A Comparative Analysis of Crop Selection Using RC Tool with Weight Aggregation Analysis Algorithm

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Farmers typically select crops for cultivation based on their conventional methods and previous agricultural experience, however this may go wrong because of a natural disaster. Therefore, a model for decision making must be established to enable farmers to make consistent decisions on farming. In this paper, we have shown the comparative analysis of crop selection using RC tool with weight Aggregation Analysis Algorithm which is used to be cultivated. Each crop in the data set can be analyzed by the developed model. The model is able to accomplish the optimum agricultural development strategy. This strategy generates better than the current production plan.

Keywords: Fuzzy soft set, Weight Aggregation Analysis Algorithm, Relative Closeness Method.

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1. Introduction

The primary source of income in India is agriculture. About 2/3rd of India population, it is the only source of income. Agricultural sectors accounted for almost 43 percent of India's geographical area. For decades, simple food crops have been produced using farming. Due to the recent technological changes, have influence over the current cultivation system. The main challenge of existing farming activities are high demand, poor income and inorganic crops. In order to solve this, the crop must be selected based on the specific region. Decision on crop selection will increase productivity and optimize benefit. It cannot be rendered with single parameters; instead, it is necessary to consider further criteria. In order to address several problems in different systems, several decision-making methods were developed earliest. None of them have the greatest results. Although, Optimizing the choice now seems to be a wonderful solution to current crop problems. This is a mathematical process which focuses on optimizing the output of many input variables which influence the outcome relatively. For instance, if we want to optimize profit, more water-intensive crops will be required. In drought areas, it is important to minimize the use of water, however it may conflict the benefit target. Therefore, the farming process itself is complex and farmers change their farm practices naturally based on previous crop output and resource availability. The crop portfolio success depends in part upon water quality, soil-based nutrients (which may rely on previous plot assignments) and crop water requirements. The key objective of this paper is to apply the decision-making optimization strategy for crop selection.

2. Related works

Al [3] introduced the concept of soft set theory as a general mathematical tool for dealing with uncertainty. The solutions of such problems involve the use of mathematical principles based on uncertainty and imprecision. In this paper, They recalled the definition of a soft set, its properties and its operations. Ananthi [2] Suggested the idea focused on fuzzy sets. When the fluidity can occur, the brightness amount should be assumed in-pixel in the images for the calculated degree. When the ambiguity of the images is treated effectively in the fuszy package, when particularly IFSs is processed. When the activation of the segmentation can be calculated by the satellite by which the unknown capture images can be decreased. Then, the segmentation of the deficit of the crops for the clustering technique will fuse an image, since it depends on the interval between the intuitionist fuzzy set Cui [7]proposed a novel extract approach for the optimized sub-set function. Cultivation depending on the forms to be tracked for algorithm items dependent on the vector machine help classification. The performance provided by the technologies can be best rated with a total accuracy of about 89.6 percentage points.

Arri.M [4] In this article, the methods of extension are relying on the de-composition of the system as they establish a decomposition-based methodology for adaptive model, which helps them to approximate for the mean randomness that the scattering canopy is based on each pixel of the image. P.K.Maji [15] defined the concept of the core is twofold. First, it can be used as a basis for computation of all reducts, then the core is included in every reduct, and its computation is straightforward. Secondly. the core can be interpreted as the set of the most characteristic part of knowledge, which cannot be eliminated when reducing the knowledge.

Leila [14]discussed adaptive neuro-fuzzy inference system (ANFIS) was used to predict the grain yield of irrigated wheat in Abyek town of Ghazvin province, Iran. Due to large number of inputs (eight inputs) for ANFIS, the input vector was clustered into two groups and two networks were trained. (Lagos-Ortiz et al., 2019) Presents an professional knowledge support program for rice, coffee and cocoa production, focused on the user's input, and external details, such as position and environment, which will assist the selection processes, tracking, surveillance, detection, pest prevention, selection of fertilizer, among others. (Manav Singhal, 2011) described a mobile based application, namely Krishi Ville, for farmers. This application takes care of the updates of various agricultural commodities, agricultural news updates, weather forecast updates etc. Pethalakshmi [18]studied and reviewed the concept of the soft set theory, and their development in the various fields of its existing literature is carried out such as Medical, Agriculture and Business etc.

The rest of the paper can be organized as follows, section 1 depicts the basic introduction about the process of the decision making and optimization of the crop selection process. The related existing methodologies were depicted in section 2. The Methodology and proposed algorithm was depicted in section 3. The experimental analysis is defined in Section 4 and Section 5 ultimately summarizes the paper.

3. Methods and Proposed Algorithm

In this section, presents a comparative analysis of various crop selection methods are discussed. Thus obtained data is to be used in the further data analysis and research process. The Model questionnaire of the crop cultivation includes the following features which is tabulated in Table1. This questionnaire helpful to take the information table from the different farmers suggestions for crop cultivation process.

