Fuzzy Systems and Soft Computing
ISSN : 1819-4362

EMPLOYING TRIANGULAR FUZZY NUMBERS TO IMPLEMENT THE IZS METHOD IN THE FIELD OF URBAN PLANNING

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Abstract

The objective of this work is maximizing profit and lowering disruption risk while considering the variety of risk factors, including the availability of agricultural land, transportation risks from farmers to distribution centres and transportation risks from distribution centres to customers. The purpose of the proposed work is to cut down on the amount of time and money we spend on using the property for experiments. When dealing with various kinds of Solid Assignment problems, the solution discovered by IZS Method (Improved Zero Suffix) techniques will assist the decision-makers in taking the best course of action. Utilizing the IZS Method approach, we analyse a numerical example and compute utilizing the two available ways. Additionally, we contrast the best results from this new approach with two already in use methods. The suggested approach is a methodical process that is simple to use to solve challenging assignment problems.

Keywords: IZS, Solid Assignment Problem, Triangular fuzzy number.

1. Introduction:

While cropping patterns provide a solid foundation for agricultural regionalization, studying them is a crucial component of agricultural geography. In a certain place at a specific moment, the crop is completely isolated from other crops. The study of comprehensive area development planning, especially for rural areas, is aided by the physical variables that govern the layout of the crop combination areas. In a developing nation like India, the significance of implementing appropriate cropping patterns cannot be overstated. Agriculture cannot expand horizontally without significant capital expenditures. The only way to solve the difficulties with food and raw materials is to use land wisely by implementing more profitable cropping patterns, scientific crop rotation and multiple cropping.

1.1 Aim

The study's objective is to determine the agriculture output and soil availability in the Erode District.

1.2 Learning environment of Erode district:

Erode is a district in Tamil Nadu, India, which was established in September 1979. It is located between the Indian Ocean and is bordered by the state of Karnataka and the state of Kerala. Its boundaries are 10.35' to 11.60' north latitude, 76.49' to 77.58' east longitude, and 171.91 m above sea level. The district has its southern border with the district of Dindigul, its eastern border with the district of Namakkal and Karur, and its northern border with the State of Karnataka. The district headquarters is Erode, and the soils of Erode are mainly red sandy and red gravel type, with red loamy soil being found in the Taluk of Gopichttipalayam.

Figure 1. Map of Erode District

Use of Land Table 12 displays the district's land use pattern. The land area is 8.16 lakh hectares in total. About 28% of this was covered in forests, and the remaining 0.02% was made up of grazing areas and pastures. Up to 10% of the total area was used for purposes other than agriculture. There were 0.19 percent of the land under cultivable waste. However, other fallows made up roughly 13 to 14 percent of the district's overall geographical area, with the current fallows making up more than 10 percent of the total. The district's net sown area accounted for over three lakh hectares, or roughly 37% of the total land area.

1.3 Recent scenario of agriculture in Erode district:

The agricultural pastime within the district is nicely supported with the aid of using a few perennial rivers. Cauvery and Bhavani are the 2 fundamental rivers in this district. The river Bhavani drastically advantages agriculture in Sathyamangalam and Gobichettipalayam taluks. Cauvery river offers irrigation centers to a restricted quantity in Bhavani taluk. Noyyal is another river flowing through Erode and Kangayam taluks.

