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MONITORING CHANGES OF TECHNOLOGY EVALUATION AND ADOPTION - OYUGIS AND KENDU BAY

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SSIRU - ICIPE

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I Introduction - The Project

SSIRU has for the last three years collaborated with CPRP in the UNECA/ICIPE/Kenya Government project on "Reduction of Food Losses Through IPM and Use of Small-Scale Low-cost Farm Equipment" in Oyugis and Kendu Bay Divisions of South Nyanza District. ICIPE is testing two components of a pest management package, developed by the CPRP, under field conditions at Oyugis and Kendu Bay. The components include inter-cropping and other cultural practices and host-plant resistance/tolerance to the major stem-borers, Chilo partellus and Busseola fusca.

Field trials were carried out in the rainy season in Oyugis and Kendu Bay by CPRP and on the SSIRU side, data on issues in monitoring technology adoption was collected.

Oyugis Division has two reliable rainy seasons i.e. the long rains (LR) and short rains (SR), while Kendu Bay Division which is drier has only one season. A rainy season here refers to a period with sufficient rains to grow a whole crop to maturity without irrigation supplement.

In each of the two divisions, 25 participating farmers cultivating between 3 to 5 acres of land and willing to allocate one acre for the project experiments/demonstrations were selected randomly at the beginning of the project in

1986. In the 1989 LR season, 25 farmers in Oyugis participated while 24 farmers in Kendu Bay participated. The farmer who did not participate in Kendu Bay had family problems.

During the three years the project has been on, all the participating farmers have planted the ICIPE's cultivars of maize, sorghum and cowpea as part of an IPM package on the one acre experimental plot. The following seeds were provided to the farmers by ICIPE in LR 1989.

Maize - KRN1, V-37 and Hybrid 511/622 (Hybrid 511 in Kendu Bay and Hybrid 622 in Oyugis)
Sorghum - LRB5 and LRB8
Cowpea - ICV2

Inter-cropping of maize and sorghum with cowpea was recommended. The suggested planting arrangement was one row of cereal alternating with one row of cowpea at a spacing of 90 cm by 30 cm, this giving a ratio of 1:1 of cereal to cowpea.

Farmers were given 50 kg of D.A.P. fertilizer in LR 1989, the same as that given in the previous LR seasons.

In addition, farmers had been provided the following equipment at the beginning of the project in 1987.

1. Ox-plough + draft + chain
2. Panga + Jembe + hoe
3. Maize sheller
4. Improved grain storage structure (jointly constructed with the farmers)

This report is based on the results of 100 survey questionnaires administered as follows:-

1. 25 project participating farmers in Oyugis
2. 25 project non-participating farmers in Oyugis
3. 25 project participating farmers in Kendu Bay
4. 25 project non-participating farmers in Kendu Bay

Definitions of Terms Used

1. "Project participating farmers" are 50 specially selected farmers for the project experiments/demonstrations.

2. "Project non-participating farmers" are a set of 50 farmers specially selected around the participating farmers so as to help monitor technology diffusion. They are, therefore, different from the bulk of the non-participating farmers in the two divisions.

3. "Experimental Plot" refers to the 1 acre demonstration/experimental plots on the project participating farmers' fields which are set aside for the ICIPE IPM practices. Surrounding farmers are also expected to learn from these plots.

4. "Farmer's Own Plots" (FOPs) refer to the rest of the project participating farmers' plots; i.e., farmers' total land, less the experimental plots.

II Agronomic Practices

Inter-cropping is an integral component of ICIPE's IPM technology in the Oyugis/Kendu Bay project areas. Specifically, the following combinations were recommended to the project participating farmers in LR 1989.

1. LRB5 + ICV2
2. LRB8 + ICV2
3. V37 + ICV2
4. KRN1 + ICV2

where LRB are sorghum varieties, ICV2 is cowpea while V37 and KRN1 are maize varieties.

In both Oyugis and Kendu-Bay, all farmers who participated planted the above four combinations on the demonstration/experimental plots as recommended. Some farmers also planted hybrid maize plus ICV2 on the same plots, while the majority planted this final combination on FOP. This was as instructed. All these seeds were provided by the ICIPE, as was the fertilizer used on these plots.

Table II-1 shows crop combinations in project FOPs while Table II-2 shows crop combinations for non-participating farmers.

