PrOpCom

Making Nigerian Agricultural Markets Work for the Poor

Monograph Series # 35

Demonstration and financial Feasibility of the use of nets to prevent bird damage

By

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1. Preamble

Regardless of the variety of rice grown, the challenge of bird damage is a primary factor in the determination of profitability of rice farming. More or less, the total area a farmer can put under rice cultivation depends on his capacity for bird scarring. PrOpCom believes that if bird damage on the rice field can be reduced to the barest minimum through modern technology or some integrated management approach, paddy production and profitability will increase due to increased quantity of paddy harvested per hectare. This in turn could bring about a general improvement in the quality of life of the Ofada rice farmers.

A review of international methods for bird control on rice by PrOpCom consultants suggested that the use of complete enclosure netting is 100% effective and might be an option for Ofada rice farmers. The consultants also showed that the use of enclosure netting could be profitable if an average yield of 1.4 tonnes per hectare and above could be attained by farmers. So far, the use of enclosure netting is restricted to research fields.

The general consensus at the Ofada Rice Stakeholders Workshop held on 8-9 March 2007 was that enclosure netting method of bird control be demonstrated in on-farm trials and the view of farmers on adoptability and affordability be determined and reported.

Consequently, an agreement (Appendix 1) was signed on August 6 2007 between the SAII Associates LTD/GTE and the Africa Rice Center (WARDA) by which WARDA undertook to conduct on-farm demonstration of the effectiveness and financial feasibility of using nets to protect rice in the field from bird damage.

2. Identification of source and cost of basic materials – nets and poles

Source of basic materials

a. Net

Sources

WARDA made several visits to various markets in Ibadan city and identified one shop that was able to supply 20 bundles of nylon bird nets (mesh size 2.4 cm), which are normally used for fishing. We did not experience any delay in the supply of these 20 bundles, an indication that the nets are readily available. They are manufactured locally in Nigeria.
The address of the shop is:
Bro. Ben Trading Co.
25 Amunigun Street
Opposite C.M.S. Bookshop
Beside United Bank for Africa Plc
Ogunpa, Ibadan.

Contact person: Esther
Telephone: 0805 867 5773/ 0803 394 8800.

However, there are a number of other shops in Ibadan, including the one below, and
Lagos where these nets are available, but the above shop seems to be the main source in
Ibadan.
Mr. Mudashiru Omotosho
Mudah Investment Co. Ltd.
Dealer & Supplier of all Agricultural Chemicals
No. 50 Idi-Igilaba-Owo Road
Ogunpa, Ibadan
Tel. 0806 611 0821

The contact address of the manufacturer is as follows:
Caitec Delta Ltd.
Tel. 021 671760
Fax: 021 671761  (We have tried in vain to use the telephone number).

Cost price:
8,000.00 Naira per bundle of 20 m x 90 m or 7,600.00 naira per bundle of 20 m x 90 m
for a thinner version of the net. The cost may be less if the nets are sourced directly from
the manufacturers.

b. Bamboo poles

The bamboo poles were sourced close to each of the demonstration farms and were
supplied by the farmers themselves from nearby bamboo groves. Most villages have
bamboo groves close to them. Bamboo poles are therefore readily available in all villages
in the major rice producing areas of Ogun State.

Cost

Each bamboo pole was 2.7 m (8 feet) long and cost 100.00 Naira. However, there are
indications that farmers would pay less than this.

3. Installation of nets
The installation of nets was done in two stages:

a. Marking out of the plots; b. Installation of the nets.

a. Marking out the plots

Pastor Adenekan, President of the Rice Farmers Association of Nigeria (Ogun State Chapter) was approached to identify farmers who would be willing to participate in the demonstration of the use of bird nets to protect rice in the field against bird damage. The procedure was explained to him and he agreed to cooperate with us. He also agreed to inform the owners of the farms to be used that compensation would be provided for any damage to the rice crop, especially in the plots that would not be protected against bird damage.

After Pastor Adenekan had identified the farmers, Dr. O. Ajayi, Dr. F. Nwilene, Mrs. O.A. Oladimeji, and Ms. B. Athanson of WARDA visited the three farms at the following locations:

1. Pastor Adenekan’s farm, planted to NERICA 1, at Moloko, Asipa (Egba Obafemi Local Government Area) on 31 July, 2007;
2. Mr. Popoola’s farm, planted to Ofada, at Lufoko Village (Egba Obafemi Local Government Area) on 01 August, 2007;
3. Mr. Jimoh Tairu’s farm, planted to Ofada, at Iwoye village, via Ibooro (Yewa North Local Government Area) on 01 August, 2007.

The size of plots marked out at each location depended on the total size of the farms:

1. Pastor Adenekan’s farm – three plots each measuring 50 m x 100 m, i.e. 0.5 hectare
2. Mr. Popoola’s farm – three plots each measuring 65 m x 50 m, i.e. 0.325 hectare.
3. Mr. Jimoh Tairu’s farm at Ibooro – three plots each measuring 90 m x 40 m, i.e. 0.36 hectare.

Plot boundaries were demarcated with 1 m long bamboo stakes of 1 m lengths and alleys of 2 meters between the different plots, with the netted plot in between of the other two plots.

b. Installation of nets

Nets were installed between 20 and 23 August, 2007 as follows:

_Pastor Adenekan’s farm at Moloko Asipa (20-21 August, 2007) (Figure 1)._ 

Installation started at 1300 hours on 20 August and was completed at 1800 hours on 21 August (5 hours on 20 August and 9 hours on 21 August, i.e. total of 14 hours). Installation was done by 7 laborers and a supervisor. Eight (8) nets of 90 m x 10 m were used, each costing 7.500 Naira. Dr. O. Osiname and the following senior WARDA staff also participated in the exercise: Dr. O. Ajayi, Dr. F. Nwilene, Mrs. O.A. Oladimeji, and Ms B. Athanson. The crop was at the maximum tillering stage but had been overtaken by weeds to the extent that WARDA had to pay some laborers to weed the three plots that
were used for the demonstration. It was evident that fertilizer application to the crop was inadequate.