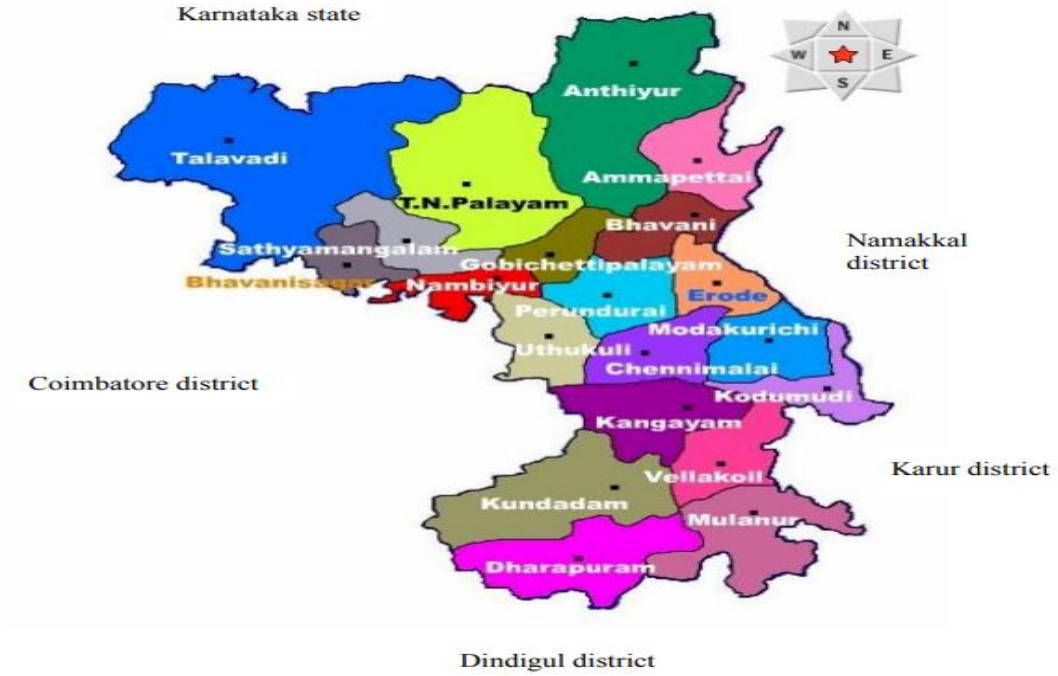

Figure 2. Map of Erode District with Development Blocks

Erode district includes seven taluks and 20 blocks, with a place of 8,a hundred and sixty Sq.km. The district had a population of 25. Seventy four lakhs as according to 2001 Census. The district has 59 city panchayats and 539 sales villages. The district has been divided into 20.Agriculture blocks with

seven taluks viz., Erode, Gobichettipalayam, Bhavani,Dharapuram, Perundurai, Sathyamangalam and Kangayam.

1.4 Soils in Erode :

The majority of Erode soils are composed of red sand and gravel with trace amounts of red loam. There are patches of black soil here and there. Large portions of the upland terrain are often composed of gravel. According to geology, the red-loam soil is primarily found beneath the Kalingarayan channel and also inside the beds that are visible in Erode Taluk. Though to a lesser extent, the crimson loam tracts can also be found in the taluks of Bhavani and Perundurai. The crimson soil of Bhavani, Perundurai, and Erode town, among other important parts of the Erode region, is often stony and sandy.

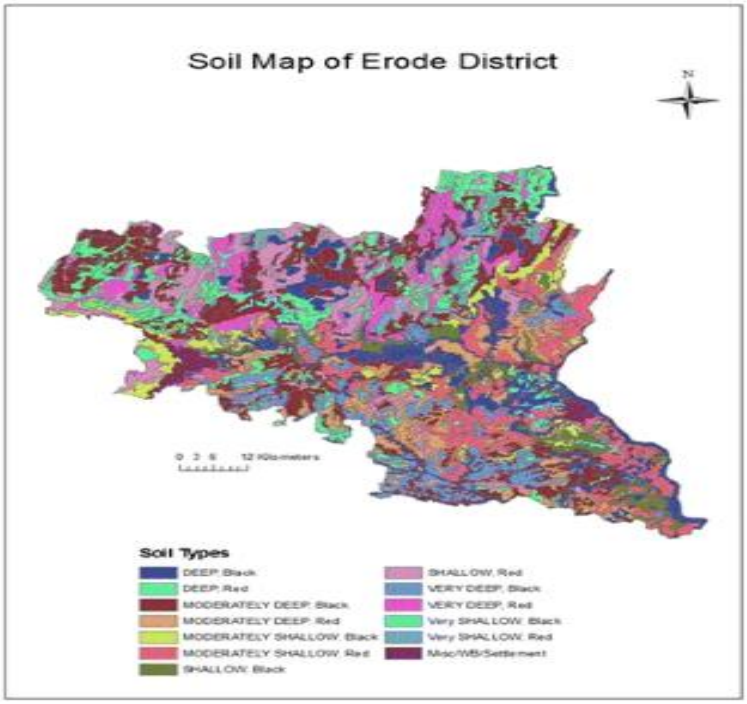

Figure 3. Soil Map of Erode District

Similar to Sathyamangalam taluk, Gobichettipalayam, a crucial midway of the Erode district, features red sandy soil. The district's soils are primarily red sand and gravel, with some patches of black loam and moderate amounts of red loam. Large portions of the highland areas are primarily made of gravel. Red-loam is primarily found in the area beneath the Kalingarayan Channel, in the tank beds of Erode Taluk, and to a lesser degree in the valleys of Perundurai taluk. It can also be found in Bhavani taluk's steep areas.

The reddish-gray, rocky, and gravelly soils are the predominant features of the Bhavani, Erode, and Perundurai taluks. The taluks of Gobichettipalayam and Perundurai are primarily home to red loam. The majority of the soils in the taluks of Gobichettipalayam and Sathyamangalam are red sandy.

1.5 Minerals :

In Erode taluk, feldspar of excellent quality is available in both opaque and translucent kinds. Mica and muscovite may be found in Vairamangalam close to Bhavani, and Punjai Puliampatti respectively. A few locations in Bhavani and Perundurai have been reported to have asbestos. Even while the area does not have abundant mineral resources, it does have a few unique and important objects.

Rich iron ore may be found in Gobichettipalayam's Doddan Combai forest. It is discovered that this ore is rich in metal and of extremely excellent quality. In Gobi, a few ferrous veins have also contained gold traces.