Table II-1 Some Crop Combinations in FOPs

Crop Combinations	Oyugis % Farms	Kendu Bay % Farms
Maize + ICV2	36	4
Maize Mono-crop	36	33
Maize + Beans	7	21
Maize + Groundnuts	4	25
Maize + Sorghum	4	63
Sorghum + Beans	4	4
Sorghum + Cowpea	4	17
Sorghum Mono-crop	-	13
Cowpea Mono-crop	-	-
Sorghum + Maize + Cowpea	-	4
Sorghum + Cotton	—	4
Groundnuts mono-crop	-	4
Simsim	-	4
Pineapples + Beans	4	0

Table II-2 Some Crop Combinations in Non-participating Farmers' Plots

Combinations	Oyugis % Farms	Kendu Bay % Farms
Maize + Cowpea	24	21
Maize + Beans	40	42
Maize + Groundnuts	24	26
Maize + Sorghum	28	47
Maize + Sorghum + Cowpea	-	32
Maize + Yams	-	11
Maize + Millet + Beans	-	5
Maize + Greengrams	-	5
Maize + Sorghum + Cowpea + Beans	-	5
Maize + Sorghum + Greengrams	-	5
Maize + Sorghum + Groundnuts	-	5
Maize + Sorghum + Beans	16	21
Maize + Fingermillet	4	-
Maize + Cotton	-	5
Maize Mono-crop	20	-
Sorghum + Beans	16	21
Sorghum + Cowpea	8	11
Sorghum + Beans + Cowpea	-	5
Sorghum + Groundnuts	-	11
Sorghum Mono-crop	4	-
Groundnuts + yams	-	11
Groundnuts Mono-crop	4	-
Beans Mono-crop	4	-
Cowpea Mono-crop	-	-

The ratio of cereals to legumes in FOPs and non-participating farms varied greatly between farmers and among combinations. These combinations are many considering that the farmed land is normally about 3 acres of land, as pointed out later. Moreover, the planting style in FOPs is often random while experimental plots are wholly linearly planted.

The above combinations show that the Oyugis and Kendu Bay farmers have several types of inter-crops. In Oyugis, 8 combinations were reported while in Kendu Bay 12 combinations were cited by the project farmers. Among the non-participating farmers 12 combinations were reported in Oyugis while in the Kendu Bay farms, 18 different crop combinations were reported. We are aware that more combinations exist and these include intercrops with bananas and coffee. In addition, farmers plant several varieties of the same crop.

One possible reason for this multi-complex cropping pattern would be that the farmers produce their own food; i.e., they do not rely on marketed grain. Thus, they have to provide their own food variations in their farming systems.

Another likely reason for diversified agricultural production among reource-poor small-scale farmers would be

that of risk aversion to crop failure. The more weather sensitive Kendu Bay division has more crop combiantions than Oyugis division.

This complex cropping pattern has been found to be prevalent in Rusinga Island of the same district (Ssennyonga, 1989)[1]. While Ssennyonga offers little explanation for this system, he quantifies the crop combinations found in the Island, and the production systems in general.

Diversified food crop production in such small holdings is unlikely to yield optimum economic benefits, considering that each cropping system is likely to require its own unique husbandry and marketing. Economies of scale are unlikely to apply in such a system. Reasons as to why these small-scale and often resource-poor farmers choose such a system in unison could be many and varied. To this end studies on farmers' insurance-risk strategies and rationale for multi-cropping system will be undertaken.

III RESOURCE INVESTMENT

A: LAND PREPARATION

The project staff monitored usage of the various equipment provided, and the acreage ploughed, harrowed and planted using these equipment.

(i) Ploughing

The following table shows the percentage of farmers who ploughed using the tractor, ox-plough and jembe.

Table III-1 Ploughing Equipment

		Tractor % farmers	Ox-plough % farmers	Jembe/Hoe % farmers
Oyugis	Part.	0	84	12
	Non-part.	4	84	52
Kendu Bay	Part.	67	13	17
	Non-part.	63	26	53

Source: Survey data

Part. refers to project participating farmers

Non-part. refers to project non-participating farmers

Thus, most of the ploughing in Oyugis was done by ox-plough for both project farmers and non participating farmers. About 84 per cent of each of these two categories of farmers used ox-plough for ploughing at least part of their land. It may be worth noting, however, that 52 per cent of the non-participating farmers used jembe/hoe for ploughing, while only 12 per cent of the project farmers used jembe/hoe for this purpose. As noted earlier, all project farmers were provided ox-plough plus accessories and jembe+hoe+panga to help in land preparation. The above data would imply that the ox-plough is being well utilized and that Oyugis project farmers have an advantage over the non-participating farmers, many of whom do not own ox-ploughs.

