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## Optimal Crop Combinations under Limited Resource Conditions — Application of Linear Goal Programming Model to Smallholder Farmers in the Drier Savannah Zone of Nigeria

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### Abstract

Smallholder farmers in the drier savannah of Nigeria have multiple goals and operate under limited resource conditions for both crop and livestock production. In most cases, the goals of providing food for the family throughout the year, accumulating monetary income and ensuring minimum use of paid labor are paramount. Therefore, this paper seeks to identify the optimal crop combinations and to analyze the resource allocation patterns of crop farmers in the drier Savannah zone of Nigeria. This is with the view to suggesting an optimal crop enterprise combination that will meet the aforementioned goals of a farm family.

Using data collected from 400 farm households selected in the rural areas of Kebbi State, in the drier Savannah agro-ecological zone of Nigeria, we applied a Linear Goal Programming (LGP) technique to model farm-family crop production enterprise. Through this, optimal crop enterprise combination that would enable smallholder farmer meet the most important goals was identified. Results from the goal programming revealed that only mix cropping enterprises are feasible. Among the 18 enterprises identified, only four enterprises are feasible. All four are cereal-based. These activities and their hectareage allocations were Millet / Maize / Rice (1.20 ha), followed by Maize / Guinea corn / Cowpea (0.94 ha), then by Millet / Cowpea (0.16 ha), and by Maize / Cowpea / Millet (0.04 ha). The minimum cost of this plan is N 6485.16 per hectare. The result further revealed that some household resources such as land were in excess of actual household requirements. This suggests that land is not yet the constraining factor among the farmers. However, effective farm advisory services on the efficient allocation of farm resources are important and should be built into programs promoting increased agricultural productivity among farmers.

**Keywords:** Drier savannah, linear goal-programming, Nigeria, optimum crop combination, smallholder farmer