

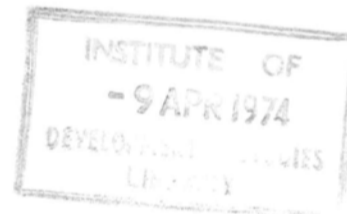
- (a) MAKERERE INSTITUTE OF SOCIAL RESEARCH (P31)  
(b) Rural Development Research Project.

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Preliminary Results of the Kabanyolo Horticultural  
Small-holding.



Note: Rural Development Research papers are written as a basis for discussion in the Makerere R.D.R. Seminars. They are not publications and are subject to revision.

PRELIMINARY RESULTS OF THE KABANYOLO HORTICULTURAL  
SMALL-HOLDING

by

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and S.A.J. Dima.

BACKGROUND:

The horticultural smallholding No.2 was introduced into the smallholdings scheme of the Department of Rural Economy and Extension partly to test the hypothesis that swamp soils could be developed for vegetable growing throughout the year with the aid of irrigation and partly to try new enterprise combinations that would satisfy the need to diversify in the region. The horticultural smallholding has been in operation for over a year.

In the present paper the horticultural smallholding will be reviewed from six points of view. These are:-

- a) To examine the enterprise combination and layout.
- b) To find out effects of its organisation on socio-economic relations in the region.
- c) To find out the influence of Makerere on decision making on the small-holding and compare this with the general managerial abilities of farmers in the region and the level of advice received from the Extension Services.
- d) To evaluate the performance of enterprises in the first year with a view to select those with the best input/output relations.
- e) To determine the feasibility of incorporating sprinkler or gravity irrigation system on the farm and
- f) Finally to recommend (on the basis of these findings and experiences elsewhere with smallholder production) where necessary changes in the present enterprises and organisation.

Farm Resources:

a) The size of the smallholdings is 2.02 hectares; this was chosen on the findings of F.A.O.'s census of Agriculture carried out in 1963. The median and mean size of holdings in Buganda was found to lie between 1.862 hectares and 2.550 hectares respectively (table I).

Table I: Size Distribution of Holdings: Buganda (I)

Holding hectare	Buganda		West Mingo		East Mingo		Mubende		Masaka	
	No.	%	No.	%	No.	%	No.	%	No.	%
0- 0.50	28	7.9	10	8	11	8.7	1	4.7	6	7.4
0.5 - 1.00	49	13.7	17	13.6	14	11.0	3	14.4	15	18.5
1.00- 2.01	126	35.3	45	36	44	34.6	7	28.7	30	37.0
2.01 3.01	72	20.2	26	20.8	28	22.1	5	20.3	13	16.1
3.01 4.02	33	9.2	11	8.8	14	11.0	2	8.1	6	7.4
4.02 5.02	24	6.7	8	6.4	9	7.1	3	10.9	4	4.9
5.02 10.04	19	5.3	6	4.8	6	4.7	3	11.9	4	5.0
10.04+	6	1.7	2	1.6	1	0.8	7	1.0	3	3.7
Total	357	100	125	100	127	100	24	100	81	100

N.B. Figures in 000's.

b) The original sketch of the layout is reproduced in figure I.

The boundaries of the different plots were drawn more or less at random and took little consideration of the contour lines on the area.


Figure I: Original Cropping Plan of Smallholding No.2 1970

Cropping Plan of Vegetable Plot.


Planned Cropping

	A	B	C
1	Lettuce 176 Radish	Cabbage Lettuce 180 Radish	Melon Lettuce 150 Radish
2	Lettuce 168 Radish	Cabbage Cucumber 166	Broccoli Cucumber 162
3	Lettuce 196 Radish	Cabbage Green Pepper 190	Cabbage Green Pepper 160
4	Lettuce 190 Radish	Cabbage Cucumber 190 Spinach	Okray Green Onions Pepper 172
5	Lettuce 204 Radish	Cabbage Cucumber 204 Spinach	Okray Egg Onions Plant Tomatoes 170
5	Lettuce 170 Radish	Cabbage Cucumber 100 Spinach	Okra Egg Plant 176

NB Figures inside plots show  
Area in M<sup>2</sup>.