The Kendu Bay data is different. Well over 60 per cent of the Kendu Bay farmers use tractors to plough their land. Only 13 per cent of the project participating farmers used ox-plough for land ploughing, while 17 per cent used the jembe. The figures differ slightly for the non-participating farmers, with 26 per cent using ox-plough and 53 per cent using jembe. Although the number of farmers who used tractors is high for both categories of farmers, the data on jembe and ox-ploughing suggests that those project farmers who used tractors ploughed more land with the tractor than the corresponding non-participating farmers.

It is worth noting that commercial tractor ploughing costs between Ksh 300.00 to Ksh 400.00 per acre. It is not unusual therefore to find a farmer hiring a tractor to plough only part of his land.

(ii) Harrowing

Many farmers combined the use of different equipment. The following table shows the percentage of farmers who used the various equipment for harrowing their land.

Table III-2 Harrowing Equipment Usage (% farmers)

		Tractor	Ox-Plough	Jembe/hoe
Oyugis	Part.	0	88 (76)	8 (8)
	Non-part.	4	76	48
Kendu Bay	Part.	21 (17)	21 (17)	13 (13)
	Non-part.	11	16	58

() - FOPs

All the Oyugis project farmers harrowed their land at least once. Most of the land was harrowed using ox-ploughs, with only two farmers using jembes. The Oyugis non-participating farmers also harrowed their land, but 48 per cent of them used jembes.

In Kendu Bay, harrowing was not done by many of the project farmers. However, 21 per cent of the project farmers and 11 per cent of the non-participating farmers used tractors to harrow. Over 50 per cent of the non-participating farmers used jembe to harrow. As with the ploughing equipment, we notice that ox-ploughs are not widely used by Kendu Bay farmers for harrowing work.

Several reasons have been given for low use of ox-ploughs in Kendu Bay, which probably the project did not foresee when they gave all the participating farmers ox-ploughs plus accessories. The first reason often given by the farmers and project staff is that the Kendu-Bay cattle died during an outbreak of tryponosomiasis (or some other cattle plague) in 1988. The percentage of farmers who currently own oxen is discussed subsequently.

Another reason for low use of ox-ploughs would be due to the fact that the Kendu Bay soils, unlike those of Oyugis, become dry and hard during the rainy season and therefore it is more convenient to use a tractor for land preparation. Both arguments show the need for the tractor the project has promised the farmers. This will start the ploughing work beginning 1990, and hopefully Kendu Bay farmers will be given priority in its services.

(iii) Planting

The table below shows the planting equipment used by the various farmers in Kendu Bay and Oyugis.

Table III-3 Planting Equipment Usage (% farmers)

		Tractor	Ox-plough	Jembe/hoe
Oyugis	Part.	0	4 (12)	92
	Non-part.	0	42	92
Kendu Bay	Part.	0	0	100
	Non-part.	0	4	100

() - FOP

Part. - Participating

Non-part. - Non-participating

Most planting is done by jembe/hoe in Oyugis and Kendu Bay. However, it is interesting to note that 42 per cent of the Oyugis nonparticipating farmers use ox-plough to plant their seeds. We shall endeavour to find out the reason for this in the next season, and also to see if this trend continues. The situation in Kendu Bay was somewhat different with all farmers using jembe/hoe to plant. In addition to the oxen problem this may also suggest that the

Kendu Bay farmers do not face as severe a labour constraint as do the Oyugis farmers, given that at least 21 per cent used the ox-plough for ploughing.

The one Oyugis project farmer who used ox-plough for planting on the experimental plot did so because of labour problems as she was in hospital for a long time. Her crop was also poorly weeded and her yield was low.

In relation to planting and equipment, we looked at the amount of land utilized during the last season. We found that about 72 per cent of the Oyugis project farmers planted seed on the required one acre experimental plot while 4 per cent planted half an acre and 20 per cent planted between 1.25 and 2 acres. These farmers planted an average of 1.8 acres each on FOPs. Thus, the average Oyugis farmer utilized about 2.8 acres of land during the 1989 LR season.

In Kendu Bay division, over 83 per cent of the project farmers allocated 1 acre each for ICIPE experiments/ demonstrations as required. The rest of the farmers allocated less than an acre each. The average acreage planted as FOP was 2 acres, ranging between 0.25 to 6 acres. Thus, Kendu Bay project farmers planted an average of 3 acres in LR 1989 which was slightly higher than that of Oyugis. This probably reflects the higher population

density in Oyugis division, but may also be related to the fact that Oyugis has two cropping seasons in a year.