**Mr. Popoola’s farm at Lufoko Village on 22 August, 2007 (Figure 2).**

Installation of 5 nets lasted from 0800 to 1800 hours on 22 August, i.e. 10 hours with 7 laborers and one supervisor. Drs. Clive Elliot and O. Osiname and the following senior WARDA staff also participated in the exercise: Dr. O. Ajayi, Dr. F. Nwilene, Mrs. O.A. Oladimeji, and Ms B. Athanson. The crop was still at the booting stage and had been well cared for in terms of weed control but the adequacy of fertilizer application could not be ascertained. Crop performance was highly variable within the farm, due probably to uneven soil fertility. Ofada crops nearby owned by Mr. Popoola were already being harvested. This was therefore a late crop.

![Figure 1. Close-up of net installed at Pastor Adenekan’s farm at Moloko Asipa](image)

**Mr. Jimoh Tairu’s farm at Ibooro (23-24 August, 2007) (Figure 3)**

Five nets were installed by 7 laborers and 1 supervisor working between 1200H and 1800 hours (i.e. 6 hours) on 23 August, 2007, and continued the next day working between 0800H and 1200H (i.e. 4 hours). The following senior WARDA staff participated: Mrs. O.A. Oladimeji. The farmer had taken good care of the crop in terms of adequate fertilizer application and weed control. The crop was at the flowering stage.

Messrs Popoola and Tairu were present at the installation of nets on their farms. However, Pastor Adenekan was represented by his assistant. The activity attracted the
attention of other farmers who were curious to know what was going on. Explanations were offered to all such farmers and they were informed that there would be a farmers’ field day at the end of the demonstration.

![Figure 2. Net installed at Mr. Popoola’s farm at Lufoko](image)

![Figure 3. Net installed at Mr. Jimoh Tairu’s farm at Ibooro](image)

Information on the installation of nets is summarized in Table 1.

<table>
<thead>
<tr>
<th>Farm/village</th>
<th>Plot size (hectares)</th>
<th>Date of installation</th>
<th>No. of nets (10 x 90 m)</th>
<th>Cost of nets (Naira)</th>
<th>No. of labor</th>
<th>Installation time (hrs)</th>
<th>PrOpCom and WARDA staff present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pastor Adenekan (Moloko Asipa)</td>
<td>0.5 x 3</td>
<td>20-23 Aug</td>
<td>8</td>
<td>$7,500 \times 8 = 60,000$</td>
<td>7 + 1 supervisor</td>
<td>14</td>
<td>O Osiname, O Ajayi, F Nwilene, OA Oladimeji, B Athanson</td>
</tr>
<tr>
<td>Mr. Popoola (Lufoko)</td>
<td>0.325 x 3</td>
<td>22 Aug</td>
<td>5</td>
<td>$7,500 \times 5 = 37,500$</td>
<td>7 + 1 supervisor</td>
<td>10</td>
<td>C. Elliot, O. Osiname, O Ajayi, F Nwilene, OA Oladimeji, B Athanson</td>
</tr>
</tbody>
</table>
4. Farmers’ field day

A Farmers’ Field Day was conducted at each of the three locations on different dates, depending on the time of maturity of the rice crop: Ibooro on 4 September; Moloko Asipa and Lufoko on 27 September. Farmers were organized by Pastor Adenekan (Ogun State President of the Rice Farmers’ Association of Nigeria, RIFAN) and Mr. Adams (leader of RIFAN in Yewa North Local government Area). While the owner of each farm and Mr. Adams were each given 1000 Naira and snacks, every other farmer received 500 Naira and some snacks. WARDA officials explained the usefulness, effectiveness, cost and installation of the net, as well as the fact that the same net can be used over several years if it is well maintained. Farmers were allowed to go underneath the installed net and to ask as many questions as they wished. In addition, a questionnaire was administered on groups of farmers in order to capture their impressions. The number of farmers at each farm is presented in Table 2.

Table 2. Number of farmers at the farmers’ field days

<table>
<thead>
<tr>
<th>PrOpCom/WARDA staff present</th>
<th>Number of farmers present</th>
<th>Number of farmers present</th>
<th>Number of farmers present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Jimoh Tairu (Ibooro)</td>
<td>0.36 x 3</td>
<td>23-24 Aug</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7,500 x 5 = 37,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 supervisor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

OA Oladimeji, G Gregorio, B Athanson

Mr. Tairu Jimoh
Mr. Luqman Tairu
Mr. Rasidi Tairu
Mr. Rabiu Adesina
Mr. Adamson Elegbede
Mrs. Mutiu Kareem
Mrs. Wasilatu Elegbede
Mr. Johnson Mathew
Mr. Isaac Idowu
Mr. Adisa Babo
Mr. Fausat Adesina
Mr. Laisi Iroko
Mrs. Fausat Tairu
Mr. Sule Ogunjimi
Mr. Fatai Adesina
Mr. Samson Omoteso
Mr. Michael Ayoade
Mr. Adebayo Sarafa
Mrs. Olade Kazeem
Mr. Ogunjimi Quadri
Mr. Adesina Sule
Mr. Arise Olorunfunmi
Mr. Sali Adana
Mr. Lamidi Agunyan

