Table (5): Household Weekly Food Need and the equivalent K.cal

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Adequacy of Smallholders' Farming Systems to Achieve Food Security in North Kordofan State, Sudan

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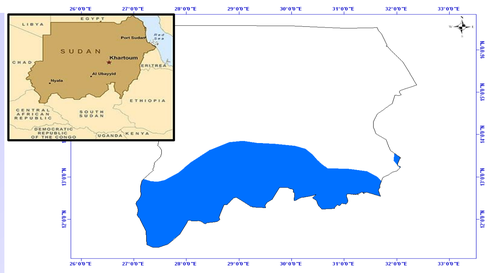
Problem statement

North Kordofan State occupies an area of about 242,000 square Km, where semi-arid zone encompasses substantial area of it. The study area is jeopardized by environmental, socio-economical and political problems. These exhibit themselves in terms of resource degradation, shortage of potable water, lack of services and fluctuation in agricultural output. They collectively deteriorate standard of living and increase poverty among the population. In spite of the huge natural resources bestowed upon the traditional agricultural sector, the area has experienced frequent situations of food insecurity. The majority of the population is rural farmers, where the livelihood forms include traditional crop farming, village-based livestock raising and employment-generated income from labor migration to national schemes. Production of food crops in the region is continuously fluctuating rendering food security of people at jeopardy.

Study area



Methodology

The paper relied on primary and secondary data that were collected from different sources. Random sampling technique was used.
A composite tools were performed for data analysis:
- ✓ Linear Programming (LP) model.
- ✓ Partial Budgeting (PB).
- ✓ Household Economy Approach (HEA).
- ✓ Robust Regression (RR) model (Hamilton,1991).
- ✓ and Policy Analysis Matrix (PAM) as cited by Mahmoud (2004).

Socioeconomic and human factors → ← **Environmental factors**

- ➢ *Dimensions to analyze food security:*
- ➢ LP was developed to determine the area for cultivation of different crops for farmers' profit maximization.
- ➢ PB was used to estimate costs and benefits of various activities.
- ➢ HEA was used to assess food security situation based on daily food intake.
- ➢ RR was used to identify coefficient of estimates of the concerned analyzed variables.
- ➢ PAM was utilized to estimate comparative advantage and competitiveness of food/cash crops.

Objective

- ➢ To determine optimum crop combinations,
- ➢ To assess food security situation, net income, production factors, comparative advantage and competitiveness pertinent to food and cash crops in the study area based on efficiency of resource allocation.

Results & Discussion

✓Optimal solution in the area came with cultivation of 3.375 feddans (feddan = 0.42 ha) of groundnut and 3.00 feddans of cowpea to get a total gross margin equals to SDG 1596 (640 USD), (Table 1).

Table 1: Optimal crop cultivation

Crop	Value/ SDG
Sorghum	0
Millet	0
Groundnuts	513
Sesame	0
Roselle	0
Cowpea	1083

- ✓ Results of PB revealed that groundnuts and cowpea were accepted as best crops with gross margin of SDG 152 and 361, respectively (Table 2).
- ✓ Results of HEA food security situation when taking into account the newly adjusted optimal solution for food items requirement, the gross margin for the area, was found to be SDG 2623.7, this makes an increment in gross margin by 132% (Table 3).
- ✓ Results of PAM (Table 4) for rain-fed crop production revealed that millet and cowpea production in the sector have extremely high comparative advantage and international competitiveness, since the DRC ratio is far less than one (0.13) and (0.06), respectively.
- ✓ Groundnuts production in the area has a very high comparative advantage and international competitiveness, since the DRC ratio is far less than one (0.10).

Table 2: Results of PB for Semi-arid areas (Rainfed sector) by Kg and SDG/Feddan

Item	Sorghum	Millet	Groundnuts	Sesame	Roselle	Cowpea
Total costs (SDG)	144.3	146.92	118	143	128	124
Yield	200	345.8	264.7	120	44.40	215.56
Field price (SDG)	1.25	1.35	1.02	1.25	3.37	2.25
Gross field benefits	250	466.8	270	150	150	485
Net benefits (SDG)	**105.7**	**319.88**	**152**	**7**	**22**	**361**
RR linear models						
Land			-0.52			-0.61
Operating capital			9.4**			5.4*
Family labor			2.50			-2.41
Hired labor			-10.20**			-1.83
Adj. R squire			0.83			0.86

- ✓ Results of household's income and expenditure revealed that, the net household income found to be negative. This result reflects the bad food conditions in the study area. The daily energy received per person per day was equal to 1243 kcal, which was below the recommended amount by WHO (2300 Kcal).
- ✓ Results of robust regression for groundnut and cowpea production found that, labor and capital inputs were significant at 1%. The R-Squared statistic indicates that the models as fitted explain 83% and 86% of the variability in yield of both crops, respectively.

Table 3: Optimal solution (adjusted value and the effect on gross margin)

Cluster	Crops	Area	Final value	Average Cultivated area	Adjusted final value	Existing gross margin	Increment in gross margin (%)
	G. nut	3.375	1596	5.98	2623.7	1130.9	132
	Cowpea	3.00					
Total		6.375					
Adjusted gross margin			Cost of food items SDG			Net income SDG	
2623.7			5982			(3358.3)	

Table 4: PAM matrix for Millet by kg and SDG/feddan & PAM indicators for millet, groundnuts and cowpea

Contents of PAM Variables	Revenue (SDG)	Tradable inputs (SDG)	Cost of domestic resources (SDG)	Profitability (SDG)
Financial prices	466.80	48.48	98.43	319.88
Economic prices	573.16	34.53	70.11	468.51
Transfers	-106.36	13.95	28.32	-148.63

PAM indicators for Millet: FP= SDG 319.88/feddan); EP= SDG 468.51/feddan
PC=0.68, NPC = 0.81, EPC = 0.78, DRC= 0.13

PAM indicators for groundnut: FP= SDG 152/feddan); EP= SDG 520.51/feddan
PC=0.29, NPC = 0.45, EPC = 0.40, DRC= 0.10

PAM indicators for Cowpea: FP= SDG 361/feddan); EP= SDG 888.36/feddan
PC=0.41, NPC = 0.50, EPC = 0.47, DRC= 0.06

Conclusions & Outlooks

1. The paper gave strong arguments that the area experiences acute food insecurity despite the huge production potentialities of food and cash crops.
2. Optimality came with cultivation of 3.375 feddan of groundnuts and 3.00 feddan of cowpea to get maximum gross margin.
3. The analysis also revealed different levels of comparative advantage and competitiveness pertinent to food (millet), cash (groundnuts) and minor cowpea) crops cultivated in the area.

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