B. Equipment Ownership and Draught Power

The project provided land preparation equipment to the farmers, and so most farmers own this equipment. However, due to various constraints, many farmers hired land preparation equipment. The hired equipment was either tractor or ox-plough. Table III-4 below shows the percentage farmers who hired such equipment.

Table III-4 Use of Hired Equipment for Land Preparation (% farmers)

	Oyugis % farmers	Kendu Bay % farmers
Participating	12	71
Non-participating	68	68

In addition to the above, a further 8 per cent Oyugis project farmers said they shared/borrowed equipment from neighbours, but did not pay for this. The high Kendu Bay

figure of 71 per cent project farmers hiring equipment is due to the fact that Kendu Bay farmers used hired tractor to plough, while those in Oyugis used project provided ox-ploughs.

It is important to note that none of the project farmers owns a tractor and these are hired from the government or private firms/individuals. The Lake Basin Development Authority is one of the government bodies that runs tractor hire services in Kendu Bay division.

On the question of oxen ownership, table III-5 refers.

Table III-5 Oxen Ownership (% farmers who own oxen)

	Oyugis	Kendu Bay
	%	%
Participating	64	21
Non-participating	28	16

About 64 per cent of the Oyugis project farmers owned oxen, ranging from 1 to 5, with an average of 3 oxen per family. In addition, twenty per cent used hired oxen, while a further 24 per cent shared animals with their neighbours.

The number of non-participating farmers who own oxen in Oyugis is much smaller than that of the participating farmers. This could be associated to ox-plough ownership by most of the participating farmers.

In Kendu Bay, only 21 per cent of the participating and 16 per cent of the nonparticipating farmers own oxen. The low figures are possibly related to the recent mass cattle deaths earlier referred to. Approximately 13 per cent of the Kendu Bay project farmers hired oxen while 21 per cent shared.

The ox-plough drivers were usually exchange labour, co-owners, family and permanent labour, or a combination of these. Very few were casual labourers.

IV Purchased Inputs

A Fertilizer

ICIPE has given project farmers 50kg of D.A.P. fertilizer in each LR season for use on the experimental/demonstration plots. Approximately 96 per cent of the Oyugis project farmers utilized all the 50kg of fertilizer but one farmer lost all her fertilizer and other belongings in a house fire. Only 8 per cent of the farmers reported having bought inorganic fertilizers for application on FOPs. They bought D.A.P. and C.A.N fertilizers.

In Kendu Bay, all project farmers utilized the fertilizer provided. However, none of the Kendu Bay project farmers reported having bought fertilizer for use on FOPs.

On non-participating farmers, the situation differed considerably with a higher per cent of farmers in this group having purchased fertilizer. In Oyugis Division, 44 per cent of the farmers said they purchased inorganic fertilizer and this was mainly purchased from the local KGGCU stores. The purchased amounts ranged from 6kg to 100kg and the farmers involved spent between Ksh 65.00 and Ksh 720.00 on it.

In Kendu Bay, only one non-participating farmer applied inorganic fertilizer, and he reported having applied 4kg only. This, he said, he received as subsidy, he did not buy it himself.

We can, therefore, conclude that Oyugis farmers are more able to purchase fertilizer than Kendu Bay farmers. One possible réason for this situation could be that the Oyugis land is more exploited and the soils more depleted due to two cropping seasons in a year. Another reason would be related to the fact that there is no local supplier of fertilizers in Kendu Bay. Investigations will also look at whether the income levels of the two divisions differ significantly.

Investigations on use of farm yard manure (FYM) showed that more non-participating farmers than project farmers use FYM.

Table IV-6: Use of FYM (% farmers)

	Oyugis % farmers	Kendu Bay % farmers
Participating	20	4
Non-participating	52	21

The above data shows that there is low use of FYM by most of Kendu Bay farmers. This would possibly be related to the lower numbers of cattle in the area in relation to Oyugis. Most of the FYM used was from farmers who own cattle. Only one farmer in Oyugis bought manure and none in Kendu Bay among both categories of farmers.

The Oyugis farmers should be encouraged to increase use of FYM. Currently many of them complain that application is difficult because they do not have wheelbarrows. Worse still, from the above data and also the oxen ownership data, many Oyugis project farmers seem to be substituting FYM with the provided inorganic fertilizers.

B. Seed

The project farmers were all provided with maize, sorghum and cowpea seed as explained in an earlier section.

