Fuzzy System for Diseases of Chilli Crop in Pakistan (Pest Section Ignored)

INPUT VARIABLES AND UNIVERSE OF DISCOURSE

1. Temperature (Temp): 10–40 °C

2. Relative Humidity (RH): 10–100 %

3. Rainfall (Rain): 0–200 mm

4. Leaf Wetness Duration (LeafWet): 0–24 h/day

5. Soil Moisture (SoilM): 0–100 %

6. Soil Drainage (Drain): 0–10

7. Seed/Seedlot Health (SeedHealth): 0–10

8. Vector Pressure (Vector): 0–10

9. Crop Stage (Stage): 0–3

FUZZY SETS (Triangular Membership Functions)

Temp:

- Low = trimf([10,10,20])

- Moderate = trimf([18,24,30])

- High = trimf([28,40,40])

RH:

- Low = trimf([10,10,45])

- Moderate = trimf([40,60,80])

- High = trimf([75,100,100])

Rain:

- None = trimf([0,0,10])

- Low = trimf([5,25,50])

- High = trimf([40,100,200])

LeafWet:

- Short = trimf([0,0,6])

- Medium = trimf([4,10,16])

- Long = trimf([12,24,24])

SoilM:

- Dry = trimf([0,0,30])

- Opt = trimf([20,45,65])

- Wet = trimf([55,100,100])

Drain:

- Poor = trimf([0,0,3])

- Moderate = trimf([2.5,5,7.5])

- Good = trimf([7,10,10])

SeedHealth:

- Poor = trimf([0,0,3])

- Fair = trimf([2.5,5,7.5])

- Good = trimf([7,10,10])

Vector:

- None = trimf([0,0,2])

- Moderate = trimf([1.5,5,8.5])

- High = trimf([7.5,10,10])

Stage:

- Seedling = trimf([0,0,0.5])

- Vegetative = trimf([0.5,1,1.5])

- Flowering = trimf([1.5,2,2.5])

- Fruiting = trimf([2.5,3,3])

Outputs (for each disease):

Risk fuzzy sets:

- Low = trimf([0,0,0.4])

- Moderate = trimf([0.25,0.5,0.75])

- High = trimf([0.6,1,1])

RULE BASE (30 Rules)

Anthracnose:

1. IF Fruiting AND Temp Moderate AND Rain High AND LeafWet Long THEN Risk High

2. IF Fruiting AND Temp High AND LeafWet Medium THEN Risk Moderate

3. IF Seed Poor AND Rain High THEN Risk High

4. IF Rain Low OR LeafWet Short THEN Risk Low

Powdery Mildew:

5. IF Temp Moderate AND RH Low AND LeafWet Short THEN Risk High

6. IF Temp High AND RH Moderate THEN Risk Moderate

7. IF RH High AND LeafWet Long THEN Risk Low

Fusarium Wilt:

8. IF Soil Wet AND Temp High AND Drain Poor THEN Risk High

9. IF Soil Opt AND Drain Moderate THEN Risk Moderate

10. IF Seed Good AND Drain Good THEN Risk Low

Phytophthora:

11. IF Soil Wet AND Rain High AND Drain Poor THEN Risk High

12. IF LeafWet Long AND Temp Moderate THEN Risk Moderate

13. IF Rain None AND Soil Dry THEN Risk Low

Cercospora:

14. IF RH High AND LeafWet Long AND Seed Poor THEN Risk High

15. IF Rain High AND LeafWet Medium THEN Risk Moderate

16. IF Seed Good AND LeafWet Short THEN Risk Low

Bacterial Leaf Spot:

17. IF Seed Poor AND LeafWet Long AND Rain High THEN Risk High

18. IF Temp Moderate AND RH High THEN Risk Moderate

19. IF Seed Good AND Rain None THEN Risk Low

Bacterial Wilt:

20. IF Soil Wet AND Temp High AND Drain Poor THEN Risk High

21. IF Soil Opt AND Drain Moderate THEN Risk Moderate

22. IF Soil Dry THEN Risk Low

Viral Leaf Curl:

23. IF Vector High AND (Vegetative OR Flowering) AND Temp High THEN Risk High

24. IF Vector Moderate AND Seed Poor THEN Risk Moderate

25. IF Vector None THEN Risk Low

Mosaic Viruses:

26. IF Vector High AND Seed Poor THEN Risk High

27. IF Seed Good AND Vector None THEN Risk Low

Nematodes:

28. IF Temp High AND Soil Opt AND Drain Poor THEN Risk High

29. IF Drain Good AND Seed Good THEN Risk Low

30. IF Seed Poor AND Soil Opt THEN Risk Moderate