1.6 Rivers

The district's principal rivers include the Bhavani, Cauvery, and Noyyal. The Palar River in the north is another important river. The Palar forms the northern boundary of Karnataka State and Erode district. The district's good drainage and guaranteed irrigation are made possible by the Bhavanisagar main canal and the aforementioned rivers. After receiving Siruvani, a perennial stream of the Coimbatore District, Bhavani rises in the quiet valley in the Palghat Mountains in the adjoining State

of Kerala. The Kundah River then fortifies Bhavani before it enters Erode District in Gobichettipalayam.

The Bhavani River is mostly fed by the South-West monsoon, making it essentially a perennial stream. Its water supplies are additionally augmented by the northeast monsoon. This river flows through the taluks of Bhavani and Gobichettipalayam for more than a hundred miles as it passes through the Erode District. It supplies water to the Bhavanisagar reservoir, which flows through the Taluks of Bhavani, Sathyamangalam, and Gobichettipalayam before joining the Cauvery River near the boundaries of Salem.

The Cauvery River rises in the Coorg and has numerous tiny tributaries that join it. It travels across Karnataka before making a dramatic swing to the east and south at Hogenakkal Fall. Its biggest tributary, the River Kabini, enters it prior to this point. From here, it turns southeast and forms the border between the nearby Namakkal District's Tiruchengode taluk and the Erode District's Bhavani taluk. The south-eastern route continues after the river Bhavani empties into it, creating the border between Tiruchengode taluk of Namakkal taluk and Erode taluk of Erode District. The Noyyal River is renowned for its irrationality. The North-East monsoon brings freshwater, which frequently causes floods, but the South-West monsoon provides the majority of the water for this. The river contributes significantly to irrigation in the districts of Palladam in Coimbatore District and Dharapuram in Tirupur District.

1.7 Forests :

Erode is one of the lucky districts in the state to have a large amount of forest space, covering more than 228,750 hectares of land with dense forest cover. Forests cover 27.7% of the district's total land. Many commercially important products, including teak, sandalwood, rosewood, vogai, pillai maruthu, etc., are abundant in these forests. In the Moyar Valley and along the Dodda Combai in the Talamalai ranges, sandalwood is abundant. The Bhavani ranges are full of tamarind trees. Various types of vegetation are common in highland forests at elevations between 2,000 and 5,000 feet.

This area has vegetation of the semi-evergreen, teak, sandal, bamboo, and shola types. The greatest amount of teak's availability falls between 3,200 and 3,600 feet. Significant locations for bamboo may be found on the north Coimbatore plateau's outer slopes, which range in elevation from 1,500 to 3,000 feet. Vadaparai and the Hasanur basin in the Sathyamangalam hills are the primary availability centres. DoddaCombai in the Bhavani ranges is noteworthy for bamboo availability as well.

The conservation of the forests in this area has also benefited from the Southern Forest Rangers' College in Coimbatore. There is a lot of wildlife in the area. It is diverse, and this district is home to every common species often seen in southern mountains and plains. The presence of tigers and wild elephants in the district is noteworthy, particularly on the hills in the northern and north eastern regions. There are still some cheetahs around. They are dispersed very thinly. Panthers can be found in the district's steep slopes and scrub jungles. The northern ranges are typically home to spotted deer, barking deer, jungle sheep, and other wildlife.

1.8 Soil Health :

The district's soils are primarily red sand and gravel, with some patches of black loam and moderate amounts of red loam. Large portions of the highland areas are primarily made of gravel. Red-loam is found mostly in the areas beneath the Kalingarayan Channel, in the tank beds of Erode taluk, and to a lesser degree in the valleys of Dharapuram and Perundurai Taluks. It can also be found in Bhavani taluk's steep areas. The predominant soil types in the taluks of Bhavani, Erode, Dharapuram, and Perundurai are reddish-gray, rocky, and gravelly. The predominant type of soil in the taluks of Gobichettipalayam and Sathyamangalam is the red District Agriculture Plan - Erode District 25 sandy soil.

The taluks of Gobichettipalayam and Perundurai are primarily home to red loam. The district's overall geographical area is 572,264 hectares, according to revenue land records. As net area seeded, 199,389 hectares of those have been put under cultivation. This represents 34.8% of the district's total area. A total of 25,397 hectares, or 12.73% of the net area seeded, have been sown more than once. 224,786 hectares, or 39.2% of the district's total area, are under cultivation. 227,511 hectares, or 39% of the entire area, are covered by forests.

In the district, the amount of cultivable waste has been decreased to just 1707 hectares. 53,004 hectares, or less than 9.2% of the total area, are used for non-agricultural purposes. However, make for 14.5%

of the total. Together trees, crops, groves, orchards, etc., make up around 0.6% of the district's total land area. A total of 224,786 hectares are cropped out of the 199,389 hectares that were brought under cultivation since 25397 hectares are sowed more than once. When this is considered, the district's overall cropped area to total area ratio will come out to 39.2%, indicating greater use of the district's available land resources.