Except for one farmer who lost her belongings in a housefire, and one other who did not plant V37, all the Oyugis project farmers generally planted the seed as specified. Only one project farmer was reported as not having planted maize in Kendu Bay, the rest planted as specified.

All the above seed was planted in the experimental plot, except for hybrid maize which the farmers were free to plant where they wished.

Different crops and varieties were grown on FOPs in both divisions. Some of these are hybrid maize, farmers' own maize, farmers' own sorghum, cowpea, beans, bananas, groundnuts and cotton. Most of these were intercropped (see agronomic practices section). Only one farmer planted farmer's own cowpea and this was in Oyugis.

Approximately 56 per cent of the Oyugis project farmers reported having planted own seed of one type or other, 12 per cent received seed as gift/subsidy while one farmer did not do any planting on his FOP in LR 1989.

In Kendu Bay too, one farmer did not plant on FOP. All 23 project farmers who planted on FOP said they planted own seed. About 17 per cent also said they received some seed as gift/subsidy. The high use of own seed could be attributed to cash resources, non-availability of treated seed in the division and faith in own seed, among other reasons.

Any package seeking to introduce seed that needs to be purchased every planting season should necessarily take into account the current seed buying pattern, the cost and

availability of seed, and the income levels of the local community.

V. Labour use

Table V-1 shows the average cost of labour used in Oyugis Division LR 1989 among the participating farmers.

The table shows that weeding consumes most labour, requiring an average Ksh 700.00 to cover one LR season. Weeding is normally done twice each season.

Harvesting and transporting require about Ksh 300.00, which is quite high. Planting requires Ksh 276.00 while ploughing costs Ksh 225.00.

Harrowing takes least money, and only 6 farmers harrowed twice.

The above costs include both costs for hired labour and the imputed costs for family and exchange labour. Thus, a farmer need not have all this money to pay for his labour, as family labour is the most important source and is not directly paid for.

Table V-2 shows the hired labour costs for the Oyugis project farmers in LR 1989.

Table V-1: Total Labour Costs (Ksh) - Oyugis Project Farmers - LR 1989

	Ploughing	Harrowing 1st	Harrowing 2nd	Planting	Weeding 1st	Weeding 2nd	Harvesting & Transport	Processing & Storage	Total Cost
Average Cost	225	150	65	276	431	268	295	162	2064
No. of farmers	25	23	6	25	25	21	25	17	17

Table V-2: Total Hired Labour Costs - Oyugis Project Farmers - LR 1989

	Ploughing	Harrowing	Planting	Weeding 1st	Weeding 2nd	Harvesting & Transport	Processing & Storage	Total Cost
Average Cost	224	244	210	263	127	246	115	787
No. of farmers	8	10	11	10	11	7	2	14

Unfortunately full data for hired labour was not collected for all the project farmers who participated in LR 1989 operations. Two of the farmers did not hire any form of labour and used family labour entirely. Most farmers hired labour for harrowing, planting and weeding. Weeding had most hired labour because there are two weedings and it cost the farmers an average of about Ksh 373.00.

An average Oyugis farmer thus requires to have ready cash of about Ksh 790.00 per season to spend on labour. This is about Ksh 130.00 per month.

Farming labour is seasonal and is required at particular times of the year while it is hardly required at other times.

VI - Yields

The 1989 LR yield data for project farmers in both Oyugis and Kendu Bay division is shown on the table VI-1. It shows that the ICIPE project cultivars of sorghum and cowpea performed better than the farmers' own cultivars, and we attribute this to the insect-pest resistance and high yielding potential of the ICIPE cultivars. The maize performance was not as encouraging.

Table VI-1: Yields in Kg/ha - Participating Farmers

	Oyugis	Kendu Bay
	Kg/ha	Kg/ha
Maize		
KRN1	1479	1434
V37	1558	1804
H622/511	2097	1817
FOM	2122	1838
Sorghum		
LRB5	1774	1629
LRB8	1942	1772
FOS	1575	1060
Cowpea		
ICV2	145	144

Source: Survey data
FOS - Farmers' Own Sorghum
FOM - Farmers' Own Maize

The yields of marked out parcels of land measuring 25m² were harvested and weighed by the project technicians. These were extrapolated to yield in kg/ha.

Approximately 44 per cent of Oyugis and 100 per cent of Kendu Bay participating farmers planted farmers' own sorghum. This is generally Andiwo or Ochuti local varieties, and we have taken an average of the yields of the two varieties to give the yields of FOS. In addition, we have averaged the yields of ICV2 intercropped with LRB8 and ICV2 intercropped with V37 to give the stated yield of ICV2.