 Rock  
Outcrop

1970

 Irrigation Area

Actual Cropping

	A	B	C
1	Lettuce 1st Cab. (+) Lettuce 2nd Cab.	Lettuce 1st Melon Lettuce Failed Radish Radish	Lettuce Melon Failed Radish 2nd Radish
2	Lettuce 1st Cab. Radish 2nd Radish	Cucumber 1st Broccoli Cuc. Fail Cuc.	Cucumber 1 Broccoli Cucum. 2nd Failed
3	Lettuce 1st Cab. (+)	Green Cab. Pepper (*)	Green 1st Cab. Pepper (*)
4	Lettuce 1st Cab.		
5	Cabbage Fail Cab. Radish 2nd Rad. Lettuce 3rd Lett.	Egg Plant Cuc. Fail Cuc. Green Pepper	
6	Lettuce Cab.	Egg 1st Plant Failed Cuc Fail Spinach Failed	Okra Egg Plants Failed

(+) Non Irrigated comparable

(\*) Irrigated comparable.

Figure I: Original Cropping Plan of Smallholding No.2 1970

BANANAS		
MUTOKE	SWEET BANANA	BOGOYA
PAW PAWS		
ELEPHANT AND GUATEMALIA GRASSES		
PASSION FRUIT		
VEGETABLES		

Table II Acreage Under Cultivation

<u>Crop</u>	<u>Hectares</u>
Pineapples	0.0447
Bananas	0.4050
Pawpaws	0.3135
Elephant Grass )	0.1931
Guatemala grass }	
Passion Fruit	0.1150
Vegetables (existing)	0.3488
Vegetables plus extension	0.5336
Total area under crop	1.4201

Source: S.A.J. Dima; An Economic Assessment of the First Year of Operations of Kabanyolo Horticultural Smallholding No.2.

Table II above gives the area under cultivation for the crops grown on the smallholding.

The vegetable area was planned to produce in most cases two crops in each plot per year. However this plan was altered partly because the area was not cleared in time, partly because some transplants failed, and partly because crops such as green pepper were allowed to grow too long instead of replanting afresh.

With respect to labour organisation, this farmer provides his own labour and hires one regular labourer at 60/- per month. During peak periods casual labour is also employed. Average working day is 7 hours so that the rate of pay per hour is 28 cents.

Capital has been provided on a loan basis at commercial rates of interest. The capital structure of the holding is given in table III which follows:-

Table III (a) Housing Capital Costs

	No.1 Shs.	No.2 Shs.	No.3 Shs.
Improvement of house	1200	-	-
New house (murrum blocks)		5000	5200
Kitchen	500	1450	1500
Toilet	300	360	400
Water Tank	450	500	850
<b>Total</b>	<b>2450</b>	<b>7310</b>	<b>7950</b>

(b) Farm Development

	No.1 Shs.	No.2 Shs.	No.3 Shs.
Cowshed & water tank	1200	-	1000
Land clearing	300	3800	-
Tractor hire	230	330	525
Sundry equipment	300	250	400
Planting material	100	350	140
Fencing	400	-	2250
Cattle	2100	-	2100
Solo Pump, engine and Water tank	-	1550	-
Hose pipe and Sprinklers	-	1155	-
<b>Total</b>	<b>4630</b>	<b>7435</b>	<b>6415</b>

Sources: E.R. Watts (1970) Notes on Kabanyolo Experimental smallholding (mimeo).  
S.A.J. Dima. Special Project 1971.

At the beginning of 1970 the farmer was paid a subsistence allowance of Shs. 200/- per month, gradually reduced to Shs.100/- when the farmer started getting revenue from vegetables, and finally to Shs. 50/- per month paid for keeping records. The farmer also pays Shs. 2/- per hour for time spent on visitors to the farm and so on.

