain concentric rings.
- The plant's growing tip may be killed or the stem broken where it is weakened by the canker. Infection may continue into the hypocotyl and root region or the primary leaf petioles.
- Older seedling and plant infections may cause stunting, leaf chlorosis, premature defoliation, and plant death [Schwartz, 1989].

LIMITATIONS:

The currently proposed expert system is specialized in the diagnosis of only the following six Lablab diseases: Anthracnose, Rust, Powdery mildew, Bacterial leaf spot, Lablab bean Mosaic virus, Ashy stem blight

SYSTEM EVALUATION:
As a primary evolution, some farmers and some interested in agriculture tested this proposed Expert System and they were satisfied with its performance, efficiency, user interface, and ease of use.

CONCLUSION:
In this paper, a proposed expert system was presented for helping Farmers and those interested in agriculture. Lablab may suffer from six different diseases they have. Farmers and those interested in agriculture can get the diagnosis faster and more accurately than the traditional diagnosis. This expert system does not need intensive training to be used; it is easy to use and has a user-friendly interface. It was developed using CLIPS Rule-Based Programming Language.

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FUTURE WORK:
This expert system is considered to be a base for future ones; more Lablab diseases are planned to be added to make it more accessible to users from anywhere at any time.

The Expert System Source Code:

```
(defrule disease1

(A. Bean pods with black sunken lesions or reddish brown blotches Anthracnose caused by Colletotrichum lindemuthianum)
(A. Black sunken lesions about inch in diameter develop on stems pods and seedling leaves cotyledons but are most prominent on pods)
(A. A salmon colored ooze on lesions and the veins on lower leaf surfaces turns black On lima beans symptoms are sooty appearing spots on leaves and pods)
(A. Anthracnose develops primarily during the spring and fall when the weather is cool and wet and not during hot dry summers Lima beans are particularly susceptible)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "1"  crlf )
)

(defrule disease2
```

(Bean rust is mainly a disease of leaves that causes rust colored spots formation on the lower leaf surfaces)
(Severely infected leaves turn yellow wilt and drop off the plant)
(Stems and pods may also be infected)
(It affects most types of beans under humid conditions)

(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "2" crlf)
)

(defrule disease3

(Leaves are covered with patches of a whitish to grayish powdery growth)
(New growth appears contorted curled or dwarfed and may turn yellow and drop Pods are dwarfed and distorted)
(New growth appears contorted curled or dwarfed and may turn yellow and drop Pods are dwarfed and distorted)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "3" crlf)
)

(defrule disease4

(There are two widespread bacterial blights that affect most types of beans common blight Xanthomonas campestris pv phaseoli and halo blight Pseudomonas syringae pathovar phaseolicola)
(The stems leaves and fruits of bean plants can be infected by either disease Rain and damp weather favour disease development)
(Halo blight occurs primarilyBacterial leaf spot when temperatures are cool)
(Light greenish yellow circles that look like halos form around a brown spot or lesion on the plant With age the lesions may join together as the leaf turns yellow and slowly dies Stem lesions appear as long reddish spots)
(Leaves infected with common blight turn brown and drop quickly from the plant)
(Common blight infected pods do not have the greenish yellow halo around the infected spot or lesion Common blight occurs mostly during warm weather)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "4" crlf)
)

(defrule disease5

(Infected leaves show sharply definedLablab bean Mosaic virus patches of unusual coloration)
(The causal agents of these symptoms may be nutrient imbalance or herbicide injury or result from infection by one of several viruses Southern beans can be infected by Cowpea aphid borne mosaic virus Bean common mosaic virus and several others)
(It is not possible to distinguish between the viruses based on symptoms alone)
(Laboratory tests ELISA are required to identify the viruses and confirm that they may be responsible for the mosaic symptoms)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "5" crlf)
)

(defrule disease6

(Symptoms may appear after soil-borne mycelia orAshy stem blight sclerotia germinate and infect seedling stems near the soil line at the base of developing cotyledons)

```
(The fungus produced black sunken cankers which have a sharp margin and often contain concentric rings)
(The plants growing tip may be killed or the stem broken where it is weakened by the canker Infection may continue into the hypocotyl and root region or the primary leaf petioles)
(Older seedling and plant infections may cause stunting leaf chlorosis premature defoliation and plant death)
(not disease identified)
=>
(assert (disease identified))
(printout fdatao "6"  crlf )
)
(defrule endline
(disease identified)
=>
  (close fdatao)
)


(defrule readdata
  (declare (salience 1000))
  (initial-fact)
  ?fx <- (initial-fact)
=>
  (retract ?fx)
  (open "data.txt" fdata "r")
  (open "result.txt" fdatao "w")

  (bind ?symptom1 (readline fdata))
  (bind ?symptom2 (readline fdata))
  (bind ?symptom3 (readline fdata))
  (bind ?symptom4 (readline fdata))
  (bind ?symptom5 (readline fdata))
  (bind ?symptom6 (readline fdata))
  (bind ?symptom7 (readline fdata))
  (bind ?symptom8 (readline fdata))
  (bind ?symptom9 (readline fdata))
  (bind ?symptom10 (readline fdata))
  (bind ?symptom11 (readline fdata))
  (bind ?symptom12 (readline fdata))
  (bind ?symptom13 (readline fdata))
  (bind ?symptom14 (readline fdata))

  (assert-string (str-cat "(" ?symptom1 ")"))
  (assert-string (str-cat "(" ?symptom2 ")"))
  (assert-string (str-cat "(" ?symptom3 ")"))
  (assert-string (str-cat "(" ?symptom4 ")"))
  (assert-string (str-cat "(" ?symptom5 ")"))
  (assert-string (str-cat "(" ?symptom6 ")"))
  (assert-string (str-cat "(" ?symptom7 ")"))
  (assert-string (str-cat "(" ?symptom8 ")"))
  (assert-string (str-cat "(" ?symptom9 ")"))
  (assert-string (str-cat "(" ?symptom10 ")"))
  (assert-string (str-cat "(" ?symptom11 ")"))
  (assert-string (str-cat "(" ?symptom12 ")"))
  (assert-string (str-cat "(" ?symptom13 ")"))
  (assert-string (str-cat "(" ?symptom14 ")"))

   (close fdata)
)
```

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