Chief Adekunle Soyoye
Mr. Tijani Shoretire
Mr. Ishola Oloyede
Mr. Sunday Oladipupo
Mr. Alani Idowu
Mr. Nojimu Folorunso
Mrs. Florence Oduntan
Mrs. Dupe Soyoye
Mr. Fatimo Raifu
Mr. Akanni Lukman
G.F. Olonade
Mr. Abass Daniel
Mr. Mufutau Sobowale
Mr. Kehinde Adekunle
Mr. Lafisi Tiamiyu
Mr. Kayode Adegeye
Mr. Fikayo Adegeye
Mr. Michael Oduntan
Pastor Bode Adenekan
Mrs. Janet Adegboye
Mr. Aweni Olojo
Mr. Mojisolade Odejindan
Mrs. Nike Kehinde
Mrs. Nofisatu Mufutau
Mr. Sikiru Popoola
Mr. Ayinla Oloyede
Mr. Alimi Ogunsole
Mr. Ayinde Owolabi
Mr. Tadeeun Akerele
Mr. Mosuru Akerele
Mr. Idowu Akerele
Mr. Omoseni Ogunremi
Mr. Waidi Tamimowo
Mrs. Afsat Sabiu
Mrs. Bintu Ogunsole
Mrs. Esther Popoola
Mr. Momudat Oloyede
Mrs. Sekinat Popoola
Mrs. Remilekun Ogunremi
Mr. Ganiu Ogunbiyi
Mr. Tadeeun Aremu
Mr. Mutiu Aremu
Mr. Muraine Owolabi
Mrs. Amope Popoola
Mrs. Titilayo Oloyede
Mr. Dauda Oloyede
Mrs. Moria Lawal
Mr. Nofiu Ogunsole
Ibooro

Observations

The net was still standing firm and intact. There were obvious differences between the three plots in terms of yield and bird damage. The netted plot was intact with no damage of any sort.

Farmers’ remarks
The farmers expressed sincere appreciation of the effectiveness of the netting technique but wondered how they may be helped to use the technique on their various farms, bearing the cost in mind. They were advised to have a strong farmers’ union or cooperative which can help them obtain credit. Thereby, they would be able to buy the nets and pay for them in installments.

Moloko Asipa

Observations
The nets were still standing upright. The netted plot had no bird damage and was obviously better than the two other plots in terms of yield. Trapped birds were seen entangled in the net (Figures 4 and 5).
Figure 4. A bird caught in the net at Moloko Asipa

Figure 5. A bird caught in the net at Moloko Asipa
Figure 6. Farmers discussing the bird net demonstration at Moloko Asipa
Farmers’ remarks

The farmers (Figure 6) were very happy to see the demonstration of the netting method of protecting rice against birds. They confessed that it had the potential of relieving them of the stress of staying on the farm all day long to chase birds away. They wondered if they could obtain the net at a lower price.

Advantages of using nets to prevent bird damage

The farmers at all locations enumerated some advantages of the net as follows:
1. It traps both birds and grass cutters.
2. Wives, children and husbands can now relax at home and take care of each other without thinking of bird problems in their fields.
3. Children can now go to school and participate in activities other than scaring birds.

Without using nets, wives and children spent a lot of time in the field per day (i.e. 6 am to 6 pm) because of the need to continuously scare birds. It also deprives their children of going to school and wives from cooking for their husbands.

Socio-economic implications

The farmers at all locations pointed out that the high cost of the net (i.e. N7,500 per bundle) will be a major obstacle to adopting the netting technique. They wanted to know if government can come to their aid by subsidizing the cost of nets. They are willing to pay between N10,000 and N20,000 per hectare for a new net.

Lufoko

Observations

The nets were still intact (Figure 7). Farmers’ impressions and comments were similar to those of farmers at the two other farms.
5. Yield estimate

In each plot, three sub-plots each measuring 5m by 5 m were demarcated. Ten plants were chosen randomly for the measurement of plant height and number of tillers per plant. Subsequently, all the plants in the sub-plots were harvested and threshed. Threshing was done by beating the harvested plants with sticks on tarpaulin sheets spread on the ground. Although farmers in the area traditionally harvest rice by cutting individual panicles, they soon decided to adopt our own method of cutting the whole plant from the base. They agreed that their own method took a much longer time and was therefore more expensive in terms of labor. Dr Gregorio demonstrated the use of bamboo stakes (Figure 8b, 8c) for threshing as against the traditional use of a drum (Figure 8a).
The yields are presented in Tables 3 and 4. Yields per plot (Table 3) were 484.8, 429.6 and 120 kg for netted, bird scaring and unprotected plots, respectively at Ibooro; 173.3 and 112.7 kg for netted and unprotected plots, respectively at Lufoko; and 353.3, 140 and 10 kg, respectively at Moloko Asipa. Yields per hectare (Table 4) were 1,448, 1,250 and 353 kg, respectively for netted, bird scaring and unprotected plots at Ibooro; 565 and 371 kg, respectively for netted, and unprotected plots at Lufoko; and 765, 296 and 20 kg, respectively for netted, bird scaring and unprotected plots at Moloko Asipa. Yield data were not available for bird scaring plots at Lufoko because the farmer had harvested and bulked rice from these plots ahead of schedule.

