

Title : Comparative Evaluation of Crop Production under Uncertainty Using Two Stage FM- TOPSIS

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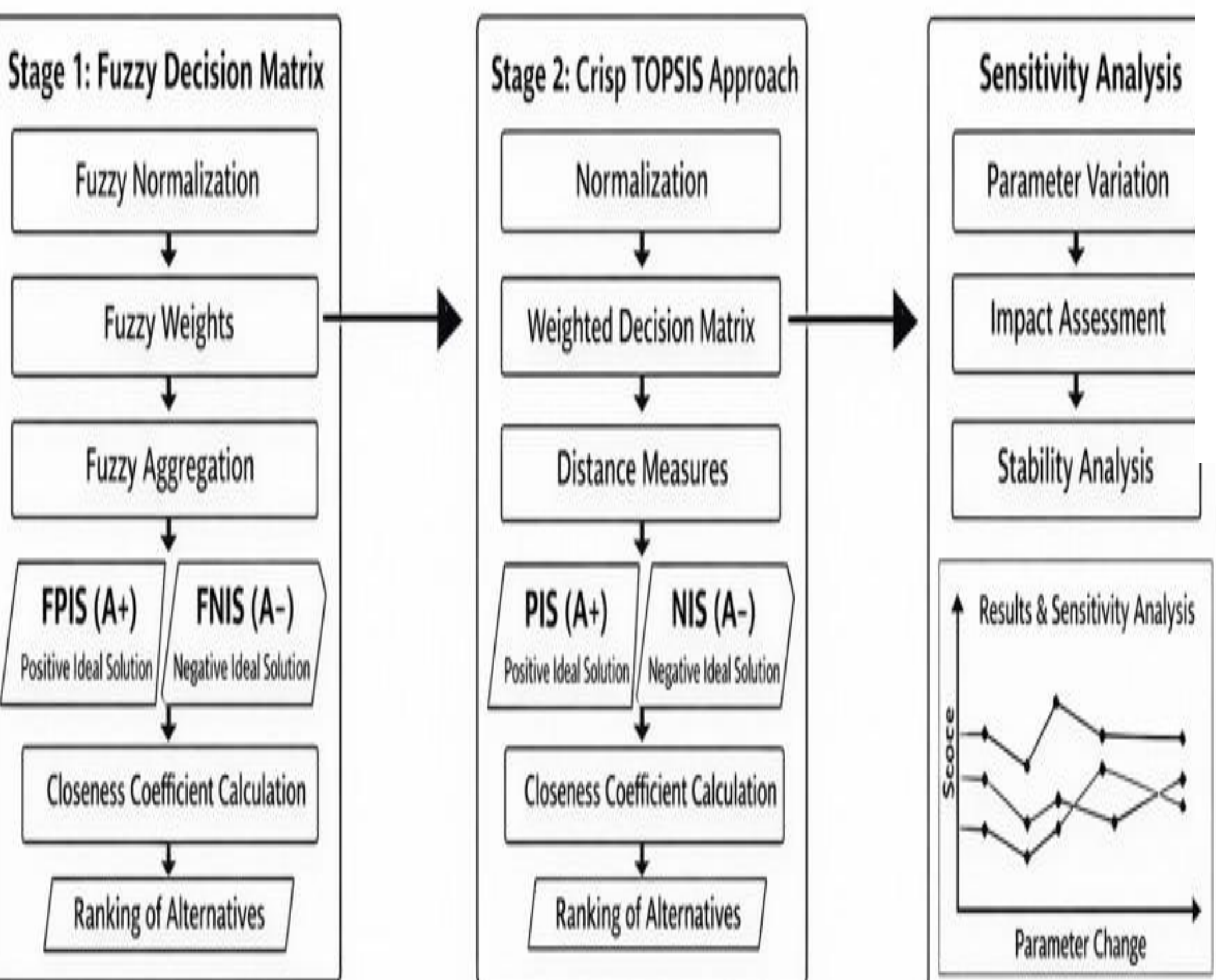
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INTRODUCTION & AIM

The study proposes a fuzzy MCDM framework based on the Fuzzy Multi-Attribute Method for Order Preference by Ideal Solution Similarity (FM-TOPSIS) for the comparative evaluation of crop production performance using year-wise agricultural data. In the proposed approach, each agricultural year is treated as an independent alternative, while multiple production related factors such as yield, rainfall adequacy, cost cultivation, pest incidence, soil fertility status, and market stability are considered as evaluation criteria under fuzzy environment. Linguistic assessments provided by domain experts and farmers are transformed into fuzzy triangular numbers in order to create the fuzzy decision matrix. FM TOPSIS is then applied to determine the relative closeness of each year to the best agriculture performance scenario. Furthermore, a two stage hybrid evaluation strategy is employed, wherein year wise rankings are obtained through FM-TOPSIS are aggregated to derive an overall performance assessment across multiple years. This hybrid framework enhances robustness and enables consistent comparative analysis of agricultural performance under uncertainty. The results demonstrate that the proposed FM-TOPSIS based methodology provides a trustworthy and useful instrument for making decisions, evaluating crop production trends and supporting sustainable agricultural planning.