Farmers' Own Maize (FOM) is an assortment of local maize varieties generally referred to as Nyamula. This is generally seed that is selected for replanting after every harvest.

The hybrid maize yields and the farmers' own maize are intercrop equivalents and these have been adjusted to such equivalents from the original mono-crops by applying a factor of .86 for maize and .66 for sorghum. [7]

The absence of local cowpea in both participating and non-participating farms implies that we are either introducing a new crop or reviving one that farmers had abandoned. In a sense then, all cowpea yield is added yield.

VII - Trade-offs in Adopting Technology

The project sought to find out the cost and utility of farm implements as perceived by the farmers. The farmers were thus asked the cost of the ox-plough plus accessories. The average cost given by Oyugis farmers was Ksh 945.00 and it ranged from Ksh 915.00 to Ksh 1,050.00, except for one farmer who gave the price as Ksh 375.00. The actual purchase price by the project was Ksh 712.00 while the current KGGCU price is Ksh 962.95 (for ox-plough plus chain). The farmers had all been provided ox-plough plus accessories by the project in 1987 and were not charged for it. Their answers show that they are aware of its cost and of how much they have been assisted.

These farmers also gave the cost of hiring ox-plough plus accessories and associated labour per acre. The average cost quoted was Ksh 314.00 per acre. Since the project farmers have the project-provided ox-ploughs, we would expect that if they are enterprising, they would be able to make close to this amount per acre by ploughing for neighbours who do not own the plough. Alternatively, the farmers would at least be able to save on this high cost if they use own ox-plough plus associated labour, and if they own oxen.

On a question on land use, 64 per cent of the Oyugis project farmers said that they had ploughed more land in LR 1989 than in the LR 1988 season. A host of reasons were given for this situation, with many farmers giving several responses. About 24 per cent of the project farmers said they had more labour this year, 52 per cent said they now had more implements while 48 per cent expected cash returns. In addition, 60 per cent of the farmers expected better food security while 20 per cent were forced by circumstances to plough more marginal land.

Among the 36 per cent farmers who did not plough more land this year than last year, 4 per cent quoted labour constraints, 8 per cent had implements' problems, while another 8 per cent did not have any more land.

On a separate question, over 83 per cent of the Kendu Bay project farmers said that they would be able to utilize more land if they used ox-ploughs to plough their land. They gave figures ranging from one to ten acres, with an average of three acres, as the amount of extra land they would utilize with ox-ploughs. Thus 83 per cent of the farmers would increase their land use if they had oxen. Better still, there is room for a lot of increase in land use if tractor services are readily available to the farmers. We shall monitor this in the next season when the project provides tractor services to these farmers.

VIII - Impact of IPM on Farmers' Knowledge Base

The project sought the impact of IPM on farmers' knowledge base. Farmers were asked whether they took measures to control insect pests of maize, sorghum and cowpea, the methods they used for control, and the constraints on each method.

All the Oyugis project farmers said that they took measures to control insect pests of maize, sorghum and/or cowpea and these are shown on table VIII-1. Approximately 96 per cent of the Oyugis farmers said they removed infested plants while 76 per cent said they practiced early ploughing. The corresponding figures for Kendu Bay are 63 per cent and 96 per cent respectively.

Also recommended as pest control methods were simultaneous planting with neighbours and removal/destroying of crop residue. Only 36 per cent of the Oyugis project farmers said they planted simultaneously with neighbours while 84 per cent said they removed/destroyed crop residues. In Kendu Bay, most farmers planted simultaneously while 79 per cent removed crop residue. The higher figure in Kendu Bay than Oyugis for simultaneous planting with neighbours is probably due to the more critical need to correctly time the rains in this division.

In addition, 36 per cent of the Oyugis farmers said they practiced crop rotation, 96 per cent intercropped while 48 per cent practiced other insect pest control methods. These others include early and clean weeding, and applying ash on the leaves.

Table VIII-1 Insect Control Measures

	Adopted Practices	% Farmers Adopted	
		Oyugis	Kendu Bay
1.	Removal of Infested Plants	96	63
2.	Ploughing Early	76	96
3.	Simultaneous Planting with Neighbours	36	83
4.	Removing/Destroying Crop Residue	84	79
5.	Crop Rotation	36	29
6.	Intercropping	96	92
7.	Other Methods	48	0

Each of the methods adopted has its own constraints as evidenced by the farmers' responses. Most Kendu Bay farmers said that most of the insect control methods were labour intensive. About 46 per cent said that ploughing was made

difficult by lack of equipment and/or expenses involved in hiring equipment. Many said that getting a tractor was both expensive and difficult because there are only a few tractors in the area. Several others said labour constraints often affected early ploughing.