Table 3. Yield (kg) per plot

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Location</th>
<th>Location</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ibooro</td>
<td>Lufoko</td>
<td>Moloko Asipa</td>
</tr>
<tr>
<td>Netted</td>
<td>484.8</td>
<td>173.3</td>
<td>353.3</td>
</tr>
<tr>
<td>Bird scaring</td>
<td>429.6</td>
<td>NA</td>
<td>140.0</td>
</tr>
<tr>
<td>Unprotected</td>
<td>120.0</td>
<td>112.7</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Table 4. Yield (kg) per hectare

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Location</th>
<th>Location</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ibooro</td>
<td>Lufoko</td>
<td>Moloko Asipa</td>
</tr>
<tr>
<td>Netted</td>
<td>1,448</td>
<td>565</td>
<td>765</td>
</tr>
<tr>
<td>Bird scaring</td>
<td>1,250</td>
<td>NA</td>
<td>296</td>
</tr>
<tr>
<td>Unprotected</td>
<td>353</td>
<td>371</td>
<td>20</td>
</tr>
</tbody>
</table>

Compensation to farmers

Because one plot at each location was neither protected with a net nor by bird scaring, it was agreed that farmers would be compensated for any losses on this plot. The compensation is the value of the difference in grain yield between the netted and the unprotected plots, calculated on the assumption that the highest price of rice would be 85 Naira per kg. Based on the yield data in Tables 3 and 4 above, the amounts of compensation due to the farmers are shown in Table 5.
Table 5. Compensation due to farmers

<table>
<thead>
<tr>
<th></th>
<th>Yield (kg/plot)</th>
<th>Difference (loss) kg</th>
<th>Value (Naira) @ N85/kg = Compensation due</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ibooro</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netted</td>
<td>484.8</td>
<td>364.8</td>
<td><strong>31,008</strong></td>
</tr>
<tr>
<td>Protected</td>
<td>120.0</td>
<td>120.0</td>
<td></td>
</tr>
<tr>
<td><strong>Lufoko</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netted</td>
<td>173.3</td>
<td>60.6</td>
<td><strong>5,151</strong></td>
</tr>
<tr>
<td>Protected</td>
<td>112.7</td>
<td>112.7</td>
<td></td>
</tr>
<tr>
<td><strong>Moloko Asipa</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netted</td>
<td>353.3</td>
<td>343.3</td>
<td><strong>29,339.5</strong></td>
</tr>
<tr>
<td>Protected</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>65,339.5</strong></td>
</tr>
</tbody>
</table>

It is not clear if compensation for the farmers is to be borne by PrOpCom or by WARDA, but no provision was made for this in the budget submitted by WARDA.

6. Damage estimates/assessment

Two individuals with two cloth bags attached to their hips moved in a zigzag manner through each plot. One bag was marked “damaged” and the other (not damaged). Every 5 steps, each person randomly selected 5 panicles, cut them at the level of the first node, examined each panicle to determine whether it was damaged or not, and dropped it into the appropriate bag. Each person cut 100 panicles, i.e. a total of 200 panicles per plot. The number and weight of panicles in each bag was then determined and percentage damage loss was calculated using the formula:

\[
\frac{\text{Mean wt. of damaged panicles} \times \text{Number of damaged panicles}}{\text{Mean wt. of undamaged panicles} \times \text{Number of damaged + undamaged panicles}} \times 100
\]

The estimated damage by birds at each location was as follows:

**Ibooro**

Netted plot

\[
\frac{0.2 \times 48}{1.2 \times (48 + 152)} \times 100 = 4.0\%
\]

Bird scaring plot

\[
\frac{0.4 \times 44}{1.3 \times (44 + 156)} \times 100 = 6.8\%
\]

Unprotected

\[
\frac{0.2 \times 176}{0.8 \times (176 + 24)} \times 100 = 22\%
\]
The calculated percentage damage losses are summarized in Table 6. Damage loss ranged from 0 to 4% in the netted plots, 2.7 to 18.8% in the bird scaring plots, and 14.3 to 48.3% in the unprotected plots. Damage loss was consistently lowest at Lufoko, where the farmer reportedly used a traditional method, other than physical bird scaring, to protect his rice crop. However, since his bird scaring was also more effective than at the two other farms, it is possible that he did some bird scaring in the unprotected plot, contrary to the agreement with him. The high variation between the three sites in the amount of damage losses may be explained by differences in the population of birds at the sites.

Table 6: Estimated losses due to bird damage at three locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Damage loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Netted</td>
</tr>
<tr>
<td>Ibooro</td>
<td>4.0</td>
</tr>
<tr>
<td>Lufoko</td>
<td>0</td>
</tr>
<tr>
<td>Moloko Asipa</td>
<td>0.7</td>
</tr>
</tbody>
</table>

7. Removal of nets

The removal of nets took place on two different days - 16 October, 2007 at Ibooro and Lufoko, and 25 October, 2007 at Moloko Asipa.
The edges of the nets that had been covered by some earth were unearthed and the stays holding the bamboo poles were removed. The nets were then rolled over from one side to the opposite side. The long roll was then tied with nylon ropes at intervals of one meter. The roll was finally folded over and tied appropriately. Weeds and other debris were carefully removed to avoid damage to the net. The nets and nylon ropes were transported to Ibadan and kept at WARDA awaiting further instructions from PrOpCom. The bamboo poles were left standing for use next year.

**Ibooro, 16 October, 2007**

The net had remained intact but grass weeds and shrubs had grown considerably taller since the rice harvest. Animals that had been trapped by the nets included birds and large scorpions. The net was removed in 2 hours by 4 laborers, supervised by 1 technician (10 man-hours) and the following WARDA staff: Dr. O. Ajayi, Mrs. O.A. Oladimeji, and Ms B. Athanson.