METHOD

The methodology integrates fuzzy linguistic modelling with FM-TOPSIS to agricultural performance on a year wise basis. The framework consist of two main stages:



RESULTS & DISCUSSION

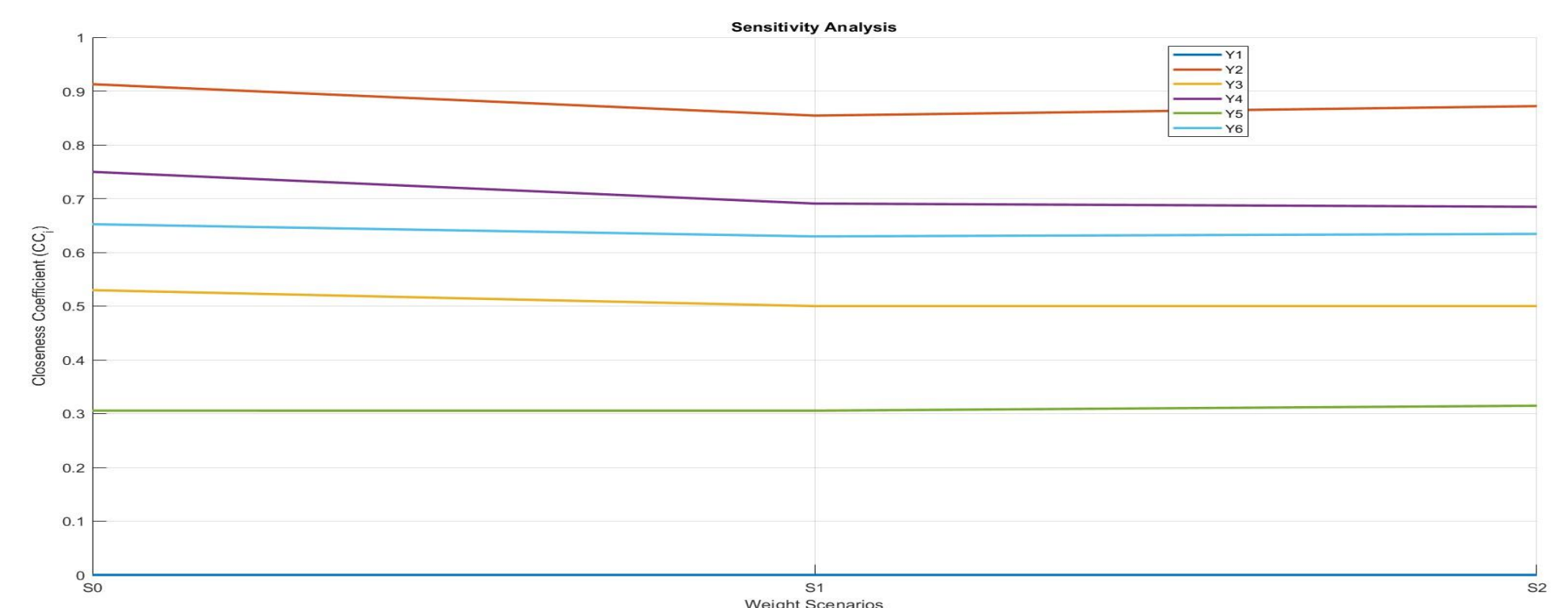
The Problem address in this study is the systematic evaluation and ranking of agricultural years from 2019-2020 to 2024-2025 of Soybean crop based on multiple performance indicators under uncertainty using a two stage FM-TOPSIS framework.

Table 8: Aggregate Distance, CC_i and Final Ranking

Alternatives	D_i^+	D_i^-	$CC_i^{(1)}$	Final Ranking
Y_1	0.27732	0	0	6
Y_2	0.02588	0.251531	0.9067100	1
Y_3	0.08244	0.194971	0.7028240	3
Y_4	0.02588	0.251531	0.9067100	1
Y_5	0.1579876	0.119322	0.4302840	5
Y_6	0.0494975	0.2128004	0.8112925	2

Table 15: Stage 2 Aggregate Distance, $CC_i^{(2)}$ and Final Ranking

Alternatives	D_i^{*+}	D_i^{*-}	$CC_i^{(2)}$	Stage 2 Ranking
Y_1	0.56502	0	0	6
Y_2	0.04949	0.51742	0.91270	1
Y_3	0.26677	0.30043	0.52967	4
Y_4	0.14191	0.425	0.74968	2
Y_5	0.39594	0.17428	0.30563	5
Y_6	0.19848	0.37233	0.652283	3



CONCLUSION

Two stage FM-TOPSIS gives the better results as compared FM-TOPSIS. The year **2020-2021 (The CORONA year)** shows better performance across all the study period. Eventually it suggest that stop all other work and concentrate on agriculture to enhance the production and yield of Agriculture. Finally, the sensitivity analysis shows the model is Stable. The findings show that the suggested FM-TOPSIS based technique offers a trustworthy and useful decision support tool for assessing crop production trends and assisting with sustainable agricultural planning.

FUTURE WORK / REFERENCES

1. C T Chen, " Extensions of the TOPSIS for group decisions making under fuzzy environment", Fuzzy Sets and systems,(2000) ,