沖縄県におけるサトウキビ農家の赤土流出防止対策適用決定に影響を与える要因の同定

Identification of Factors Affecting Sugarcane Farmers' Decision on Adoption of Soil Conservation Measures in Okinawa

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Introduction

Red soil erosion and nutrient run-off on agricultural land, specially sugarcane farms, and its tragic consequences have been identified as major agricultural and environmental problems in Okinawa since 1970s. Different kinds of programs and approaches have been initiated during last few decades in the agricultural sector in order to mitigate these problems. Though, introduction of soil conservation measures and sediment yield reduction techniques have been given priority in those programs, less adoption of conservation measures by farmers has led the problem still remains at a critical level. It believes that the less attention paid on factors that affect the decision by farmers on adoption of soil conservation measures, has been caused not to deliver envisaged results of different initiatives. Therefore, this research study was undertaken to identify and assess the influencing factors on farmers' decision on adoption of soil conservation measures. Further, it was extended to identify potential soil conservation measures appropriate for farmers as well.

Materials and Methods

Two-stage questionnaire survey of 300 sugarcane farmers in *Kume Island* was administered in order to gather information on sugarcane farmers` perception on soil erosion and nutrient runoff problem and the factors affecting farmers` decision on application of soil conservation measures that prevent non-point source pollution of water streams. In order to assess the importance of the factors influencing farmers` decision, the Analytic Hierarchy Process (AHP) technique was used in the second stage of the questionnaire survey and the data analysis process. The AHP technique was applied to rank the appropriate soil conservation measures according to the farmers` perception as well.

The AHP is a Multi-Attribute Decision Method (MADM). MADM refers to a host of quantitative techniques used to facilitate decisions that involve multiple competing criteria. The AHP was started with the decomposing the problem into a decision hierarchy, as illustrated in the Figure 1, with a *goal*, (adoption of soil conservation measures) *criteria* (factors affecting farmers decision: Labor scarcity, Financial constraints, Income reduction and concern on environment) and *alternatives* (different soil conservation measures: Growing green manure, Shifting from summer crop to spring crop and Establishing of greenbelt or buffer zone). The criteria and alternatives of the hierarchy were identified through the first stage of the questionnaire survey. In the next steps farmers (decision-makers) were individually asked to express their opinions regarding the relative importance of the criteria with regards to the goal and the preference among the alternatives with respect to all factors (criteria) using pairwise comparisons and a 9-point system (scale) from 1 to 9. This process was undertaken for each and every elements of the hierarchy, arranging comparisons in reciprocal matrices. The priorities obtained from the pairwise comparisons

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were used to weigh the priorities in the level immediately below. Then for each element in the level below was added its weight values and obtained its overall priority. This process was continued until the final priorities of the alternatives (soil conservation measures) in the bottom level were obtained. Consistency ratio was calculated for each level comparison to check the consistency of the judgments.

Results and Discussion

The priority vector obtained for the factors with respect to the goal (application of soil conservation measures) is given in Table 1. The relative weights of factors *Income reduction (9.03)* and *Concern on environment (4.45)* are very small and therefore, it can be assumed that the effect of leaving them out from further consideration is negligible. Therefore, the weights of considering factors (Labor scarcity and Financial constraints) be adjusted and their values were 66.30% and 33.7% respectively.

Table 1: Priority Vector for the Factors with Respect to the Goal

Factor	Priority Vector
Labor Scarcity	57.39%
Financial Constraints	28.13%
Income Reduction	9.03%
Concern on Environment	4.45%

The overall composite weight of alte rnatives (soil conservation measures) with respect to the factors of *Labor scarcity* and *Financial constraints* is given in the Table 2. The overall consistency of the hierarchy is 9.39%. Since this value is less than 10% the judgment of this process could be considered as consistent judgment.

Table 2: Overall Composite Weight of Alternatives

	Labor Scarcity	Financial Constraints	Composite Weights
Weight (Adjt.)	66.3	33.7	
Growing Green Manure	51.05%	11.49%	37.73%
Shifting from Summer Crop	38.93%	70.28%	49.49%
Establishing Greenbelt	10.01%	18.22%	12.78%

Conclusion

The labor scarcity and financial constraints (high cost) have significance influence on farmers decision on application of soil conservation measures while the influence of other two factors considered in this study is not significant. Further, the influence of labor scarcity is higher than that of financial constraints. The most appropriate soil conservation measure for farmers is shifting from summer crop to spring perennial crop cycle followed by growing green manure and establishing buffer zone.

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