**Lufoko, 16 October, 2007**

The net was removed in 1 hour by 4 laborers, supervised by 1 technician (5 man-hours) and the following WARDA staff: Dr. O. Ajayi, Mrs. O.A. Oladimeji, and Ms B. Athanson. Mr. Saka and Ms Omolara Adekanmbi obtained socio-economic data on rice production by interviewing several rice farmers, using a questionnaire as a basis.

**Moloko Asipa, 25 October, 2007**

Four laborers supervised by 1 technician with support from 2 WARDA staff – Dr. O. Ajayi and Mrs. O.A. Oladimeji - and two socio-economists – Mr. Saka and Ms Lara Adekanmbi - participated in the removal of the 8 nets in 3 hours (15 man-hours).

**8. What is to be done with the nets**

PrOpCom has not indicated what is to be done with the nets. One possibility is to give them as compensation to the farmers whose farms were used for the demonstration, in lieu of cash for yield losses occasioned by non-protection of a part of their crops. The other option is to erect the same nets in the same farms in 2008 in continuation of the demonstration.

**9. Lessons learnt**

We had used polythene bags to protect the nets from damage by the sharp top ends of the bamboo poles. While removing the nets, we noticed that a thicker material, such as the used inner tubes of motor vehicle tires, would be more effective. We would therefore recommend used inner tubes in the future.
10. Economic evaluation of bird net technology in rice production in Ogun State

Methodology

In determining the most economically acceptable treatment, partial budget analysis was carried out to estimate the gross value of rice output from each treatment across the three locations namely:

- Ibooro with plot size 3600m$^2$
- Lufoko with plot size 3250m$^2$
- Moloko Asipa with plot size 5000m$^2$

The treatments are:

- Treatment 1: Use of bird net.
- Treatment 2: Use of manual scaring.
- Treatment 3: Unprotected

Agronomic yield data were obtained from trial sites while the prevailing farm gate price for rice (paddy), market price for variable inputs and rates paid to farm laborers at the location were used to estimate the cost that vary. However, no adjustment was made to the obtained yield data as the farmers were close to being completely left to manage the plots with their usual practice consequent upon which it can be said that the experimental practice and design were close to farmers’ practice.

In addition, the accruing net benefit and the costs that vary were then compared across treatments in dominance analysis based on the criterion that any treatment that had net benefit equal to or lower than that of another treatment with lower cost is dominated and as such would not be considered for investment by the farmer (CIMMYT, 1988). Also, marginal analysis was carried out on the undominated treatments in a stepwise manner passing from one treatment with the lowest cost that vary to the next. This is to reveal how the net benefit from a decision to change from one treatment to another increases with cost. Usually, a minimum rate of return is fixed as the baseline for acceptance of an option in order to account for the cost of capital, inflation and risk. In this regard, literature has established that for the majority of situations, the minimum rate of return acceptable to farmers is between 40% and 100% (Asumadu et al., 2004; Dillon and Hardaker 1993; Saka et al., 2006).

A minimum rate of return criterion of 50% (CIMMYT, 1988) was set for the Marginal Rate of Return (MRR) analysis as the treatments simply require that farmers change from one bird protection method to another without having to learn new skills or acquire new equipment that require a highly specialized form of training in handling. Hence, any treatment that returns MRR above 50% is considered worthy of investment by farmers.
Results

Partial Budget Analysis

Table 7 shows the physical quantities of inputs and outputs per hectare (extrapolated) across project locations. The result of the partial budget analysis (Table 8) indicated a great deal of variation in the potentials of the bird net technology relative to the use of labor for scaring away birds and unprotected treatments from one location to the other. With a Total Cost that vary of N69,500.0, N60,000.0 and N62,256.0 per hectare (Table 8) for Ibooro, Lufoko and Moloko Asipa, respectively, production cost was consistently highest for bird scaring across locations. The resultant net benefit was highest for bird net at Ibooro with a value of N62,687.8 compared to a net benefit of N36,750.0 and N27,442.6 for bird scaring and unprotected treatments respectively. Similarly, the bird net technology gave the highest net benefit of N5,947.0 compared to a net benefit of N1,260 and a net loss of N37,096 recorded for the unprotected and bird scarring treatments, respectively, at Moloko Asipa.

However, the unprotected treatment gave a higher net benefit of N28,816.7 per hectare compared to a net loss of N9,357.3 recorded for the use of bird net at Lufoko while no yield data were available for the bird scaring plot at this trial site.

Dominance and Marginal Rate of Return Analyses

The results of the Dominance and Marginal Rate of Return (MRR) analyses are presented in Table 9. The results show that bird scaring was not economically viable (i.e. dominated) based on the assumption that no rational farmer will choose a farming practice which has a comparatively lower benefit at higher cost as it is dominated by bird net and unprotected treatments across locations thereby rendering it unsuitable for MRR analysis. The MRR analysis gave MRR values of 60.95 and 08% for bird net over the unprotected treatments at Ibooro and Moloko Asipa, respectively (Table 9). The result obtained from Ibooro thereby implies that farmers stand to gain about N61 in return for every N100 spent in changing from unprotected treatment to bird net technology. However, the results from Moloko Asipa gave an indication of a marginal gain of about N8 for every N100 spent in effecting similar change in practice.