Table Area under different Soil Types

S.No	Soil Type	Area (Ha)
1	Red Soil	607737
2	Black Soil	10113
3	Alluvial Soil	40030

1.9 Crops production in Erode district : The region has made great strides in agriculture, despite its reputation for trade and manufacturing. The ryots have been able to stay abreast of developments in agricultural practices and technologies, as well as improved seed strains, because to their close relations to the Coimbatore district, which benefits from two prominent agricultural institutions: the Agricultural College and the Research Institute. Public relations and development activities of the Coimbatore agricultural institutes were widely disseminated throughout the Erode District.

Propaganda and demonstrations from the Agricultural Department were added to this. The availability of irrigation infrastructure and improved farming practices promoted agricultural advancement. Farmers in the district have managed to increase their yield despite the subpar soil by employing improved seed strains and growing methods. The total area of paddy is 86,939 hectares. Raised on around 11240 hectares, Cholam is situated adjacent to paddy fields.

Pulses are not cultivated extensively in the district. Only 31498 hectares are used to raise pulses. Chilies and turmeric are essential seasonings and condiments. Spread on 14533 hectares of land, turmeric is farmed. The majority of crops that aren't used for food are oil seeds. 55.23% of the total area planted to non-food crops is made up of oil seeds. 95018 hectares are cultivated for oil seeds in total, of which 24084 hectares are planted with gingely and 55696 hectares with groundnuts. Groundnut is the most widely grown oil seed in this region.

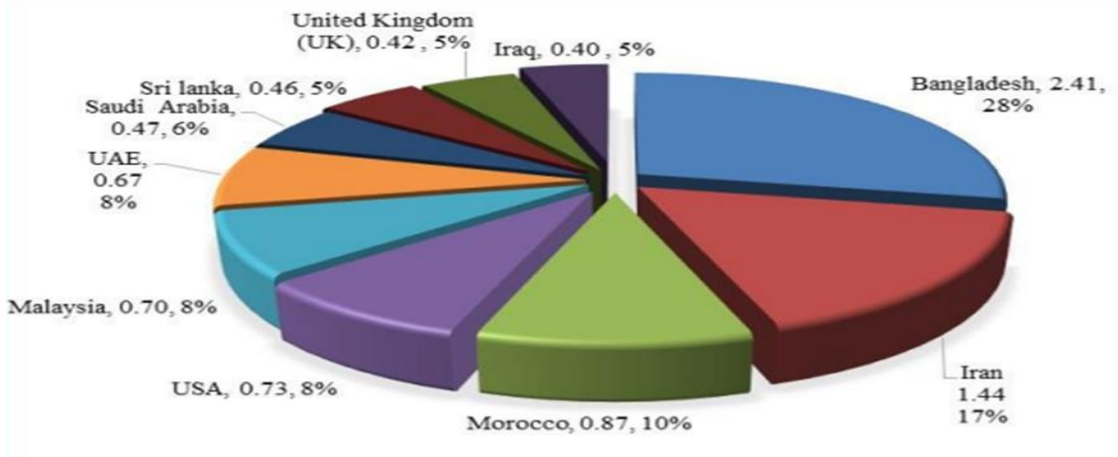

Figure 4 : Major importing countries of Turmeric from India during 2019-20 (in lakh tonnes)

Here, cotton, sugarcane, and tobacco are the three main non-food crops farmed. Sulphur is cultivated over 30,903 hectares. In the district, cotton is cultivated on a little amount of hectares, whereas tobacco is raised on 4923 hectares. For all commercial crops, farmers have adopted better varieties, allowing them to maintain high yields.

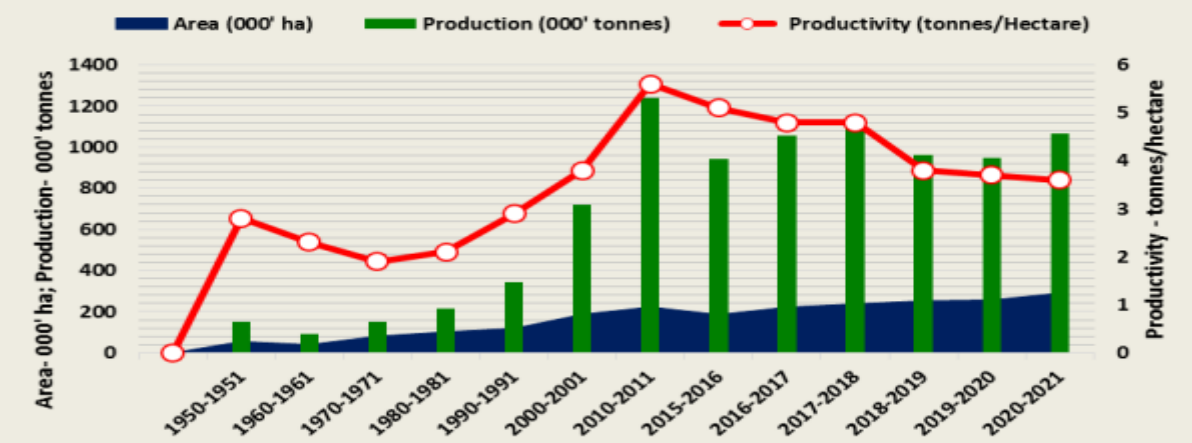

Figure 5: Growth parameters of Turmeric in India

1.10 Crop Activities in the District:

The Dharapuram and Kangeyam taluks contain the majority of the district's arid lands, while the region as a whole gains from important canal irrigation projects. During the noncanal season, groundwater is a crucial source of irrigation for areas outside the control borders of canal irrigation projects. Thanks to the different soil types and irrigation sources, certain plants are grown in Karnataka state, Coimbatore district, Namakkal district, Karur district, Dindigul district, and District Agriculture Plan - Erode district. Given the poor rainfall in the district, the crop diversification sample is a good fit for lowering the risks in agricultural manufacturing.