Table 1. Sample survey features of the various crops

Features/ Crops	Minimum Capital (f1)	Short duration (Yield) (f2)	Minimum Irrigation (f3)	Low Manpower (f4)	Easy Cultivation (f5)	Minimum Fertilizer (f6)	Low Risk (f7)	Low Machinery (f8)	Easy Harvesting (f9)	Flexible Marketing (f10)	High Profit (f11)
Sugarcane(C1)	6	5	4	5	4	4	5	2	6	7	8
Paddy (C2)	4	2	1	3	2	3	2	2	3	5	6
Maize (C3)	7	6	4	2	4	2	4	3	3	6	6
Turmeric(C4)	5	3	3	4	3	4	2	4	4	6	7
Tomato (C5)	7	6	3	3	4	5	4	1	5	7	7
Cotton (C6)	7	6	2	4	2	5	3	1	2	4	6
Groundnut(C7)	6	5	2	4	3	4	3	1	2	7	7
Plantain(C8)	2	1	2	3	1	4	3	2	5	7	8
Tapioca (C9)	7	4	2	3	2	3	2	3	3	6	7

3.1 Problem description

Regarding the decision making problem involving eleven features of each crop F_i(i=1,2,….11) and Nine Crops C_j =(j=1,2,…9) all the crop feature values are the maximum number of acceptance of the Farmers in cultivation. The attribute weight value is calculated the Maximum value of the features. Try to compare the various decision methods Relative closeness(R_i) value of the each crop and make the effective decision depending on the maximum value of R_i for the selection of the crop.

3.2 K-Means Algorithm

Partitioning algorithms construct partitions of a database of N objects into a set of k clusters. The construction involves determining the optimal partition with respect to an objective function. K-Means algorithms, where each cluster is represented by the center of gravity of the cluster[22]. The basic algorithm is given below.1.Select k points as initial centroids.2.Repeat3.Form k clusters by assigning all points to the closest centroid.4.Recompute the centroid of each cluster5.until the centroids don't change.

3.3 Relative Closeness Method

This is the Optimization tool for effective decision making. For calculating the relative closeness, first determine the weight value, this value is multiplied by the features of the crop and also find the ideal score

and Negative of each crop. Relative closeness(R_i) not only indicates how good the solution is but also corresponds to how close the features to each crop. This can be evaluated by $R_i = NS_i'/(IS_i + NS_i')$.

3.4 Proposed WAARC Algorithm

In this section, the proposed algorithm for crop selection is detailed below.

STEP 1: Select the group of crops depending on decision of Farmer by applying K-Means algorithm.
STEP 2: Form the Decision table in three ways
i) Having Selected (All) maximum value of the Features Information table.
ii) By applying the Quick Reduct Algorithm to form the Reduct features Information table.
iii) By categorizing the Information table and applying the Fuzzy Membership function OR.
STEP 3: Construct the All Features and Reduct Features Weight Analysis Aggregation Table by applying maximum weight for the decision parameters.
i) For AFWAA calculate Si= eijVfi*Wi. The Weights (Wi) are Max(f1)=0.7,Max(f2) = 0.7 and Max(f3) = 0.8.
ii) For RFWAA calculate Si= eijVfi*Wi. The Weights (Wi) are Max(f1)=0.7, Max(f2) = 0.8.
iii) For MFWAA (OR) calculate Si= eijVfi*Wi.The Weights (Wi) are Max(d1)=0.7, Max(d2) = 0.8
STEP 4: Determine the All Features, Reduct Features and Membership Relative closeness value of each crop.
STEP 5: Finally crop selection can be optimized by Maximum value of R_i using AFRC,RFRC and FMFRC Tool. The decision is S_k if S_k=Max R_i. Lastly, comparative R_i value for AFWAA, RFWAA and MFWAA RC Tool is represented by Relative closeness Chart which is used to show the best method to take the effective decision making for all kinds of problems.

3.5 Proposed Model

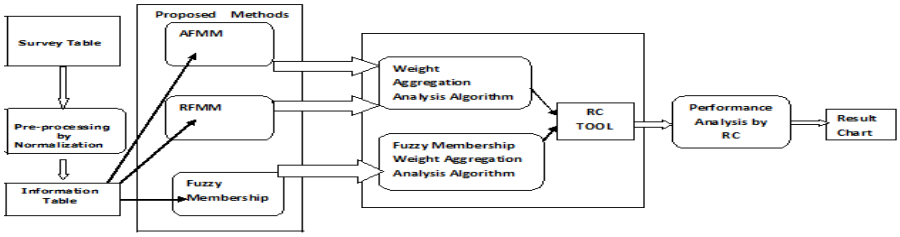

Fig 1: Model

4. Experimental Results

In this section shows the comparative analyzes of AWAARC, RFWAARC and MFWAARC by using proposed RC Tool for effective decision making to which crop is to be cultivated by the farmer. Here we get the acceptance from 100 Farmers in Nallampatti village. The content or input of the Table 2 can be created by the choice of the farmers decision from the Table 1 with the maximum acceptance of the farmer.