While the results from Ibooro (with an MRR value greater than the minimum criterion of 50%) established economic justification to the bird net technology and made it attractive for investment by farmers, the results obtained at Moloko Asipa present the bird net technology as unattractive for investment with a MRR that is far lower than the 50% minimum criterion. The results from Lufoko could not be subjected to further analysis due to incomplete data.
Table 7: Input and Output in Physical Quantities per Plot across Locations

<table>
<thead>
<tr>
<th>Locations</th>
<th>Netted</th>
<th>Scared</th>
<th>Unprot</th>
<th>Netted</th>
<th>Scared</th>
<th>Unprot</th>
<th>Netted</th>
<th>Scared</th>
<th>Unprot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibooro</td>
<td>1,448.0</td>
<td>1,250.0</td>
<td>353.0</td>
<td>565.0</td>
<td>0.0</td>
<td>371.0</td>
<td>765.0</td>
<td>296.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Lufoko</td>
<td>1,250.0</td>
<td></td>
<td></td>
<td>353.0</td>
<td>0.0</td>
<td></td>
<td>765.0</td>
<td>0.0</td>
<td>765.0</td>
</tr>
<tr>
<td>Moloko Ashipa</td>
<td>565.0</td>
<td>0.0</td>
<td>371.0</td>
<td>765.0</td>
<td>0.0</td>
<td>296.0</td>
<td>0.0</td>
<td>400.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td>50kg bags</td>
<td>27.8</td>
<td>25.0</td>
<td>5.6</td>
<td>12.3</td>
<td>0.0</td>
<td>6.2</td>
<td>14.0</td>
<td>6.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Bird net (rolls)</td>
<td>13.9</td>
<td>0.0</td>
<td>0.0</td>
<td>15.4</td>
<td>0.0</td>
<td>0.0</td>
<td>14.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
<td>Poles</td>
<td>361.1</td>
<td>0.0</td>
<td>0.0</td>
<td>369.2</td>
<td>0.0</td>
<td>0.0</td>
<td>400.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Rope (Cost in ₦)</td>
<td>3925.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3923.1</td>
<td>0.0</td>
<td>0.0</td>
<td>3924.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Nylon (Cost in ₦)</td>
<td>505.6</td>
<td>0.0</td>
<td>0.0</td>
<td>507.7</td>
<td>0.0</td>
<td>0.0</td>
<td>506.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Labor</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Net installation (mandays)</td>
<td>13.9</td>
<td>0.0</td>
<td>0.0</td>
<td>15.4</td>
<td>0.0</td>
<td>0.0</td>
<td>14.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Net removal (mandays)</td>
<td>4.2</td>
<td>0.0</td>
<td>0.0</td>
<td>4.6</td>
<td>0.0</td>
<td>0.0</td>
<td>8.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Bird Scaring (mandays)</td>
<td>0.0</td>
<td>120.0</td>
<td>0.0</td>
<td>0.0</td>
<td>120.0</td>
<td>0.0</td>
<td>0.0</td>
<td>120.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Harvesting (cost/kg in ₦)</td>
<td>2896.0</td>
<td>2500.0</td>
<td>706.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
</tr>
<tr>
<td>Threshing (cost/kg in ₦)</td>
<td>2896.0</td>
<td>2500.0</td>
<td>706.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
</tr>
<tr>
<td>Winnowing (cost/kg in ₦)</td>
<td>2896.0</td>
<td>2500.0</td>
<td>706.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
<td>1130.0</td>
<td>0.0</td>
<td>742.0</td>
</tr>
</tbody>
</table>

1 Unprotected.
Table 8: Partial Budget Analysis per Hectare

<table>
<thead>
<tr>
<th>LOCATIONS</th>
<th>IBOORO</th>
<th>LUFOKO</th>
<th>MOLOKO ASIPA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Netted</td>
<td>Scared</td>
<td>Unprotected</td>
</tr>
<tr>
<td>Output</td>
<td>1,448.0</td>
<td>1,250.0</td>
<td>353.0</td>
</tr>
<tr>
<td>Value of Rice @ N85/kg</td>
<td>123,080.0</td>
<td>106,250.0</td>
<td>30,005.0</td>
</tr>
<tr>
<td>Costs that Vary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of bag @ N80/50kg bag</td>
<td>2,222.2</td>
<td>2,000.0</td>
<td>444.4</td>
</tr>
<tr>
<td>Cost of Bird net @ N7500/roll (Depreciation charges)</td>
<td>5.0</td>
<td>20,833.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Cost of pole @ N100/pole (Depreciation charges)</td>
<td>2.0</td>
<td>18,055.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Cost of rope</td>
<td>2.0</td>
<td>1,962.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Cost of Nylon</td>
<td>1.0</td>
<td>505.6</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total material costs that vary</strong></td>
<td><strong>43,579.2</strong></td>
<td><strong>2,000.0</strong></td>
<td><strong>444.4</strong></td>
</tr>
<tr>
<td>Labor Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor cost for net installation @ N450/man day</td>
<td>6,250.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor cost for net removal @ N450/man day</td>
<td>1,875.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Bird Scaring wage @ N500/day</td>
<td>0.0</td>
<td>60,000.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Harvesting N2/kg</td>
<td>2,896.0</td>
<td>2,500.0</td>
<td>706.0</td>
</tr>
<tr>
<td>Threshing @ N2/kg</td>
<td>2,896.0</td>
<td>2,500.0</td>
<td>706.0</td>
</tr>
<tr>
<td>Winnowing @ 2N/kg</td>
<td>2,896.0</td>
<td>2,500.0</td>
<td>706.0</td>
</tr>
<tr>
<td>Total Labor Costs that vary</td>
<td>16,813.0</td>
<td>81,500.0</td>
<td>2,118.0</td>
</tr>
<tr>
<td><strong>Total Costs that Vary</strong></td>
<td><strong>60,392.2</strong></td>
<td><strong>69,500.0</strong></td>
<td><strong>2,562.4</strong></td>
</tr>
<tr>
<td>Net Benefit</td>
<td>62,687.8</td>
<td>36,750.0</td>
<td>27,442.6</td>
</tr>
</tbody>
</table>
Table 9: Dominance and Marginal Rate of Return Analysis per Hectare across Locations

