Challenges Faced by Small Scale Onion Cultivators in Namakkal District – An Analysis using Neutrosophic Soft Sets

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Abstract

Neutrosophic sets and soft sets are new mathematical tools for dealing with uncertainties. The combination of these two sets makes a new mathematical tool "neutrosophic soft set" which has rich potential in solving real life problems. In this article, the authors attempted to analyse the challenges faced by small scale onion cultivators using neutrosophic soft sets.

Keywords: *Neutrosophic set, Soft set, Neutrosophic soft sets.*

I. INTRODUCTION

India is the second largest onion growing country in the world. Indian onions are famous for their pungency and are available round the year. Small onion is one of the most important commercial vegetable crop grown in TamilNadu. Its water requirement is modest when compared to paddy and sugarcane. So the farmers who depend on underground water and rainfall prefer to cultivate onion. Like any other venture, they also face many challenges in the cultivation and marketing of onion.

Here the researchers attempted to analyse the challenges faced by small scale onion cultivators using neutrosophic soft sets.

II. BASIC DEFINITIONS

Definition: 1

A **neutrosophic set** A on the universe of discourse X is defined as $A=\{ <x, T_A(X),I_A(X),F_A(X)>, x \in X\}$ where $T,I,F : X \rightarrow]^-0,1^+[$ define respectively the degree of membership, the degree of indeterminacy, and the degree of non-membership witrh the condition $^-0 \leq T_A(X)+I_A(X)+F_A(X) \leq 3^+$.

Definition: 2

Let U be an initial universe and E be a set of parameters. Let P(U) denotes the power set of U, and let $A \subseteq E$. A pair (F,A) is called a **soft set** over U, where F is mapping given by $F:A \rightarrow P(U)$.

In other words, a soft set over U is a parameterized family of subsets of the universe U. The soft sets (F,A) is also denoted as F_A.

Definition: 3

Let U be an initial universe set and E be a set of parameters. Consider $A \subset B$. Let N(U) denotes the set of all neutrosophic sets of U. The collection (F,A) is termed to be the **neutrosophic soft set** over U, where F is a mapping given by F : A→N(U).

III. APPLICATION OF NEUTROSOPHIC SOFT SETS

To collect data regarding the challenges in onion cultivation, the researchers selected five villages in Namakkal district which are listed below:

V_1 – Elaccipalayam
V_2 – Vaiyappamalai
V_3 – Kokkalai
V_4 – Mettupalayam
V_5 – Elimetu

U	V_1	V_2	V_3	V_4	V_5

The researchers collected opinion from fifty small scale onion cultivators, ten from each village, regarding the challenges faced by them while cultivating onion.

Following are the challenges identified:

C_1 – Storage problems
C_2 – Rainfall at the time of harvest
C_3 – Price fluctuation
C_4 – Unfavourable climatic conditions
C_5 – Water scarcity for irrigation

To apply neutrosophic soft sets consider the five challenges as the universal set
$U = \{C_1, C_2, \ldots, C_5\}$ and $E = \{V_1, V_2, \ldots\ldots, V_5\}$
Based on the data collected from the onion cultivators the neutrosophic soft sets are framed and are given in a tabular form.

In this table the entries M_{ij} corresponds to the challenge C_i and the onion cultivators in the village V_j, where $M_{ij} = (T_{ij}, I_{ij}, F_{ij})$

Here T_{ij} (respectively I_{ij}, F_{ij}) stands for the ratio between the number of onion cultivators in the village V_j who are highly affected (respectively moderately affected, not affected) by the challenge C_i and the total numbers of respondents in that village V_j.

The tabular representation is

U	V_1	V_2	V_3	V_4	V_5
C_1	(0.5,0.1,0.4)	(0.4,0.2,0.4)	(0.5,0.2,0.3)	(0.7,0.2,0.1)	(0.3,0.3,0.4)
C_2	(0.8,0.1,0.1)	(0.6,0.2,0.2)	(0.5,0.2,0.3)	(0.7,0.1,0.2)	(0.4,0.1,0.5)
C_3	(0.3,0.2,0.5)	(0.6,0.3,0.1)	(0.3,0.3,0.4)	(0.6,0.2,0.2)	(0.3,0.3,0.4)
C_4	(0.5,0.3,0.2)	(0.3,0.5,0.2)	(0.4,0.2,0.4)	(0.3,0.5,0.2)	(0.3,0.1,0.6)
C_5	(0.3,0.3,0.4)	(0.3,0.2,0.5)	(0.7,0.1,0.2)	(0.2,0.1,0.7)	(0.4,0.1,0.5)

Comparison Matrix

It is a matrix whose rows are labeled by $C_1, C_2, \ldots\ldots, C_5$ and the columns are labeled by $V_1, V_2, \ldots V_5$. The entries e_{ij} are calculated by $e_{ij} = a + b - c$, where 'a' is the integer calculated as 'how many times T_{ij} exceeds or equal to T_{kj}', for $i \neq k, \forall C_k \in U$, 'b' is the integer calculated as 'how many times I_{ij} exceeds or equal to I_{kj}', for $i \neq k, \forall C_k \in U$ and 'c' is the integer calculated as 'how many times F_{ij} exceeds or equal to F_{kj}', for $i \neq k, \forall C_k \in U$.

The comparison matrix is

C_1	1	1	4	6	3
C_2	5	4	4	2	3
C_3	-1	7	0	2	6
C_4	6	3	0	2	0
C_5	2	-1	4	-3	3

Score of an object

The score of C_i is S_i and is calculated as $S_i = \sum_j e_{ij}$

The score matrix is

U	Score(S_i)
C_1	15
C_2	18
C_3	14
C_4	11
C_5	05

Here the highest score is 18.

Hence in this study "Rainfall at the time of harvest" is the topmost challenge for onion cultivators in the selected villages of Namakkal district. The other challenges in the order of rank are "Storage problem", "Price fluctuation", "Unfavourable climate condition", "Water scarcity for irrigation".

IV. CONCLUSION

In this paper, the authors analyzed the challenges faced by small scale onion cultivators in the selected villages of Namakkal district, Tamilnadu using neutrosophic soft sets.

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