Table 2: Selected Features Information Table

Features/ Crops	Minimum Capital (f1)	Flexible Marketing (f10)	High Profit (f11)
Sugarcane(C1)	6	7	8
Paddy (C2)	4	5	6
Maize (C3)	7	6	6
Turmeric(C4)	5	6	7
Tomato (C5)	7	7	7
Cotton (C6)	7	4	6
Groundnut(C7)	6	7	7
Plantain(C8)	2	7	8
Tapioca (C9)	7	6	7

STEP 1: Select the group of crops depending on all the features by applying K-Means algorithm with k=3. After applying the K –Means algorithm and the final Clusters are cluster1 = {C1,C4,C5,C7}; cluster2 = {C2,C8} and cluster3 = {C3,C6,C9}.The above cluster values are tabulated in Table 3. This Table 3 contains three input features with one " decision value" column which can be yielded from K-Means algorithm.

Table 3. Decision Table

Features/ Crops	Minimum Capital (f1)	Flexible Marketing (f10)	High Profit (f11)	Decision Value
Sugarcane(C1)	6	7	8	C1
Paddy (C2)	4	5	6	C2
Maize (C3)	7	6	6	C3
Turmeric(C4)	5	6	7	C1
Tomato (C5)	7	7	7	C1
Cotton (C6)	7	4	6	C3
Groundnut(C7)	6	7	7	C1
Plantain(C8)	2	7	8	C2
Tapioca (C9)	7	6	7	C3

STEP 2: Construct the AFWAA ,RFWAA and MF Weight Aggregation Analysis Table by applying the maximum weight of the decision parameters. Si= eijVfi*Wi. The Weights (Wi) are Max(f1)=0.7, Max(f2) = 0.7 and Max(f3) = 0.8

STEP 3: Determine the Relative closeness value(R_i) of the parameters for each crop by using the Ideal score(ISi)= Max(C1) and Negative score(NSi') =Min(C1). $R_i = NS_i'/(IS_i + NS_i')$ and its tabulated in Table 4 for AFWAA, Table 5 for RFWAA by using RC tool and Table 6 for FMFWAA by using RC tool.

Table 4. AFWAA- Weight Aggregation Analysis Table & Relative Closeness Method

Crops	S1	S2	S3	Isi	Nsi	Ri
Sugarcane(C1)	42	49	64	64	42	0.3962
Paddy (C2)	28	35	48	48	28	0.3684
Maize (C3)	49	42	48	49	42	0.4615
Turmeric(C4)	35	42	56	56	35	0.3846
Tomato (C5)	49	49	56	56	49	0.4667
Cotton (C6)	49	28	48	49	28	0.3636
Groundnut(C7)	42	49	56	56	42	0.4286
Plantain(C8)	14	49	64	64	14	0.1795
Tapioca (C9)	49	42	56	56	42	0.4286

From the above Table 4, Crop Tomato (C5) has First Maximum Value, Maize (C3) has second Maximum Value and Groundnut, Tapioca (C7 & C9) has Third Maximum Value.

Table 5. RFWAA- Weight Aggregation Analysis Table & Relative Closeness Method

Crops	S1	S2	Isi	Nsi	Ri
Sugarcane(C1)	42	49	49	42	0.4615
Paddy (C2)	28	35	35	28	0.4444
Maize (C3)	49	42	49	42	0.4615
Turmeric(C4)	35	42	35	35	0.4545
Tomato (C5)	49	49	49	49	0.5000
Cotton (C6)	49	28	49	28	0.3636
Groundnut(C7)	42	49	49	42	0.4615
Plantain(C8)	14	49	49	14	0.2222
Tapioca (C9)	49	42	49	42	0.4615

From the above Table 5, Crop Tomato (C5) has First Maximum Value, Maize (C3) has second Maximum Value and Groundnut (C7) has Third Maximum Value.

STEP 4: Finally crop selection can be optimized by Maximum value of R_i using AFWAA, RFWAA and FMWAA.

The decision is S_k if S_k=Max R_i. By both the Method , Thus proved, Tomato (C5) is suitable for cultivation depending on the farmers decision and also RFWAA having Max(Ri = 0.5000) comparing to the AFWAA .