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cost (₦)</th>
<th>Net Benefit (₦)</th>
<th>Dominance</th>
<th>Incremental Benefit (₦)</th>
<th>Incremental Cost (₦)</th>
<th>MRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBOORO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprotected</td>
<td>2,562.4</td>
<td>27,442.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird net</td>
<td>60,392.2</td>
<td>62,687.8</td>
<td>Undominated</td>
<td>35,245.3</td>
<td>57,829.7</td>
<td>60.95</td>
</tr>
<tr>
<td>Bird Scaring</td>
<td>69,500.0</td>
<td>36,750.0</td>
<td>Dominated</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LUFOKO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprotected</td>
<td>2,718.3</td>
<td>28,816.7</td>
<td>Undominated</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bird net</td>
<td>57,382.3</td>
<td>-9,357.3</td>
<td>Dominated</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bird Scarring</td>
<td>60,000.0</td>
<td>-60,000</td>
<td>Dominated</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MOLOKO ASHIPA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unprotected</td>
<td>440.0</td>
<td>1,260.0</td>
<td>Undominated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bird net</td>
<td>59,078.0</td>
<td>5,947.0</td>
<td>Undominated</td>
<td>4,687</td>
<td>58,638</td>
<td>8.0</td>
</tr>
<tr>
<td>Bird Scaring</td>
<td>62,256.0</td>
<td>-37,096</td>
<td>Dominated</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Analysis on bird-net cost-effectiveness

The sensitivity analysis results (Table 10) indicate that farmers at Ibooro will need a minimum yield of 724 kg per ha (about 50% of what they currently produce) to be cost-effective in the use of bird net technology and any yield below this will result in a loss. Similarly, farmers at Moloko Asipa will require a yield of about 734 kg per ha (about 4% lower than what they currently produce) to remain profitable and any yield below this will give a loss. For Lufoko farmers whose output shows a loss in the use of bird-net technology, they would require a minimum yield of about 678 kg per ha (about 20% increase above the current yield) for the bird net technology to be cost-effective/profitable for them.
Table 10: Sensitivity analysis on bird-net cost effectiveness per hectare

<table>
<thead>
<tr>
<th>Life span</th>
<th>IBOORO</th>
<th>LUFOKO</th>
<th>MOLOKO ASIPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>724.0</td>
<td>678.0</td>
<td>734.4</td>
</tr>
<tr>
<td>Value of Rice @ N85/kg</td>
<td>61,540.0</td>
<td>57,630.0</td>
<td>62,424.0</td>
</tr>
</tbody>
</table>

Costs that Vary

Material Cost

Cost of bag @ N80/50kg bag | 2,222.2 | 984.6 | 1,120.0 |
Cost of Bird net @ N7500/roll | 5.0 | 20,833.3 | 23,076.9 | 24,000.0 |
(Depreciation charges)
Cost of pole @ N10/roll | 2.0 | 18,055.6 | 18,461.5 | 20,000.0 |
(N10/pole (Depreciation charges))
Cost of rope | 2.0 | 1,962.5 | 1,961.5 | 1,962.0 |
Cost of Nylon | 1.0 | 505.6 | 507.7 | 506.0 |

Total material costs that vary | 43,579.2 | 44,992.3 | 47,588.0 |

Labor Cost

Labor cost for net installation @ N450/man day | 6,250.0 | 6,923.1 | 6,300.0 |
Labor cost for net removal @ N450/man day | 1,875.0 | 2,076.9 | 3,600.0 |
Bird Scaring wage @ N500/day | 0.0 | 0.0 | 0.0 |
Harvesting N2/kg | 2,896.0 | 1,130.0 | 1,530.0 |
Threshing @ N2/kg | 2,896.0 | 1,130.0 | 1,530.0 |
Winnowing @ N2/kg | 2,896.0 | 1,130.0 | 1,530.0 |
Total Labor Costs that vary | 16,813.0 | 12,390.0 | 14,490.0 |

Total Costs that Vary | 60,392.2 | 57,382.3 | 62,078.0 |

Net Benefit | 1,147.8 | 247.7 | 346.0 |

11. Farmers’ Perception

An assessment of the farmers’ perception was carried out at Lufoko with a random selection of 5 farmers who participated in the trial. All the farmers acceded to the high potential of the bird net technology to minimize loss due to bird invasion. However, they expressed reservation on the cost of procuring and erecting the bird net for large farms of sizes raging from 5 hectares and above.

12. Conclusions

The economic analysis has indicated the potential of the bird net technology in reducing labor cost relative to the use of bird scaring while generating acceptable marginal rate of return, going by the results obtained at Ibooro. However, the marginal rate of return obtained at Moloko Asipa was much lower, thereby casting some doubt on the potential of the bird net technology in generating acceptable return. This could, however, be taken as a variant of differences in managerial capabilities of the farmers and probably some
hitches in the management of the trial as evident in the inability to obtain the bird scaring
data from Lufoko. The rice crop at Moloko Asipa had been virtually abandoned to weeds
by the farmer and this evidently affected the grain yield and economic returns. The
inconsistency in the results thereby raised some difficulties in making any specific
recommendation, but rather the on-farm trial could be repeated with adequate monitoring
alongside exploring the possibility of involving more farmers. However, the farmers
interviewed were able to observe the inherent potential in the bird net technology in
minimizing loss due to bird invasion. It may be concluded that the bird net technology is
cost-effective if the farm is well managed – adequate and timely application of fertilizer
and timely weeding. This is supported by the sensitivity analysis results, which indicate
that the farmers at Ibooro will need a minimum yield of 724 kg per ha (about 50% of
what he produced in 2007) to be cost-effective in the use of bird net technology and any
yield below this will result in a loss. Similarly, the farmer at Moloko will require a yield
of about 734 kg per ha (about 4% lower than what he produced) to remain profitable and
any yield below this will give a loss. However, the farmer at Lufoko would require a
minimum yield of about 678 kg per ha (about 20% increase above the current yield) for
the bird net technology to be cost-effective/profitable. The yield data from Lufoko also
indicate that the use of the traditional crop protection method against birds, other than
physical scaring (referred to as indigenous method) was almost as effective as the use of
nets.

