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APPLICATION OF RULE BASED FUZZY INFERENCE SYSTEM IN PREDICTING THE QUALITY AND QUANTITY OF CARROT CROP YIELD IN NILGIRIS

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Abstract: *Conservatory growers want stead fast amount of yields so as to precisely meet the demand objective of this paper is to apply rule based fuzzy inference system to forecasting crop yield by using ecological parameters. Inputs to RBFIS are derived from a crop development model [temperature, humidity, water, irrigation, available soil, fertilizer and seed quality]. RBFIS has two output nodes for the quality and quantity of yield, with carrot as a case.*

Keywords: *Crop yield, Fuzzy system, Inference, Rules based fuzzy set.*

I. INTRODUCTION

The real world problem are complex having lot of Inter- dependent parameters deriving the results. The fuzzy system is a tool capable of building a machine with intelligence. The concept of fuzzy sets initiated by Attanasov is an expansion of the concept of the fuzzy sets, found to be more rational and realistic as the non membership function is self-determining of the membership function but both are linked to each other through a condition.

Fuzzy system is used in this paper because of its nearness to real life implementation in execution of work, happening in agriculture too. The use of fuzzy system is lift up an effective workable accumulation to the field of artificial intelligence and conceivably more generally to formal mathematics as a whole.

The inference system is a tool to solve the problem like crop prediction therefore an inference engine is a software program that endeavors to obtain solution from a knowledge base (KB). An inference system contains three major sub systems are

1. Knowledge base
2. Inference Engine
3. User Interference

To develop the inference system based on fuzzy for crop prediction for carrot. Process includes collection of vague data and converts this in fuzzy membership function and also develop a knowledge based on fuzzy inputs and fuzzy

outputs of the problems i.e., agriculture management on carrot.

II. LITERATURE SURVEY

The RBFIS has been acknowledged as a constructive approach to model many multifaceted phenomena in the field of forecasting prediction. These mathematical models bring into play different equations and formulae to resolved such problems. Basic results linked to the growth of fuzzy logic data from Zadeh (1973) and Mamdani and Assilian (1975). Fuzzy logic is used to convey the linguistic rules. Rules based fuzzy logic is a straight forward problem solving method with wide-range applicability. The large area crop inventory experiment and Ag Ristars demonstrated studies on considering crop yield models. A subtractive based fuzzy inference system is introduced to estimate the carrot crop parameter like biomass leaf area index and plant height and soil moisture. The plant height, biomass and leaf area index of carrot crop and soil moisture measured at its various growth stage were used as a target variable during the validation of the network. The developed FCM model consists nodes linked by directed edges, where the nodes linked by directed edges, where the nodes represent the main soil factors affecting yield and the directed edges show the cause – effect relationships between the soil properties and yield.

A. System model

To get the effective outputs by formulation and mapping of given inputs based on fuzzy logic is called as fuzzy inference. The process of fuzzy inference entails all of the pieces like: If-then rules, logical operations and membership functions. For this proposed system as per advised by the domain experts and survey meet the point that in initial phase some important input parameters for the carrot crop production in context of the Nilgiri district i.e., six input parameters and two output parameters. The fuzzy parameters input or output is defined by some standard function. Some standard functions are illustrated in the table as:

Function	Description
Dsigmf	Built in membership function composed of different between two sigmoidalmembership function
Gauss2mf	Gaussian combination membership function
Gaussmf	Gaussian curve built in membership function
Gbellmf	Generalized bell-shaped built in membership function
Pimf	IT- shaped built – in membership function
Psigmf	Built in membership function composed of product of two sigmoidally shaped membership function
Sigmf	Sigmoidally shaped built in membership function
Smf	S – shaped built – in membership function
Trapsmf	Trapezoidal – shaped built – in membership function
Trimf	Triangular – shaped built – in membership function
Zmf	Z – shaped built – in membership function

Table 1: Standard function to define fuzzy parameters

For this modeling the trapsmf function. The trapezoidal curve is a function of a vector x and depends onfour scalar parameters a, b, c and d as given.

In general the equation 1 can be written as ,

$$f(x; a,b,c,d) = \max\left(\min\left(\frac{x-a}{a-b}, 1, \frac{d-x}{d-c}\right), 0\right) \quad \text{---------- 1}$$

The rule based fuzzy inference system has the following components consists of two parameters they are input parameter and output parameter.

$$f(x; a,b,c,d) = \begin{cases} 0, & x \le a \\ \frac{x-a}{b-a} & a \le x \le b \\ 1, & b \le x \le c \\ \frac{d-x}{d-c} & c \le x \le d \\ 0, & d \le x \end{cases} \quad \text{---------- 2}$$

B. Input parameters

1. Soil

Soil is the base for the agriculture. Soil is the layer of minerals and organic matters. The carrot crop needs loose loamy soil. It requires a pH ranging from 6.0 to 7.0 for higher production. At elevation between 1000 – 1500 meters. The total area of agriculture utilized land = AUA in hectares.

Figure 1 Minerals and organic matters

2. Water

The second input parameter is water is requiring for the irrigation of crop is Diet for the crop. A maximum water use by carrot is approximately 0.15 in of water per day.

Total number of water resources = WR

Figure 2 irrigation of crop

3. Temperature

Temperature is the next input parameter for this inference. It means that minimum temperature at this level required for production. Carrot is a cool season crop and will develop a good colour when grown at 15^{o}C to 20^{o}C / Do not exceed 75^{o}F.