#### Analysis of Enterprise Performance.

An examination of the physical record sheets reveals that the number of hours spent on the holding by both the farmer and hired labour is 4886 (Dima 1971) as against that of the small holding No. 1 which has been found to be 3276 (Hall 1969) which would suggest that horticultural enterprises in general require more labour. This is also reflected in the fact that the farmer in the horticultural holding spent less time on non-farm activity (1981.5 hours) in the first year compared to that of small holding No.1 (2338 hours), despite the fact that the latter has additional assistance from his wife.

The labour requirements of the individual enterprises on the other hand indicates that vegetables and pineapples require more labour than any other crop such as banana.

#### The Sprinkler Irrigation Trial

Sprinkler irrigation has been developed for the production of valuable crops such as fruits and vegetables. The capital cost of irrigation turns out to be 2700/-, but there has been frequent breakdowns which has raised running cost. Since only 12 plots (of 100 square meters) were irrigated in 1970 average running cost plus repairs was 36/80 per plot.

It was possible to compare yields of two crops - cabbage and lettuce - under irrigated and non-irrigated conditions and the result indicates some response to irrigation. For irrigated plots the gross margin realised were 25/70 and 2/30 respectively for lettuce and cabbage.

The feasibility of sprinkler irrigation on the vegetable plots was also investigated by a simple L.P. matrix. The cost of inputs were estimated by using data from various sources: fertiliser and insecticide from <sup>Kampala</sup> shops; labour inputs records from the holding and Kawanda Research Station, yield estimates from Will's work<sup>(4)</sup> and average prices.



The results of the L.P. solution suggests that Sprinkler irrigation does not pay at low levels of input of management and production.

Unfortunately the average level of management and input used are low in the region/ <sup>as a whole.</sup> For example a trial carried out at Kawanda for 5 years revealed that it requires at least 14,000/- capital cost to develop a profitable holding (Wills 1970). This is only possible for rich farmers who want to specialise on market gardening.

Enterprise Gross Margins  
Irrigation versus non-irrigation

The optimal L.P. plans for the vegetable area are summarised in the table which follows:

Table IV: Vegetable Area Optimal Linear Programme.  
Plans (without Fertilisation) Total Area 3625m<sup>2</sup>

<u>Combination No.</u>	<u>Gross Margins</u>	
	<u>Non-Irrigated</u>	<u>Irrigated</u>
1. Total Revenue	421.10	650.55
Total Variable costs	67.15	342.75
Gross margin	<u>353.95</u>	<u>307.80</u>
2. Total Revenue	460.10	655.50
Total Variable costs	70.75	338.75
Gross margin	<u>389.35</u>	<u>316.75</u>
3. Total Revenue	487.25	779.68
Total Variable costs	69.25	319.45
Gross margin	<u>418.00</u>	<u>460.23</u>
Total Gross margins	1161.30	1084.78
Mean Gross margin =	<u>390.00</u>	<u>362.00</u>

Source: S.A.J. Dima, Op. Cit.

It is apparent from this that Sprinkler irrigation does not

induce sufficient yield response to overcome its cost. As was indicated earlier Sprinkler irrigation is uneconomic at low levels of output. An attempt was therefore made to raise the level of output by introducing fertiliser to test the optimal plans. The summary of the results are shown below:

Table V: Summary of Vegetable Area Optimal Linear Programme Plans (with Fertilisers)

	<u>Non-Irrigated</u>	<u>Irrigated</u>
Total Revenue	823.10	862.68
Total Variable costs	249.99	766.22
Gross Margin	<u>573.11</u>	<u>96.46</u>

Source : S.A.J. Dima, Op.Cit.

Table V gives the impression that there is much more response to fertilizers than irrigation. The combined effect of fertilization and irrigation is almost negligible.

In other words water stress on vegetables during the dry spell is not great as long as only two vegetables are grown on each plot; one in the first rains and the other in the second rains. Table V also reveals a very crucial point to be considered by the small holder planners, <sup>namely</sup> whether to incorporate sprinkler irrigation into the scheme at its early stages or whether to introduce fertilizers and lime as a must especially in swamp soils. At present there is no plan perceived as to how the fertility and  $p^H$  of the soil is going to be maintained except perhaps that the farmer will be advised to fertilize and lime when he has already experienced setbacks.

