Challenges Faced by Banana Cultivators in Karur District - An Analysis using Fuzzy Soft Matrices

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Abstract

In this article the authors attempted to analyse various problems encountered by banana cultivators using fuzzy soft matrices.

Keywords - *Soft set, Fuzzy soft set, Interval-valued fuzzy set, Interval-valued fuzzy soft set.*

I. INTRODUCTION

Most of the real life problems have various uncertainties. A number of theories have been proposed for dealing with uncertainties in an efficient way. In 1965, Zadeh introduced the concept of fuzzy set theory which provides us with an intuitively pleasing method of representing one form of uncertainty. In 1999, Molodtsov initiated a novel concept of soft set theory which is completely a new approach for modeling vagueness and uncertainty. Maji et al (2001) initiated the concept of fuzzy soft sets.

Matrices play a vital role in the analysis and study of several of the real world problems. Yong yang and Chenli ji [6] initiated a matrix representation of a fuzzy soft set and successfully applied the proposed notion of fuzzy soft matrix in certain decision making problems. In this article the authors attempted to analyse various problems encountered by banana cultivators using fuzzy soft matrices.

Banana is the most common fruit known to man. It is nutritious, delicious and easily digestible fruit. It is available throughout the year. Every part of the plant is used in India. Other than fresh fruit, it can be eaten in a variety of processed forms such as chips, jam, flakes and the like.

Banana is an important cash crop cultivated by large number of farmers in Tamilnadu. The farmers could earn good revenue from banana cultivation, however the cultivators face many hardships during cultivation. So, a research has been conducted to study the challenges faced by banana cultivators and the inferences were drawn using fuzzy soft matrices.

II. PRELIMINARY DEFINITIONS

Definitions: 2.1[3]

Let U be an initial universe and E be a set of parameters. Let P(U) denotes the power set of U and Abe a nonempty subset of E. A pair (F, A) denoted by F_A is called a soft set over U, where F is a mapping given by F: A → P(U).The family of all soft sets over U with respect to the parameter set E is denoted by $SS(U)_E$.

Example: 2.2

Let U ={C_1,C_2,C_3} be the set of three cars and E={costly(e_1),metallic color (e_2),cheap (e_3)} be the set of parameter and A={ e_1, e_2}⊂E,then (F,A)={F(e_1) ={C_1,C_2,C_3}, F(e_2) ={C_1,C_2,C_3}} is the crisp soft set over U which describes. The "attractiveness of the cars ''which Mr.S(say) is going to buy.

Definitions: 2.3[2]

Let U be a universe. A **fuzzy setX** over U is a set defined by a function μ_X representing a mapping μ_X:U ⟶[0, 1] .Here μ_X called membership function of X, and the value μ_X(U) is called the Grade of membership of u∈U. The value represents the degree of belonging to the fuzzy set X. Thus, a fuzzy set X over U can be represented as follows:

X={u/(μ_X(u)): u∈U, μ_X(u) ∈[0, 1]}.

Definitions: 2.4[1]

Let U be a universal set, E a set of parameters and A⊂ E. Let F (U) denotes the set of all fuzzy subsets of U. Then a pair (F, A) is called **fuzzy soft set** over U. where F is mapping from A to F (U).

Example: 2.5

Let U = {C_1, C2, C3} be the set of three cars and E= {costly (e_1), metallic colour (e_2), getup (e_3)} be the set of parameter and A= { e_1, e_2}⊂E, then(G, A) = {G (e_1) = { C_1/0.6, C_2/0.4, C_3/0.3}, G (e_2) = { C_1/0.5, C_2/0.7, C_3/0.8}}is the fuzzy soft set over U describes the "attractiveness of the cars'' which Mr. S (say) is going to buy.

Definitions:2.6[2]

The**interval fuzzy number** is defined as $\hat{A}$= [a_{L} ,a_R] = {a:$a_L \le a \le a_R$} where a_{L} ,a_R ∈[0,1]

Definitions: 2.7[1]

An interval- valued fuzzy set $\hat{X}$ on a universe U is mapping such that $\hat{X}$: U ⟶ Int [0,1], where Int ([0,1]) stand for the set of all closed subintervals of [0,1]. The set of all **Interval-valuedfuzzy sets** on U is denoted by $\tilde{F}$(U).

Suppose that $\hat{X} \in \tilde{F}$(U), ∀x∈ U,$\mu_{\hat{X}}(x)$=[$\mu_x^-(x)$, $\mu_x^+(x)$] is called the degree of membership an element X to $\hat{X}$.$\mu_x^-(x)$ and $\mu_x^+(x)$ are referred to as the lower and upper degree of membership X to $\hat{X}$ where $0 \le \mu_x^-(x) \le \mu_x^+(x) \le 1$.

Definitions: 2.8[1]

Let U be an initial universe and E be a set of parameters, a pair (F, E) is called an **Interval- valuedfuzzy soft set** over U, where F is a mapping given by F : E ⟶ $\tilde{F}$(U).

Definitions: 2.9

Interval-valued fuzzy soft matrix is a matrix whose entries are interval fuzzy numbers.

III.APPLICATION OF INTERVAL VALUED FUZZY SOFT MATRICES

In order to analyse the problems encountered by the banana cultivators, an interview schedule was administered to 60 banana cultivators in the following three different villages of Karur district, Tamilnadu and were asked to give their responses for each problem.

