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INTERCROPPING - THE HIDD
LAND SCARCITY AND HOUSEH

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Many development economists have regarded intercropp
stand up to present day realities. The results in this pape
intercropping has a higher total productivity per unit
monocropping counterparts. It could therefore be seen
problem of scarcity of land as well as using it to improve

***TUSSENVERBOUING - DIE VERSKUILDE REV
HUISHOUDELIKE VOEDSELSEKURITEIT***
*Heelwat ontwikkelingsekonome het tusserverbouing be
realiteite van vandag kan akkommodeer nie. Die resulta
'n ander prentjie. Dit toon dat tussenverbouing 'n hoër
Dit kan dus beskou word as 'n sisteem wat gebruik kan w
oorbrug, en ook gebruik kan word om huishoudelike voe*

1. INTRODUCTION

African agriculture has for the past two or three decades been in a parlous state; and the picture continues to look blurred. The FAO report (1987) indicates a deterioration in access to land for the majority of farmers in the developing world (continued persistence of large inequalities in the size of land holdings), large increases in very small and marginal holdings and increased landlessness. According to other reports, many African households simply lack the means to secure consistent access or entitlement to the amount of food which allows them to lead an active, health live (Spio & Groenewald, 1996). One effective way to overcome these problems may involve land and capital saving innovations and sustainable production systems such as intercropping which will ensure that the very little land and capital in the hands of the small rural farmer are used efficiently through multiple use. This should bring about better yields per unit of land and capital, greater reliability and hence improve household food security. Intercropping or mixed cropping has been practised for years, but the modern concepts about them are relatively new, very little research has been reported. Various commentators of African agriculture have failed to recognise the significance of indigenous developments in this area. Richard (1985) suggested that in extreme cases intercropping was further evidence of the intrinsic "backwardness" of African agriculture. Krants (1979) suggested the following reasons for this attitude:

- The advent of mechanical harvesting, especially in developed countries, caused the practice of intercropping to be abandoned.
- Since intercropping is generally associated with traditional agriculture and subsistence farming at low input, plant breeders concentrated on developing genotypes for monocrops and not for intercropping.
- A general belief that intercropping advantages are manifested only at low levels of inputs and technology.

The topic of intercropping has however lately begun to attract the attention of many scientists (Willey, 1979; Rejat De & Singh, 1970; Norman, 1971; Steiner, 1982). Recent research has shown substantial yield advantages of intercropping at medium to high levels of technology.

i) The nearer the plot is to the home, complex and pronounced is the crop mi

ii) Combinations tend to be largest in the f where the range of possible crop comb greater.

iii) In combinations which involve cash cro crop (eg. Oil palm/plantain/vegetables carries out the bulk of the work on the (oil palm) and the woman is responsi subsidiary intercrops (plantain and vege

iv) In an effort to achieve a desirable r farmer manipulates three variables dates, maturity period and harvest tim scheduling is required. For example quick and long maturity varieties t staggering planting so that different c together (Richard, 1985).

v) In the savanna regions, spatial organ terms of planting are more pronounced forest belts because of the topograph inability to clear and stump the big t forest.

This paper reports on a study on the economic ev intercropping .

3 METHODOLOGY

A survey was conducted in Ajumako-Enyan-Essi in the Central Region of Ghana. One hundred far interviewed with a designed questionnaire. In personal interviews, farm visits and do information were used.

3.1 Evaluation of land productivity

The concept of the land equivalent ratio (LER) w compare the productivity of intercropping to mon LER is defined as the ratio between crop yields i over yields in monoculture under similar m practices or alternatively as the total productivity c crop equal to that of one hectare of intercrop. An to measure it is the area of pure stand that is r produce the same yield as intercrop under management practices.