## 2. Individual Vegetables

This gross margin analysis would not be complete without a closer look into the gross margins of some of the vegetables.

It should be pointed out, <sup>however, that</sup> a large number of vegetables were introduced in the first rains some of these failed or have been abandoned for a number of reasons. From talking to the farmer four reasons stand out:-

- (i) Inadequate cropping plan before the first rains so that some of the vegetables were planted out of season.

- (ii) There was some disease attack on some of the vegetables like cucumbers.
- (iii) No knowledge of the vegetables physiology was considered as vegetables like cucumbers that need a lot of water were planted first before the drought period proceeding the second rains.
- (iv) The ecology of the environment was

not considered for example the okra was located near the north-east end of the vegetable area and as a result monkeys were the first to harvest the okra crop.

Table VI below shows the optimal linear programme plans for the vegetables that gave some yields on the swamp area.

Table VI. Optimal Linear Programme plans with Fertilizers and spraying. (Non-Irrigated).

Vegetable	G.M. Shs/Ar.	G.M. Shs/Ar. Will Estimates.
Radish	16.00	21.25
Spinach	27.20	27.20
Beans	27.26	28.90
Cucumber	28.28	49.75
Lettuce	38.85	55.25
Green Pepper	49.15	36.90
Cabbage	49.48	40.00
Egg plants	53.18	61.00
Tomatoes	118.80	178.30

Note that the gross margin 'Will Estimates' were calculated from Will's yield estimates in 'Vegetable Growers Guide. Conversion to gross margins per Ar. were converted by Dima, Op Cit.

It should be realized that the gross margins are bound to vary with the season in regards to yields as well as prices of inputs and produce in the market. On the basis of the data in table VI, it is recommended that tomatoes, egg plants, cabbage, green pepper, lettuce and cucumber be grown or given priority in that order. But it is important that the vegetables to be grown be selected on the basis of other factors such as pest and disease control, demand in the market, ease of production and the length of period of maturity. It is interesting to note that the farmer has already made similar findings and in the first rains of 1971 has been growing tomatoes, green pepper, cabbage, lettuce, spinach and onions.

3. All Enterprises.

Table VII shows gross margin estimates for all the enterprises on the small-holding. Pineapples stands out as the most profitable enterprise, followed by pawpaws, vegetables, passion fruit and bananas in that order.

It should be noted that the estimates of vegetables is rather conservative (for non-irrigated) and is therefore expected to increase as the farmer gains experience and uses every plot for growing catch-crops. Calculations based on the area or planned area under each enterprise gives an estimate of 6400/- as the farmer's potential total cash farming surplus. This is close to the planned figure of 7600/- (table VIII).

Table VII: Summary of Gross Margin Analysis (Estimates) of Kabanyolo's Horticultural Small holding.

	1	2	3	4	5	
	Pine- Apples	Bananas	Paw Paws	Passion Fruit	Vegetables Non- Irriga- ted.	
Estimated yields Kg/Hectere	20455	14550	25000	2273	Variable	
Price cts/Kg	110	20	20/Fruit	45	Variable	
Revenue in Shs	22500	2910	5000	10228	6250	9750
Total Variable costs	10545	848	750	7300	2000	7000
G.M. Shs/Hectere	11955	2052	4250	2928	4250	2750

Source:

- 1 and 4 : calculated from estimates/Acre for Kabanyolo crops by Dr. Wurster.
2. Gross Margin analysis of Kabanyolo crops by Dr. Willy.
3. Estimates by writer based on farmers information.
5. Calculated from estimates by Will

It is further emphasised that better husbandary practices will generally increase yields. These include proper bed preparation, spacing, planting and weeding in time and harvesting when the vegetable is at its highest market value. This should further increase the farmers cash surplus.

1. Trading Account

1. Table VIII is a summary of the budget and actual income and expenditure for 1970. The cash income from crops is much less than the budgeted one. This can be explained by the fact that at the end of the year most of the enterprises were not yielding except for the vegetables which realized 956/-.