About 50 per cent of the Kendu Bay farmers said they faced labour constraints in trying to plant simultaneously with neighbours while over 58 per cent said they faced labour problems in relation to destroying crop residue.

The Kendu Bay farmers said they have no problem with crop rotation as such but over 83 per cent reported that intercropping is labour-intensive because it slows the weeding operation.

IX - Wider Policy Issues

A. Credit

Farmers were asked whether they had obtained any agricultural credit, the source of such credit, and the terms of repayment. All the Oyugis project farmers said that they had not obtained any agricultural credit from the organized credit institutions in the last two years.

Lack of credit in Oyugis is not entirely strange, considering that the area does not have a cash crop that has an organized marketing co-operative like those of tea, coffee, sugar or large scale maize crops. In a similar study undertaken in Murang'a District, over 83 per cent of the farmers who had obtained credit had obtained it from the local Coffee Farmers' Union [2].

The Agricultural Finance Corporation, although having a branch at Oyugis, is not an important creditor to the small scale farmers country wide. Neither are commercial banks important creditors to Oyugis farmers and in any case, there is no commercial bank in Oyugis division.

Lack of banks and credit do not imply no demand for loans. It is in fact government policy to enhance credit acquisition to farmers. Sessional Paper No.1 of 1986 states

that it is necessary to provide both seasonal and long-term credit to help farmers adopt and intensify their use of modern practices.[3] IPM is one such modern practice. The same article, however, shows cognisance of problems of administering small holder credit but also states that the government undertakes to subsidize this.

In Kendu Bay division, like in Oyugis, all the participating farmers said that they had not obtained any formal credit in the last two years. We shall investigate the role of the cotton co-operatives in providing credit.

Among the Oyugis non-participating farmers, one farmer said he had obtained formal credit. None of the Kendu Bay non-participating farmers had obtained credit.

B. Extension

Agricultural extension is the means by which new knowledge and ideas are introduced to farm communities so as to improve their agricultural production. It often involves agricultural personnel teaching farmers new farming methods and is an important development input because it often determines the level of use of other farm inputs. In recognition of this, Sessional Paper No.1 of 1986 (4) stresses the importance of extension education and cites

that in the case of maize production the returns to improved husbandry are considerably greater than that of fertilizer.

In relation to extension services, the farmers were asked the number of times they had been visited by various extension agencies. We found that 48 per cent of the Oyugis participating farmers had been visited by the Ministry of Agriculture's extension personnel at least once during their last planting season. About 24 per cent had been visited three times while 21 per cent had been visited once or twice. One farmer had been visited six times.

Further, we found that 36 per cent of the Oyugis project farmers had been visited by various Non Governmental Organisations (NGOs). These included church groups and schools. In particular, Ober School and Dudi Girls were cited. About 60 per cent of those visited by NGOs were the same visited by Ministry of Agriculture personnel.

All the project farmers said they were visited by ICIPE extension personnel very many times with 72 per cent of them saying that they were visited weekly.

In Kendu Bay Division, only 8 per cent of the project farmers had been visited by the Ministry of Agriculture personnel in the whole LR 1989 season. The same farmers had also been visited by NGOs. These NGOs were CARE and Homa

Hills. All the project farmers in this division said they were visited by ICIPE extension personnel very many times.

All project farmers said they had found the extension visits by the project extension staff useful in solving farming problems. The improvement quoted as resulting from these visits was in planting patterns, increased yield and importance of pest management.

In view of the above, we can conclude that the project farmers have adequate extension services reaching them particularly from the ICIPE. On the other hand, the ministry personnel visits are very few, and although T and V is in use (see Benor, Training and Visit) [5] farmers may never come into contact with extension personnel, especially on their own farms.

C. Marketing

Agricultural marketing remains a major bottleneck to increasing smallholder productivity and output in Kenya (Karua 1989) [6]. Karua gives various reasons for this situation, among which are uniform setting of gazetted producer prices for commodities such as maize; market inefficiency as a result of movement controls on various agricultural commodities; and that marketing prospects for the farmers are also hampered by lack of rural

infrastructure, especially within smallholder food economy. Such are the marketing circumstances that Oyugis farmers, like many other Kenyan farmers, face.