2. REVIEW OF LITERATURE:

Dr.M.JayanthiA.Vaideke [5] , The study focuses on the methods used by farmers in the Eroding District to cultivate turmeric. Turmeric growers have numerous challenges, including poor monsoons, outdated technology, storage issues, and issues with private merchants and middlemen. The findings showed that developing nations' agricultural development strategies should be focused on raising the productivity of their cultivated land while lowering costs and optimising input utilisation in a way that minimises or eliminates negative environmental and human health effects.

Senthilkumar, Manivannan [3] , The production and sale of chilli and turmeric in Erode District are the focus of their investigation. Studying the socioeconomic factors impacting the production and sale of turmeric and chillies is the primary goal of the research. To research strategies for boosting output and successful marketing. They came to the conclusion that improving technology for chilli and turmeric cultivation and processing, as well as reforms in the domestic and international marketing of these products, are major obstacles that India's chilli and turmeric sector must overcome in order to increase efficiency in several of its sub-sectors.

In the year 2020 Dr.K.Chitra [4], The fertility of the soil is crucial to agriculture. Only crops with high nutritional value can be grown on fertile soils. Agricultural soils are poisoned these days for a variety of reasons. To produce crops, farmers employ synthetic insecticides and fertilisers. They are crucial to the fertility of the soil. The current state of soil fertility is enabled by the physicochemical properties of the soil. Samples of dirt were gathered in Erode. Every agricultural soil has an acidic composition. All of the samples' electrical conductivity indicated that the soils were suitable for seed germination. All of the samples had salinity and total dissolved solids at the proper levels. The amount of organic carbon was sufficient. The level of macronutrients was moderate. All of the soil samples had adequate levels of calcium and magnesium.

P. Kannan1*, S. Natarajan, R. Sivasamy and R. Kumaraperumal [6] , Tamil Nadu's paddy field is the Cauvery delta zone. One of the districts that contributes significantly to the production of pulses and paddy is Tiruvarur. The two main landforms, virtually level plain and very gently sloping, were identified as having twenty-two image interpretation units (IIUs) based on the visual interpretation of geocoded FCCs IRS-1D PANS combined LISS III satellite data. A semi-detailed soil survey was conducted based on the IIUs, and the soils were characterised in terms of landform. A comprehensive analysis was conducted on sixteen representative pedons that encompassed the entire Tiruvarur district in Tamil Nadu. The pedons were evaluated based on their nutrient content and suitability for various crops.

The deep to very deep soils had a wide range of textural changes, were light yellowish brown to dark red, excessively to poorly drained, slightly acidic to slightly alkaline, lacking in organic carbon, and had a low to high cation exchange capacity. The soils had medium levels of available potassium, medium levels of available phosphorus, and low levels of available nitrogen. Soil response, sudden textural variations in soil profiles, low organic carbon, and low fertility are the soil-site restrictions. The issue of these soils' low organic matter content, which is the cause of their unhealthy state, must be resolved immediately. A suitable land use plan was recommended for the Tiruvarur district in order to manage the soil resources sustainably, taking into account the main constraints on the area.

V. Geetha and Dr. R. Thirumoorthy[7] : The reliance of Indian agriculture on unpredictable rains is the subject of this working paper. The farmers also face marketing and other production risks associated with various crop enterprises, agro climatic zones, and other factors. After that, it makes the case for crop insurance as a substitute for other risk management strategies. The performance of crop insurance products throughout history is then covered. The review of the crop insurance plans that are now offered for particular crops and geographical areas comes next. The two significant products—the Weather Based Insurance Scheme and the National Agricultural Insurance Scheme—are covered in great detail. It also highlights certain flaws in these goods.

S Saravanakumar and P Alagesan[8] : The study, which used personal interviews and observations to determine the site specificity of the innovations, was carried out in the Tamil Nadu district of Erode in order to uncover farmer-led innovations at the grassroots level. Nine advances in total land preparation, cultivation features, harvesting technology, acid lime varietal development, organic liquid manure production, and insect management were chosen for this study. We conducted in depth interviews with each inventor to learn more about their individual qualities and distinctiveness.