4. Humidity

Humidity can make the temperature of the surrounding air feel like it is warmer than the actual temperature, because the cooling effect of evaporation. At 0^{o}C and 90 to 95% relative humidity, carrot will keep for up to 6

months.

5. Fertilizers

A substance that provides nutrients of plants. Some, such as manners are natural others are human – made or synthetic. For carrot plants, it is best to choose a fertilizer low in nitrogen and high in phosphate and potassium 0 – 10 – 10 or 5 – 15 – 15 fertilizer.

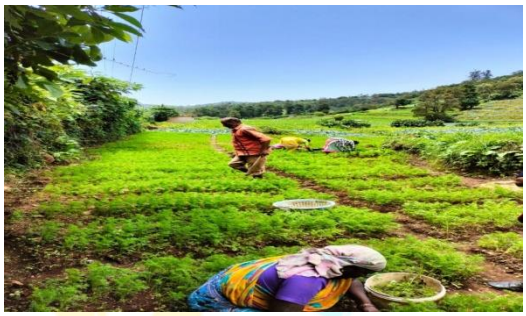

Figure 3 Fertilizers

6. Seeds

Seed is the part of a plant that can make another plant. Carrots are propagated using seeds, the carrot seeds that are sowing or broadcast in the field with a seed rate of 5 to 6 kg/ha orit can be up to 6 to 9 kg/ha this depends upon carrot variety. The seeds are small, approximately 800 per gram. They remain viable for nearby three years and up to 85 % germination. Carrot seeds are tiny, about the size of the tip of a sharpened pencil. The seed quality is the factor which emphasis the quality and quantity of the total crop .

Output Parameters

The output of any crop is the quantity and quality of the production.

1.1 Quality

This parameter can be scale in scale 0 to 1, define the quantity by five categories.

Very low	Low	Medium	High	Very High
QL<40%	31% < QL < 53%	48%< QL < 73%	68% < QL <87%	QL >82%

1.2 Quantity

This parameter can be scale in scale 0 to 1, define the quality in 5 categories.

Very Low	Low	Medium	High	Very High
QT < 183	211<QT <221	219<QT<229	228 < QT < 239	QT>235

III. SIMULATION AND RESULT

For test this system the government statistical look data is used which illustrate the data of past years.

Input parameters	Y - 2020	Y- 2021	Y - 2022
Temperature (ºC)	15.2	17	**18**
Humidity (%)	68.2	70	**70.3**
Water (#)	138000	138234	**140560**
Soil (ha)	262320	264445	**264695**
Fertilizer (m tones)	**58817**	**58281**	**790844**

Table 2. Values of three years data of city of The Nilgiris

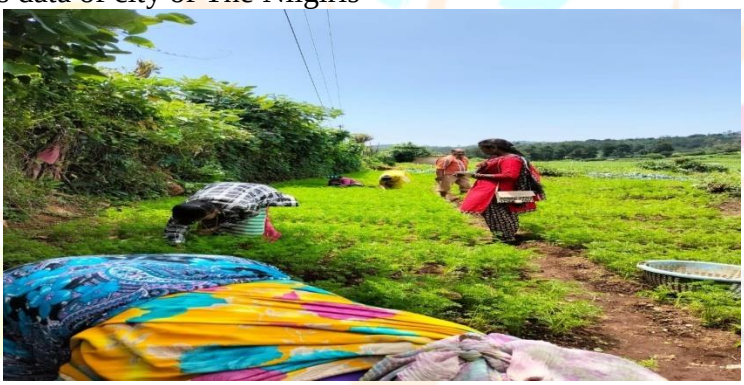

Figure 4 Resultant performance

Test the system on the above data and the result of the system in mentioned below in Table 3 we apply the inputs as given in table 1 and the output of the system is given in the table 2. Under limitation of the accuracy of the data and information the results are fruitful.

‘ Output parameters	Y- 2020	Y-2021	Y-2022
Actual yield output	230.63 Medium	241.84 High	**251.49 Very High**
Measured output	226 Medium	235 High	**245 Very High**
Error in %	**2%**	**2.8%**	**2.58%**

Table 3.Output parameters in terms of production

4. Conclusion

The evaluation between considered and stimulated values meet the expense of it a role in forecasting of carrot crop. The proposed system design and simulation work could also lead to the new possibilities in the field of crop forecasting with available measurements of parameters. Our anticipated fuzzy inference system estimates the quantity and quality of carrot crop. Under the limitation of the parameters value and accuracy of the exact rules we can say the systems outputs are near to the actual outputs the system fulfilled our proposed hypothesis and also it can be used for betterment and development of agriculture and planned the future business related to the particular crop.

Reference:

[1]Shah, Farooq and Wei Wu. “Soil and crop management strategies to ensure higher crop productivity within sustainable environments “. Sustainability 11.5 (2019) : 1485.

[2]Deepa . N ., & Ganesan , K. Multi – class classification using hybrid soft decision model from agriculture crop selection. Neural computing and Applications, 30(4),1025- 1038.(2018).

[3] http://www.fao.org/india/fao-in-india-at-a-glance/en/

[4]Sharma D.K .,2016. Fuzzy goal programming for agricultural land allocation problem. Yug oslav Journal of Operattion Research,17(1).

[5]Ahamed,T.N., Rao K.G and crop-land suitability analysis. Agricultural systems,63(2),pp.75-95.

[6]A. Ammi and N. Nikraz, “ Proposing two defuzzification methods based on output fuzzy set weights”, International Journal of Intelligent system and Application, MECS Publisher,vol.8, no.2, pp. 1-12,2016.