The villages are

1) Lalapet (25 cultivators)
2) Mahadanapuram (20 cultivators)
3) Sithalavai(15 cultivators)

The authors identified the problems encountered by the farmers as listed below;

P_1 – Shortage of quality banana suckers

P_2 –Shortage of water for irrigation

P_3 – Natural calamities

P_4 – Labour issues

P_5 – High cost of pests and manures

P_6 – Unstable prices

Based on their land holding (in acres) the respondents were grouped into three categories as detailed below:

Groups	Land holding (in acres)	Number of respondents
G_1	1-5	20
G_2	6-10	20
G_3	11-15	20

Each respondent was asked to a give a score value ranging between 1 and 10 for each problem. Using the data, Mean(M) and standard deviation (S.D) were calculated for each group G_1, G_2, G_3. An interval fuzzy soft matrix was framed by taking the six factors $P_1, P_2, P_3, P_4, P_5, P_6$ as rows and the three groups G_1, G_2, G_3 as columns. Each entry in the matrix is an interval fuzzy number which was framed by taking $\frac{M-S.D}{10}$ and $\frac{M+S.D}{10}$ as the left and right end points of the interval respectively.

$$\begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \\ P_6 \end{array}\begin{array}{c} \begin{array}{ccc} G_1 & \quad\quad G_2 & \quad\quad G_3 \end{array} \\ \begin{bmatrix} [0.5,0.9] & [0.4,0.9] & [0.3,0.9] \\ [0.4,0.9] & [0.2,0.9] & [0.4,0.8] \\ [0.5,0.9] & [0.4,0.9] & [0.4,0.9] \\ [0.2,0.8] & [0.4,0.9] & [0.3,0.9] \\ [0.3,0.9] & [0.3,0.9] & [0.5,0.9] \\ [0.3,0.9] & [0.4,0.9] & [0.4,0.9] \end{bmatrix} \end{array}$$

The following is the algorithm for finding the solution to the problem using Interval-valued fuzzy soft sets.

Step 1:

Construct the interval valued fuzzy soft set (H, E), where H is s mapping given by $H:E \longrightarrow \tilde{F}(U)$. Let U = { $P_1, P_2, P_3, P_4, P_5, P_6$} and E= {$G_1, G_2, G_3$}

$H(G_1)$ = {< P_1[0.5, 0.9] >, < P_2[0.4, 0.9] >, < P_3[0.5, 0.9] >, <P_4[0.2, 0.8] >,< P_5[0.3, 0.9]>,<P_6[0.3, 0.9] >}

$H(G_2)$= {< P_1[0.4, 0.9] >, < P_2[0.2, 0.9] >, < P_3[0.4, 0.9] >, <P_4[0.4, 0.9] >,< P_5[0.3, 0.9] >,<P_6[0.4, 0.9] >}

$H(G_3)$= {< P_1[0.3, 0.9] >, < P_2[0.4, 0.8] >, < P_3[0.4, 0.9] >, <P_4[0.3, 0.9] >,< P_5[0.5, 0.9] >,<P_6[0.4, 0.9] >}

Step 2:

$\forall F_i \in U$ compute the choice value c_i for each features F_i such that

$C_i = [C_i^-, C_i^+] = [\sum_{G_i \in E} \mu^-_{H(G_i)}(P_i), \sum_{G_i \in E} \mu^+_{H(G_i)}(P_i)]$, where i =1 to 6

C_1= [1.2, 2.7], C_2= [1.0, 2.6], C_3= [1.3, 2.7], C_4= [0.9, 2.6], C_5= [1.1, 2.7], C_6= [1.1, 2.7]

Step 3:

$\forall F_i \in U$ compute the score r_i of F_i such that

$r_i = \sum_{F_j \in U}((c_i^- - c_j^-) + (c_i^+ - c_j^+))$where i , j =1 to 6.

Thus we have,

r_1= 0.8,r_2= -1 , r_3= 1.4 , r_4= -1.6, r_5= 0.2 , r_6= 0.2

Step 4:

Find $\max_{h_i \in U}\{r_i\} = \{r_i\}$

The decision is one of the elements is U for which $r_3$is maximum.

Here $\max_{h_i \in U}\{r_i\} = \{r_3\}$

Hence in our study the problem **P_3– Natural calamitiesis the most affected problem.**

IV.CONCLUSION

In the real life situations there are vast number of problems that warrant rational, logical and scientific decisions that fit best for the accomplishment of desired objective. The concept of fuzzy soft matrices has rich potentials for developing such decision making models suitable for personal, social, technical, commercial and managerial issues.

REFERENCES

[1] Chetia,B. and Das, P.K., "An Application of Interval – valued Fuzzy soft sets in medical Diagnosis'', International journal of Mathematics and Mathematical Sciences, 5 (38),(2010).

[2] Kalaichelvi,A. and Janofer , K., "Some New Operators on Interval Valued Fuzzy Number Matrices and Interval Fuzzy Soft Sets in the Analysis of the Factors Influencing High Scores in Higher Secondary Examinations '', International Journal of Mathematics Sciences and Applications, 2(2), (2012), pp. 777-780.

[3] Molodstov, D., "Soft Set Theory – First Results'', Computers and Mathematical with Application, 37(1999), pp.19-31.

[4] Roy A.R. and Maji ,P.K., "A Fuzzy soft set Theoretic Approach to Decision Making Problems'', Journal of Computational and Applied Mathematics , 203(2007), pp.412-418.

[5] Yang , X., Lin, T,Y.,Yang ,J.,and yu,D.," Combinations of Interval Valued Fuzzy set and soft set '', Computers and Mathematics with Applications , 58 (2009), pp.521-527.

[6] Yong Yang and Chenli Ji., 2011."Fuzzy soft matrices and their applications "partI, LNAI 7002,pp:618-627.