In relation to agricultural marketing farmers were asked whether they had adequate facilities for transporting, storing and marketing farm produce. All the Oyugis project farmers said that they did not have adequate facilities for transporting produce from the farm to the farm stores. About 44 per cent of the farmers gave the reason for this situation as lack of wheelbarrows. Another 40 per cent said they lacked finance required to purchase transport equipment. They also said that carrying produce on one's head is a difficult and tedious task.

Unfortunately, the project farmers had earlier been promised wheelbarrows when the project began and thus they still expect to get them free. This has not been possible on the project's side.

All the Oyugis project farmers said that they did not have adequate facilities for transporting their crop to the market. About 20 per cent needed a wheelbarrow, handcart or bicycle, while 52 per cent said they lacked sufficient funds to transport produce to markets. Some said the market is far while others said they only took small amounts of

produce to the market because they ferried these on their heads, and their heads could only hold so much.

On storage, most farmers said they had adequate storage facilities. All project farmers were provided with an improved grain storage structure which most of them are making good use of. Over 60 per cent of the farmers said they had adequate storage facilities while 20 per cent said they needed more storage facilities.

The project further sought the distances from the farmers' homes to the nearest public transport points and to the nearest market centres. The distances between farmers' homes and the nearest public transport points ranged between 20 metres and 3 kilometres and averaged 0.5 kilometres. The distances between farmers' homes and the nearest markets ranged between 100 metres and 10 kilometres and averaged 3 kilometres.

In Kendu Bay, like in Oyugis, 96 per cent of the farmers said they lacked sufficient facilities for transporting produce to farm stores. They also felt that wheelbarrows would go a long way to helping them. All the farmers said they lacked sufficient facilities to transport produce to the market while 42 per cent of the Kendu Bay farmers felt that they did not have adequate storage facilities.

The distances between farmers' homes and nearest public transport points ranged between 10 metres and 4 kilometres and averaged 1.1 kilometres in Kendu Bay. The distances between farmers' homes and the nearest markets ranged between 100 metres and 8 kilometres and averaged 2.4 kilometres.

X Conclusion

This work has shown that Oyugis and Kendu Bay farmers practice a complex multi-crop combination pattern with farmers in one division having as many as twenty three different crop combinations. In such a situation introducing new and related crop combinations does not involve asking the farmers to drastically change their ways. This is probably one reason why the ICIPE/ECA project has enjoyed such cooperation with their clients, the small-scale resource poor farmers of South Nyanza District.

The farmers have learned IPM technology as presented to them by ICIPE and furthermore, they have gained from the project provided inputs, mainly the ox-plough, but also the grain shellers, the storage structure and other implements. The farmers have especially gained in extension knowledge on IPM and better crop husbandry, and a big majority of them are now practicing the ideas learned.

Several constraints, however, face the farming community in Oyugis and Kendu Bay and they directly or indirectly affect adoption of IPM and possibly any other technology anyone may think of introducing in this area. Labour is a constraint quoted by most farmers, and related to it is the lack of cash or sufficient income generating activities by the farmers.

The provided inputs seem to be of paramount importance to adoption of IPM technology. For instance, farmers need ox-ploughs and hoes to plough, plant and weed on time. They also need the insect resistant seed every season. The technology to be adopted must necessarily be affordable as the farmers in question really are resource poor. Moreover it must not be excessively labour demanding as there is shortage of labour in the farm household and often the farmers cannot afford to hire sufficient labour. To this end the IPM as presented by ICIPE/ECA project is still on the affordability test as indeed most farmers complain that field sanitation, early ploughing, planting and weeding are all labour intensive.

On the side of policy makers, a lot needs to be done to improve marketing efficiency. The distances to the markets are considerable and many farmers cannot take as much produce to the markets as they would like. There is need for agricultural credit specifically for small scale farmers and there is need for an inputs store in Kendu Bay Division. Moreover, there is need for IPM trained Ministry of Agriculture extension personnel to train the farmers on this.

On the SSIRU side, more interfacing is needed with the biological scientists in an attempt to develop labour and cash-saving IPM technologies, and to further monitor farmers

assessment of IPM. Moreover studies need to be done on many issues already pointed out for instance, reasons for ox-plough planting, rationale for small-scale multi-crop combinations and marketing. Some of these are already on-going.

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7. Please refer to Prof. Saxena, Head CPRP for a discussion on criteria for the monocrop conversion factors.

Note: KGGCU - Kenya Grain Growers Co-operative Union

ICIPE - International Centre for Insect Physiology and Ecology

SSIRU - Social Science Interface Research Unit (of the ICIPE)

CPRP - Crop Pests Research Programme (of the ICIPE)