STEP 5: The decision is represented by Relative closeness Chart and its represented in

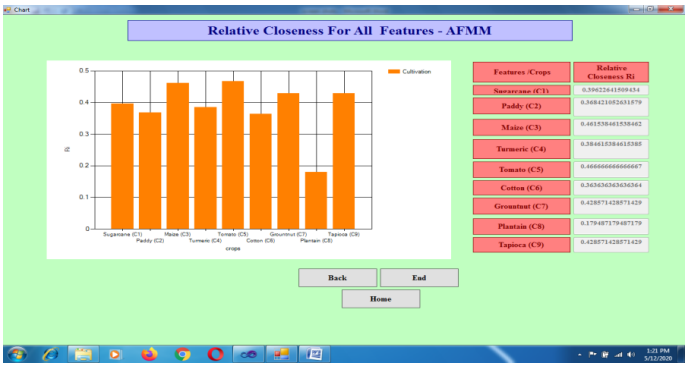

Fig.1 shows RC for AFWAA

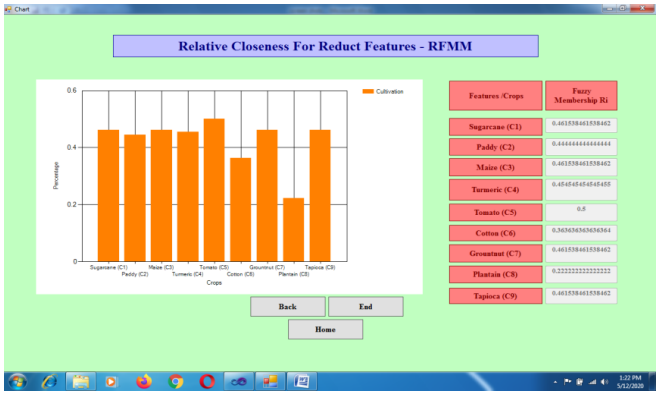

Fig 2. shows RC for RFWAA

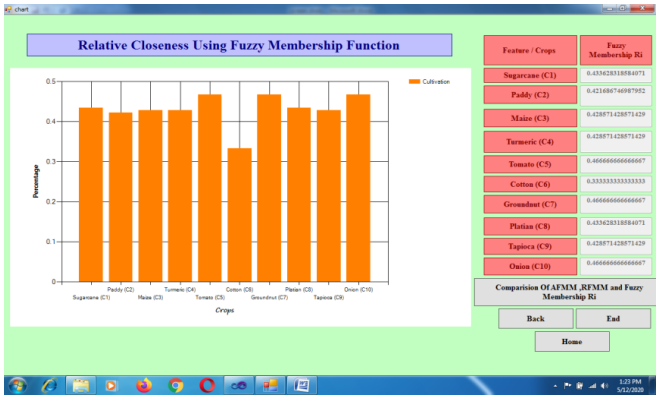

Fig 3, shows RC for MFWAA

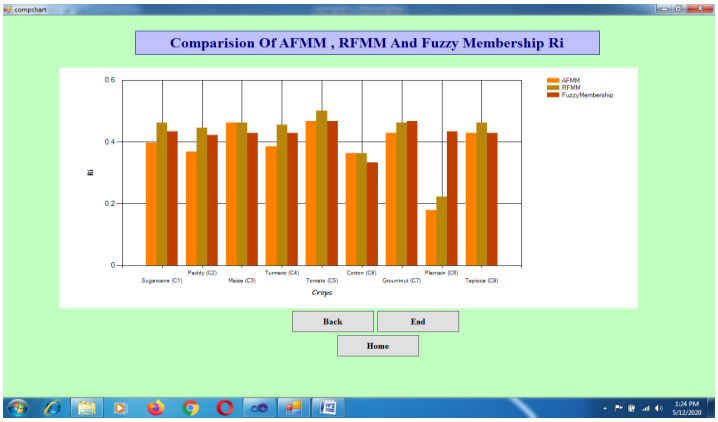

Fig 4.shows comparative analysis of RC for AFWAA, RFWAA &MFWAA

5. Conclusion

Integration of science and technology in agriculture is considered to be judicious action. The proposed work of this paper, K-Means algorithm was applied to group the crops, which is taken from the questionnaire depending on the motivating features of the Farmers. In this paper we used a Relative Closeness tool with Weight Analysis algorithm that can be helpful to classify the variety of crops based on the planting schedule. To make the effective decision for the particular crop selection done by the proposed methods like AFWAA, RFWAA and MFWAA with Weight Aggregation analysis algorithm, depending on the features which can be optimized by Relative Closeness(R_i) Method. In this crop data set among 9 crops Tomato crop was selected for cultivation and also observed Crop C5(Tomato) & C7(Groundnut) coming under the same group resulted from the K-means algorithm. This study clearly shown that the proposed approach ended in effective manner to select the particular crop. Further research is required for the application of the above mentioned technology to improve agricultural conditions.

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