TABLE VIII: Summary of Budgeted and Actual income and Expenditure 1970.

	<u>Budgeted</u>	<u>Actual 1970</u>
Cash Income from crops	*7600.00	956.00
Produce Consumed	+ 600.00	46.85
Other Income	-	20.00
Salary	-	2000.00
Valuation charge	-	5497.00
<b>Total Income</b>	<b>8200.00</b>	<b>8519.85</b>
<hr/>		
Farm cash Expenses	* 860.00	677.80
Depreciation - Equipment	37.50	37.50
<b>Total Farming Expenses</b>	<b>897.50</b>	<b>715.30</b>
Farming surplus	7302.50	7804.55
Cash living expenses		2020.00
Produce consumed		46.85
<b>Total living expenses</b>		<b>2066.85</b>
Surplus for saving		<u>5737.70.</u>

\* Quoted from 'Plan' of Horticultural small holding drawn by Extension Assistant.

+ Adopted from J.P.G. Webster tables 2 and 4.

Note that the farm cash expenses is lower than that budgeted - partly because the area planned for vegetables was not all opened up and partly because in the opened up area some plots remained blank throughout the year. Other factors have already been pointed out earlier.

Although table VIII shows a comfortable surplus for savings of 5737.70, it must be pointed out that most of this is valuation change - 5497.00 thus leaving apparently 240/- in the hands of the farmer. What is interesting to observe in the table is the apparent superseding of the planned total income with that 'realized' by the farmer. Subsequently the farming surplus has maintained higher level than that budgeted for. Unfortunately it should be noted that the budget was incomplete and therefore impossible to perform complete comparison with the performance of the enterprises in the first year.

## 2. Balance Sheet.

Table IX is a statement of the financial state of small holding No. 2 as at 31st December, 1970. It indicates that outside claims left the farm a net worth of 1409.00. This is slightly higher than the 1330.00 for small - holding No. 1 after one year's operation.

TABLE IX Balance Sheet of Small holding.  
No. 2 as at 31st December, 1970.

<u>Assets</u>	<u>Shs.</u>	<u>Shs.</u>
Sundry equipment	250.00	
Less depreciation	37.50	212.50
Valuation of crops		
Pineapples		330.00
Bananas		1200.00
Pawpaws		981.00
Mulch grass		686.00
Passion fruit		800.00
Vegetables		1500.00
TOTAL ASSETS		5709.50
<u>LIABILITIES</u>		
Short term loan	500.00	
Less repayments	-	500.00
Long term loan	3800.00	
Less repayments	-	3800.00
Total Liabilities		4300.00
NETWORTH		1409.50

NB. Valuation figures have been calculated from government compensation statistics for the various crops as supplied by the Extension Assistant.

Note that the balance sheet reveals further that most of the surplus is accounted for by the valuation of crops and indeed in this case the networth is more than accounted for by the crop valuation. Although the short-term loan for the passion fruit has been written off by the Department of Rural Economy and Extension this has not changed the situation.

The long term loan was used for clearing the land and the terms are that the farmer has to start repaying the loan as well as interest after five years.

The findings in small holding No. 1 show steady increase in produce consumed by the farmer<sup>7</sup>. There is no valuation increase of the crops expected. This means that the farmer has to find combinations or adjustments in the enterprises that will give him more cash to enable him to pay the loan and interest and at the same time increase the level of inputs. In the section on gross margin analysis, it was pointed out that some of the estimates are conservative. Further it was indicated that not all the land planned to be cropped was opened up. These alternative methods of increasing cash incomes should then be brought into the farm activities. In addition the selection of enterprises on the basis of their marketable values should be considered very seriously.