C.Tholkappian and PB. Rukmanidevi [9]: The present study analysed the economic aspects of both conventional and organic turmeric cultivation. Specifically, the assessment focused on under organic farming in relation to key sustainability indicators, including soil, water, and electricity conservation, as well as the financial security and well-being of farmers. Based on primary data obtained from 30 organically grown crops and 30 conventional sample homes in the Tamil Nadu district of Erode between 2010 and 2011, the study was conducted. Larger landholdings and greater resources were identified in the sample families of organic farming, which were also found to be younger and more educated. Organic farming requires a lot of effort, but because it uses less chemical fertilisers, irrigation, seeds, and agrochemicals, it is less expensive to produce. Although farmers who grow organically have been reported to have lower yields, this has been more than offset by the price premium they receive and the production and profit stability they have seen.

M Manikandan , N Mani and P Karthikeyan[10] : The current research focused on cost and return analysis in a few selected villages in Tamilnadu's Erode District, a significant paddy producing area. The study specifically looked at socioeconomic factors influencing rice production in the area, evaluated costs and returns from production, and described the socioeconomic features of paddy farmers. From the list of revenue village framers, a sample of farmers was chosen at random to participate in the revenue village.

Dayalan N, Pavendar T [13]: India has a vast history of agriculture that dates back more than ten millennia. India is currently the world's second-largest producer of agricultural products. Numerous uncontrollable climate elements, including the primary cause of rainfall (drought and flooding), have an impact on agricultural production. Many academics are interested in how rain functions as a resource in agricultural production. Rainfall is a more significant agricultural input than other inputs. The single most significant factor influencing annual variations in the levels of crop production across the country is often the quantity and temporal distribution of precipitation. The research area spans 1,30,058 square kilometres and is located between latitudes 8°5' and 13°35' north and longitudes 76°15' and 80°20' east. Research depends solely on secondary data.

With the use of a carefully designed questionnaire, 100 respondents were randomly sampled in order to collect primary data. For the examination of the cost and return data, the traditional percentage approach, average method, standard deviation, coefficient of variation, and analysis of variance were used.

According to the study, the area's paddy production required significant investments in irrigation, ploughing, fertiliser, manure, and transplantation. Cultivation operations after harvest use up a large portion of the money spent on paddy production. The research area's cost of producing paddy was significantly influenced by caste and land holding size; the cost of cultivation was unaffected by another component, namely education. Nonetheless, the paddy growers' net profits differed depending on every socioeconomic condition.
When compared to the net return made from other commercial crops, the net return from paddy cultivation is very low. The study suggested that the cause for the increased expense associated with fertiliser application is the rise in fertiliser prices. Therefore, government subsidies on fertiliser prices are necessary, or farmers can choose to utilise organic manures instead, which will lower the cost of paddy farming.

Cost of cultivation of paddy in Erode district: Grown on well-drained, irrigated ground, paddy is a tropical crop. In clay soils, it grows nicely. As a result, river valleys and coastal areas are where it is grown. It's a labour - intensive crop that needs more chemical fertilisers and farm yard manure. It needs meticulous attention during cultivation because it is a crop that is susceptible to weeds and pests. Furthermore, paddy cultivation involves a larger effort in processing and marketing. Processing entails a significant financial investment in labour and chemicals. It is feasible that an examination of the cost of cultivation will reveal a pattern that would allow farmers to implement cost-cutting strategies when cultivating paddy.

3. Methodology : One of the first uses is the assignment problem, which is a specific instance of linear programming problems that arise in a variety of industries, including healthcare, transportation, education, and sports. In actuality, a great deal of study has been done on disciplines of operations research or challenges involving combinatorial optimization. Additionally, the sales force accessible to different regions from cars to highways is mentioned. Assume there are 'n' jobs that need to be completed and 'n' workers available to complete them. Assume that everyone is capable of performing any task at any given moment to varied degrees of efficiency. The goal of examining the employment issue is to identify a task where performing every task has no total cost.
Generally, the things or tasks to be allocated are represented by the columns, and the objects or people to be assigned are represented by the rows. Numerous approaches, including transport methods and linear programming techniques, have been used thus far the assignment method created by Hungary is more practical than the earlier approaches. It is well known that the Hungarian approach to assignment problem is significantly quicker and more efficient.
The topic of transportation deals with the challenges of moving goods from one place to another while attempting to keep costs as low as possible. The cost of transportation, supply, and demand with a quantity of fuzzy are the issues of fuzzy transport. In order to find the best answer for cost transportation, the research compares the theories from the zero-point technique and the zero-suffix method.
Uncertainty and periodic changes in conditions are common in the sphere of transportation difficulties involving the value of an item. This occurs as a result of a lack of data regarding the importance of these issues [2]. Zadeh's theory presents fuzzy problems and fuzzy theories that have been investigated in relation to everyday life [3][4]. The amount of costs, supply, and demand of fuzzy value is the transportation fuzzy problem [5][6].
The zero-point method and the method zero suffix are two techniques used to determine the best answer for transportation costs in fuzzy transportation situations. Annie Christi MS and Kumari Shoba K's research leads to the conclusion that the robust ranking approach combined with the zero-suffix method yields an accurate and efficient optimal solution to the fuzzy problem [7]. Chandrasekaran, S., et al.'s research from the following year came to the conclusion that the zero-suffix method, when combined with a heptagon fuzzy number, produced optimal solutions for tackling fuzzy issues, including the transportation problem[12].
Based on the example of the fuzzy problem, Fegade, et al. concluded that the ideal solution by transforming the problem from fuzzy to crisp using the approach robust ranking would result in an optimal and more effective total fuzzy cost [14]. Nirmala G. and Anju R.'s research, which found that