The statistic used is

$$LER = \frac{\Sigma Cmi + \Sigma Bmi}{\Sigma Cmo + \Sigma Bmo}$$

Where:

LER = Land equivalent ratio
Cmi = Mean yield of crop C, in co with otther crops.
Bmi = Mean yield of the other c combination with crop C.
Cmo = Mean yield of C as monocrop
Bmo = Mean yield of B as monocrop

The ratio could be equal to one , less than one or one. If it is equal to one, the productivity of mon and intercropping is equal. If less than one, mon namely that intercropping is superior to monocr

Table 4: LERs for the various crop combinations

Crop combination	
	Maize
Pure Maize	2 100
Pure Cassava	
Pure Plantain	
Maize + Cassava	1 125
Maize + Plantain	1 025
Cassava + Plantain	

equivalent ratios for maize and cassava intercrops are 0.54 and 0.73 respectively, giving a LER of 1.27. Thus, the total productivity is 27 percent higher than monocropping and the land equivalent ratio is 1.27 hectares. Maize and plantain intercrops yield partial LERs of 0.49 and 0.74 respectively, giving LER of 1.23. Productivity of intercropping is 23 percent higher, and its land equivalent is 1.23 hectares. The partial land equivalent ratio for cassava and plantain are 0.74 and 0.66 respectively, giving a LER of 1.40, indicating that intercropping has a yield advantage of 40 percent over its monocrops; its land equivalent is 1.40 hectares.

Although yields for the both crops are lower with the intercropping system, the combined yields are higher than those under the monocrop system. Willey (197() attributes the higher yields to better use of environmental resources.

4.4 Net revenue analysis

Although the total productivity of intercropping exceeds that of monocropping, farmers will adopt intercropping only if it is economically viable. Table 5 presents a summary of net revenues for intercrops and monocrops. The results in Table 5 show intercropping to have a monetary advantage over monocropping. When maize and cassava, cultivated as monocrops, the expected monetary gains are ¢ 256 187.50 and ¢228 937.50 respectively; when intercropped, the expected monetary gain is ¢415 437.50 . The intercropping system has a monetary advantage of ¢159 250.00 and ¢286 500.00 over maize and cassava respectively. The same analogy can be drawn for the other monocropping and intercropping systems; the intercrop of maize and plantain has a monetary advantage of ¢801 125.00 and

Table 5: Cropping systems and their net revenues

Cropping system	Y
	As monocrop
Pure maize	1 500.0
Pure Cassava	7 637.5
Maize + Cassava	
Pure maize	1 500
Pure Plantain	10 500.0
Maize + Plantain	
Pure Cassava	7 637.5
Pure Plantain	10 500.0
Cassava + Plantain	

* EMV= Equivalent monetary value

Table 6: Yield fluctuations with intercroppi

Crop	Coef A
Cassava/beans	
Cassava/sweet potatoes	
Cassava/maize/sweet potatoes	
Cassava/maize/bean	

Intercropping also protects the soil from water erosion since the land is always occupied (Norman, 1974). There is better control of pes and diseases. The land is in constant cu Competition from quick growing minor crops weeds down in the early part of the season to th of a slower growing main crop. It ensures effe of labour because all crops are weeded in one According to Richards (1985), a single intercro is much easier to protect against birds, roc human thieves than several sole-cropped plots. has shown intercropping to be less vulnerable weeds and diseases because of its greater diversity (Kayumbo, 1976).

It helps to maintain soil fertility (Ruthenber Inclusion of legumes provides nitrogen. It m labour absorption, and uses labour more e (Bains, 1960; Finlay, 1975; Norman,1967). (1981) in Nigeria shows that traditional inte strategies even out labour input profiles.

Intercropping also leads to more efficient environmental resources. Different crops have feeding depths, nutritional requirements an cycles. Some beneficial effects are achieved th impact on soil temperatures and the micr Some crops benefit from conditions of humidity and reduction of soil temperat transpiration adjacent to earlier establishe plants. Others benefit from the windbre provided by tree crops or by a boundary "hedg grain such as sorghum (Richards, 1985).

6. FUTURE RESEARCH

Research needs mainly exist in the following fi

- ***Crop compatibility***

Maximum yield advantage can be obtained onl is an element of complementarily between cr instance, planting a high-nutrient demanding p a low-nutrient demanding plant, eg., cass groundnuts, or a short stature crop in advance crop, eg cowpea and maize or slow growing c plantain and fast maturing crops like maize.

- ***Plant population and spatial arrangemen***

- The total plant population has a determi on the yielding ability of crops, Any p above or below optimum population will competition and under utilization of respectively. Appropriate planting geomet required to alleviate competition as we permit some forms of mechanization.

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