As previously discussed, the increase in outputs depends on the ability of the farmer in adopting a package of practices rather than say providing good seeds or irrigating alone. Since the ordinary farmer in the region has a low level of sophistication to be able to adopt package practices, his level of output is bound to increase slowly and so will be his incomes. This means that if he is given loans he should be given more time before he starts repaying the loan and interest if he is not to be discouraged from adopting innovations that require him to borrow money. It should be noted that as soon as a farmer sees himself paying most of his incomes for loan after one year of moratorium as is the case with short-term loans at the moment, he will have little incentive to work harder the following year. But money lenders need their money back perhaps to re-invest at a higher rate of interest and are little sympathetic with conditions that farmers face. This is even more aggravated when 'bad years' occur. It is for these reasons that the effort of the Government in setting up a cooperative Development Bank for providing loans to farmers should be commended. It is hoped that better loan terms and facilities for supplying the loans to the farmers will be provided. It should be emphasised that some of the Cooperatives are rather inefficient and some of the Co-operative chiefs are corrupt so that the Cooperative Development Bank loaners should make efforts to encourage initiatives and give incentives to farmers who may not be in the cooperatives, but are in a position to use the loans effectively by contributing to increased outputs in agriculture.



### Conclusion and Policy recommendations

The following conclusions emerge from this brief paper:

First, that no adequate planning of the farm lay<sup>out</sup> was done before the first rains especially on the vegetable enterprise and as a result the cropping of some of the vegetables fell out of season and resulted in failures <sup>notably</sup> cucumbers and okra. Following from inadequate planning of location of the different enterprises, some of the <sup>crops</sup> like passion fruit were located where monkeys are easily accessible.

Second, that individual soil requirements such as p<sup>H</sup> were not considered and as a result some of the vegetables for example cucumber failed.

Third, too many vegetables were tried at the same time and subsequently the size of area under each of them was uneconomic as vegetables require intensive management. This might be beyond the capability of average farmers in the region especially when the particular vegetables gives a small return on capital investment.  
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Fourth, that some farmers are impressed by the 'appearance' of the smallholding and its objectives but expressed the fear that it is beyond their resources as the smallholding is flourishing under the umbrella of Makerere.

Fifth, that <sup>the</sup> on/basis of the records of the first year, the farmers level of recording is rather low and analysis of yields, incomes, allocation of labour on the various enterprises and operations within an enterprise has been very difficult.

Sixth, that the response to irrigation is uneconomic with the present level of inputs and management. Irrigation might pay if applied with other package practices such as following the recommended rotation, liming, fertilizing and using any empty plot for growing catch crops.

Alternatively irrigation might pay if a cheaper probably hand operated pump is developed. This would be suitable for farmers in the region in terms of its cost and <sup>the</sup> technical knowledge required to operate it.

On the basis of the foregoing analysis some suggestions for improvement of the Kabanyolo Horticultural Smallholding. may be attempted;

First it would appear that there is need to reorganise the farm rotation based on the findings to date and taking into consideration the recommendation for vegetable growing as worked out at Kawanda.

Second, that to operate more economically some of the vegetables like radish, cucumbers, and spinach should be discarded on the basis of the present low demand for them in the market, susceptibility to disease and present gross margins.

Third, that the passion fruit plot be shifted to the area near the pineapples to allow protection from monkeys. The present passion fruit plot should then be planted to 'lusuku' and in future part of the present lusuku area be cleared for pineapples as it gives the highest gross margin. Finally part of the area under mulch should be opened for reserve crop such as cassava or sweet potatoes.

Fourth, that the conflict arising from the aims of the smallholding namely extension and experimental aims should be minimised by limiting visitors to come to the smallholdings at certain days or certain hours during the day without interfering with the farmer's programme of work.

Fifth, that the farmer be advised well in advance of the rainy or planting period on crops he wants to plant but that the final choice of the combinations be left to him.

Sixth, that the farmer should be regularly checked in his records. The newly introduced system of field note book and monthly summary of labour allocation by hours on the various enterprises, recommended should lead to production of high quality data. This would enable the assessment of the true farm situation.

Seventh, that the Department of Agricultural Engineering be encouraged to develop a similar cheaper engine and pump for sprinkler irrigation with a view to recommending it to farmers in the region. The type of components to be used should be mass produced (similar lines as for the Kabanyolo Specials).

In the meantime if the engine and pump is repaired, it should be used to irrigate vegetables with high gross margins such as tomatoes, green pepper, cabbage and lettuce.

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