the zero-suffix approach yields an ideal solution in transportation issues with few iterations, provided support for this study [15].
Ismail Mohideen's research on the zero point technique leads S and Senthil Kumar P to the conclusion that, when it comes to multiplication operations, adopting the zero point approach is preferable to Vogel's Approximation method and method modified distribution in the fuzzy distribution problem [3]. According to P. Pandian and G. Natarajan, the zero-point technique yields the ideal value of the objective function for transportation fuzzy with a number fuzzy trapezoid [12].

4. Preliminaries

The Mathematical model of the assignment problem as follow
The objective function is to
Minimize $z = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} x_{ij}$
Subject to the constraints

$$\sum_{i=1}^{m} x_{ij} = 1 \ , for\ all\ i$$

$$\sum_{j=1}^{n} x_{ij} = 1 \ , for\ all\ j$$

Where $X_{ij} = o\ or\ 1$ and c_{ij} represent the cost of assignment of resource i to activity j.
Consider the following solid assignment problem (SAP) as follow
The objective function is to
Minimize $z = \sum_{i=1}^{m} \sum_{j=1}^{n} \sum_{k=1}^{l} c_{ijk}\, x_{ijk}$
Subject to the constraints

$$\sum_{j=1}^{n} \sum_{k=1}^{l} x_{ijk} = 1 \ , \qquad i = 1,2, \dots m$$

$$\sum_{i=1}^{n} \sum_{k=1}^{l} x_{ijk} = 1 \ , \qquad j = 1,2, \dots n$$

$$\sum_{i=1}^{n} \sum_{j=1}^{n} x_{ijk} = 1 \ , \qquad k = 1,2, \dots n$$

Where $X_{ijk} = o\ or\ 1$, for all $i, j\ \&\ k$.

Triangular Fuzzy Number:

It is a fuzzy number represented with three points as follows: $A = (a_1, a_2, a_3)$ This representation is interpreted as membership functions and holds the following conditions (i) a_1 to a_2 is increasing function (ii) a_2 to a_3 is decreasing function (iii) $a_1 \le a_2 \le a_3$.

Definition Triangular Fuzzy Number:

A triangular fuzzy number A is a fuzzy with piecewise linear membership function μ_A defined by

$$\mu_A = \begin{cases} 0 & x < a_1 \\ \dfrac{x - a_1}{a_2 - a_1} & a_1 \le x \le a_2 \\ \dfrac{a_3 - x}{a_3 - a_2} & a_2 \le x \le a_3 \\ 0 & x > a_1 \end{cases}$$

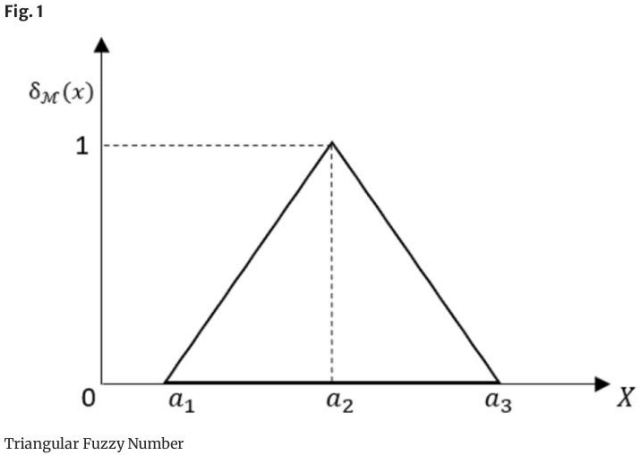

Figure 6 : Representation of Triangular Fuzzy number

A farmer is using three distinct plant kinds for various crops, one of which he believes is necessary to outperform the others. In addition, he believes that applying three distinct kinds of fertilizer will fortify the crops. He concludes from taking these factors into account that one crop will be more aggressive than the others. Assume that there are three soils indicated by S_1, S_2, S_3, three crops indicated by C_1, C_2, C_3 and three fertilizers indicated by F_1, F_2, F_3. It is known that A_{xyz} is the cost of assigning soils to be best crops in the fertilizers. The solid assignment costs A_{xyz} are given in the following table. A new Method for finding an Optimal solution to SAP By using improved IZS Method :

Fertilizers	F_1			F_1			F_1		
		F_2			F_2			F_2	
			F_3			F_3			F_3
Crops / Soils	S_1			S_2			S_3		
C_1	0,5,6,3	1,4,2,5	3,1,2,0	7,4,3,2	3,4,2,0	6,3,2,0	1,2,3,5	6,5,4,3	2,7,9,0
C_2	4,2,1,3	3,4,1,2	9,8,7,10	4,5,7,1	8,3,5,2	7,4,6,5	10,7,9,8	9,6,5,4	6,4,3,2,
C_3	3,5,2,1	4,5,3,8	7,3,8,9	9,4,5,6	8,5,6,3	0,4,3,5	0,4,3,2	1,2,4,1	8,6,7,2

Solution : Note that the given SAP is balanced one.