The outcome of the demonstration trials enable us to conclude as follows:

1. Availability and cost of netting material
   The nets used by fishermen are suitable. They are made locally and are therefore readily
   available in Nigeria. It costs N120,000 per hectare and can last for at least 5 years. The
   size of the nets used was 20 m x 90 m. However, it should be possible to request the
   manufacturers to produce larger sizes. The procurement of large quantities of the net
directly from the manufacturers (by government or farmers’ cooperatives) would also
lower the cost considerably.

2. Availability and cost of poles/support materials for enclosures
   Bamboo poles are readily available near every village in Ogun State. For the
demonstration, each pole cost N100 but should be cheaper if bought by farmers.

3. Most effective method of installation of enclosed nets
   Poles are erected 5 m apart, nylon ropes are tied from pole to pole to prevent the net from
   sagging, a piece of used inner tire tube is place over the top of each bamboo pole to
   protect the net, and the net is spread over the tops of the poles, one bundle at a time. Each
   net is tied to the next one, using cotton ropes to avoid creating entry points for birds. The
   lower end of the nets are buries in the soil to keep rodents out.

4. Total cost of installation
   The total cost of installation (nets, poles, labor, etc) was between N52,439.2 to N53,888.0
   per hectare per year.

5. Skills required and availability of skilled labor/service providers to do installation
No special skills are required. However, an initial demonstration by WARDA would be necessary to avoid damage to the nets.

6. Cost to maintain netting and to take it down
It cost between N1,875 and N3,600 per hectare to remove the nets. The only cost of maintenance would be for removing grass and other debris that might be caught in the net while it is being removed and rolled up for storage.

7. Comparative analysis of effectiveness of nets versus human bird scarers
Damage loss due to birds varied from 0 to 4% with netting compared to 2.7 to 18.8% with human bird scaring. Grain yield ranged from 565 kg to 1,448 kg per hectare with netting as against 296 kg to 1,250 kg per hectare using human bird scaring.

8. Benefit from use of nets
Netting gave a net benefit of N61 for every N100 spent at Ibooro, where the crop was well maintained, and N3 for every N100 spent at Moloko Asipa, where the crop was virtually abandoned to weeds. The outcome for Lufoko could not be determined due to some missing data.

9. Cost/benefit analysis of net use versus traditional net scaring technique
Production cost was consistently higher for bird scaring across locations. Netting cost N52,439.2 to N53,888.0 per hectare compared with N134,722.2 to N135,384.6 per hectare for human bird scaring. At Ibooro, netting gave a net benefit of N62,687.8 per hectare compared to a net loss of N37,972.2 for human bird scaring. The corresponding figures for Moloko Asipa were a net benefit of N2,947 for netting and a loss of N112,096 for bird scaring.

10. Feasibility of use of nets
The sensitivity analysis results indicate that farmers at Ibooro and Moloko Asipa produced 4-50% more than the threshold grain yield that would make the use of nets to be profitable. The use of nets is therefore cost-effective, profitable and feasible.

11. Farmers’ willingness to use nets
Every farmer who saw the demonstration indicated a willingness to adopt the netting method for protecting rice against birds. They all agreed that it would save them much time and labor that could be more gainfully used for other activities or for resting. Children would be able to go to school and women would have enough time to care for their children and husbands. Their only concern was how to access funds to purchase the nets, especially for large scale farms. They requested some form of assistance in this regard.

13. Recommendations

1. Based on the economic analyses, the use of nylon nets by farmers in Ogun State to protect the rice crop against bird damage is recommended because it is cost-effective and the threshold yield is attainable.
2. Farmers who wish to utilize the bird net technology to protect their rice crop against bird damage should be encouraged to take good care of the crop – timely and adequate application of suitable fertilizers, timely and adequate weed control, etc.

3. Farmers have indicated their interest in adopting the bird net technology but also requested financial assistance. A suitable credit facility (in kind) should be made available to such farmers, preferably through farmer cooperative associations. This would enable them to pay in convenient installments. Arrangements could be made to purchase the nets directly from the manufacturers in order to lower the price.

4. The on-farm demonstration of the use of the bird net technology should be repeated in 2008. More farmers should be involved and participating farmers need to be well educated on the actual intention behind the demonstration. They should be encouraged to provide accurate information on their yields, income, market prices, etc., and to follow protocols agreed before the start of the demonstration.

5. The installation of the net should be done much earlier in the crop growth than we did, preferably immediately after seeding, to avoid bird damage at seedling emergence and reduce/avoid damage to the crop during installation.

6. The nets used in the 2007 trials should be given to the farmers whose farms were used for the trials.

7. The participating farmers should in addition receive compensation for damage to the unprotected plots as follows: Mr. Jimoh Tairu (Ibooro) – N31,008; Mr. Popoola (Lufoko) – N5,151; Pastor Adenekan (Moloko Asipa) – N29,339.5 (Total N65,339.5).

14. References