From the given Assignment problems fuzzy, then changed to the Assignment problem crisp using trapezoidal fuzzy number.

Fertilizers	F_1			F_1			F_1		
		F_2			F_2			F_2	
			F_3			F_3			F_3
Crops/ Soils	S_1			S_2			S_3		
C_1	4.2	3	1.5	3.8	2.5	2.7	2.7	4.5	5.7
C_2	2.2	2.5	8.2	4.8	4.3	5.3	8.3	5.8	3.7
C_3	3	4.7	6.3	5.5	5.5	3.2	2.7	2.3	6

Table : 1$C - S$ table

The application of steps 2 to 5 of the IZS Method results in the creation of the C-S table as follows.

	S_1			S_2			S_3		
	F_1	F_2	F_3	F_1	F_2	F_3	F_1	F_2	F_3
C_1	2.7	1.5	0	1.4	0.1	0.3	1.2	3	4.2
C_2	0	0.3	6	1.7	1.2	2.2	6.1	3.6	1.5
C_3	0.7	2.4	4	2.3	2.3	0	0.4	0	3.7

Table : 2 $S - F$ table

The S-F table below is generated using step 7 of the IZS Method.

	F_1			F_2			F_3		
	C_1	C_2	C_3	C_1	C_2	C_3	C_1	C_2	C_3
S_1	2.7	0	0.7	1.5	0.3	2.4	0	6	4
S_2	1.4	1.7	2.3	0.1	1.2	2.3	0.3	2.2	0
S_3	1.2	6.1	0.4	3	3.6	0	4.2	1.5	3.7

Table : 3 $F - C$ table

By employing step 8 of the IZS Method, the obtained F-C table is presented below.

	C_1			C_2			C_3		
	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
F_1	2.7	1.4	1.2	0	1.7	6.1	0.7	2.3	0.4
F_2	1.5	0.1	3	0.3	1.2	3.6	2.4	2.3	0
F_3	0	0.3	4.2	6	2.2	1.5	4	0	3.7

Table : 4 $C - S - F$ table.

The following C-S-F table can be derived using the IZS Method.

Fertilizers	F_1			F_1			F_1		
		F_2			F_2			F_2	
			F_3			F_3			F_3
Crops / Soils	S_1			S_2			S_3		
C_1	2.7	1.5	0	1.4	0.1	0.3	1.2	3	4.2
C_2	0	0.3	6	1.7	1.2	2.2	6.1	3.6	1.5
C_3	0.7	2.4	4	2.3	2.3	0	0.4	0	3.7

6. **Conclusion :**

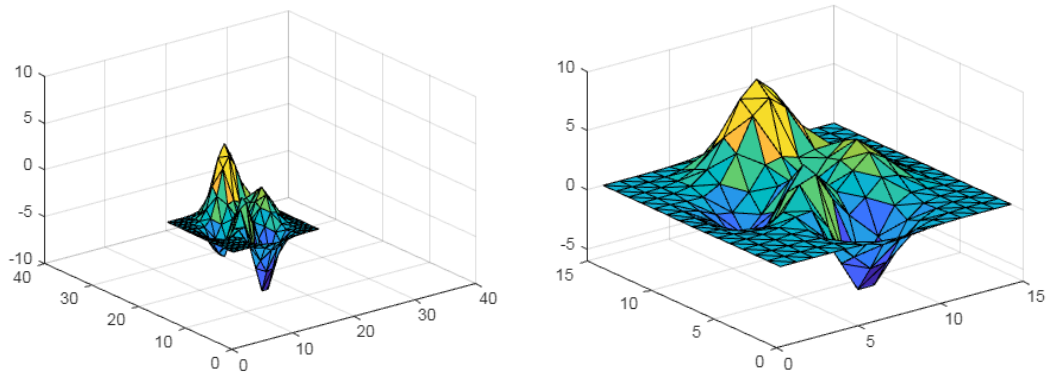

Figure 7 : Representation of best solution

In the above graph shows, the best solution for the solid assignment problem can be obtained by assigning

$$C_1 \overset{S_1}{\rightarrow} F_3 = 0$$
$$C_2 \overset{S_2}{\rightarrow} F_1 = 1.7$$
$$C_3 \overset{S_3}{\rightarrow} F_2 = 0$$

resulting in a minimum total assignment cost of 1.7. The researcher has created a mathematical method for using IZS Method to solve the SAP, which can help with decision-making that is well-informed and efficient. The best crop, soil, and fertilizer mix is chosen based on the actual situation.

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