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# The Economy of Smallholder Coffee: Evidence from Honde Valley, Zimbabwe

Edinah Shambare, Fred H. Johnsen and Mandivamba Rukuni

## Introduction

Honde Valley of Manicaland is situated 200 km east-south-east of Zimbabwe's capital city, Harare. The area forms part of the Eastern boundary with Mozambique. The valley is characterised by steep slopes ranging between 600-1500 m above sea level.

Small scale coffee growing has been going on in the Honde Valley since the 1960´s. A project was established in 1986, funded by EU (at that time known as the EEC). This project developed 300 hectare to be cultivated by 600 farmers. Main objectives of the project included creating employment, improved income to small scale farmers and encouragement of crop diversification (EEC 1983). Maize is the main staple, and also the dominant crop in the area.

The rainfall pattern is unimodal, and the rainy season is from October to April. Honde Valley receives a mean annual rainfall of more than 1000 mm, but variation between years is substantial. Two permanent rivers, Honde and Pungwe, offer reliable water sources that can be used for irrigation. The soils are mainly orthoferralitics, characterised by inherently low fertility due to lack of weatherable minerals and high leaching (EEC 1983).

Crops cultivated in Honde Valley range from plantation crops like coffee and tea to annuals like maize, rice, finger-millet and groundnuts. The annuals are mostly grown for home consumption, but some excess produce is sold. Sugarcane, bananas, yams and vegetables are complimentary crops mainly grown in the flood plains.

A large number of women in the area are left with their children on the farm most of the time, without the man's participation. This is partly because 50% of the family heads have a paid job either on an estate or in town, and partly because 10-20% of the farms are run by widows (EEC 1983).

The objectives of this study are:
- to establish the profitability of coffee and maize production at farm level.
- to assess the financial consequences of a proposed irrigation project
- to establish the extent of soil and water conservation
- to assess gender division of labour in maize and coffee production.

## 1. Materials and methods

### 1.1 Data collection

A questionnaire was designed to collect primary data from 150 randomly selected farmers in Honde Valley. The sample was based on a list including all the 1821 coffee growers who sold their coffee through the marketing facility organised by the project. Sixty five percents of the respondents were women. The survey data were supplemented by informal interviews with members of project staff and by secondary data sources.

The questionnaire included questions related to firm size, size of the household availability of credit and extension services, access to markets and off-farm income sources. Most of the questionnaire, however, was devoted to a survey of the agricultural system: Area under each

crop or crop mix and the number of livestock were registered. More detailed information was sought on the cultivation of coffee and maize, the most important cash and food crops in the study area respectively. Such information included yield (separated into sold and retained yield), input of manure and chemical fertilisers, and use of pesticides and hired labour. Any experiences with mechanical soil and water conservation works were recorded, and the division of labour between men and women in the various field operations was registered.

A questionnaire was pre-tested on ten farmers within the study area. After the pre-test, the questionnaire was adjusted, and the main survey was conducted during the autumn 1992.

### 1.2 Data analysis

Data on coffee and maize production were first analysed by basic statistics. The profitability was established by gross margins based on average per hectare quantities of yields and inputs from the questionnaire survey. The present performance was compared with performance according to planning data by calculating net present values of anticipated cash flows for the next 20 years. A proposed alternative of irrigating the fields was also assessed by net present value based on planning data.

Information on the use of soil and water conservation and on the motives for such use was collected within the questionnaire survey. Data were analysed only in terms of simple counts and percentages of each alternative answer.

The survey also included information on the gender division of labour in each of the field operations, in maize and coffee. These data have been recorded in terms of percentages of the respondents who reported that women or men participated.

## 2. Results

### 2.1 Present value calculations on maize and coffee

Gross margins of maize and coffee were calculated based on three alternatives:
1) Today's performance according to averages from questionnaire survey.
2) Inputs and yields according to planning data for rainfed farming.
3) Performance in case of irrigation, according to planning data.

Expected yields, inputs and prices for maize are the same for all the years. In the case of coffee, however, yield will vary substantially depending on the age of the coffee trees. In order to make the figures comparable, the net cash flow of each year was discounted to present value. A ten years time perspective was adopted based on the rationale that the coffee trees are assumed to be replaced every ten years. The discount rate is 10% . Results based on these assumptions are presented in Table 1.

Present performance and performance according to planning data are based on the assumption that the coffee trees presently cultivated will be replaced in year 6. In the case of irrigated agriculture, it is assumed that the coffee trees will be replaced in the first year of the irrigation project.

The irrigation alternative is based on the assumption of a government project, in which only a maintenance fee per hectare of irrigated coffee would be paid by the farmers. This fee is based on existing government irrigation schemes.

**Table 1: Farm economic analysis of maize and coffee production under three assumptions: Today's performance, as observed in the survey, performance according to planning data and assumed performance in case of irrigation All figures are given per hectare.[a]**

| A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| **Maize, today's performance** | 2512 | 562 | 23 | 190 | - | 113 | 428 | 141 | 866 |
| **Maize, planning data** | 3000 | 672 | 24 | 294 | - | 150 | 575 | 97 | 596 |
| **Maize, irrigated** | 5000 | 1120 | 34 | 440 | - | 249 | 874 | 246 | 1512 |
| **Coffee, today's performance** | | | | | | | | | |
| Year 1-5 | 334 | 1335 | 59 | 612 | - | 48 | 982 | 353 | |
| Year 6 | - | - | 135 | 338 | - | 12 | 1086 | -1086 | |
| Year 7 | 100 | 400 | 53 | 338 | - | 12 | 639 | -239 | |
| Year 8 | 200 | 800 | 46 | 336 | - | 12 | 599 | 201 | |
| Year 9-10 | 334 | 1335 | 59 | 612 | - | 48 | 982 | 353 | 982 |
| **Coffee, planning data** | | | | | | | | | |
| Year 1-5 | 900 | 3598 | 83 | 903 | - | 88 | 1443 | 2155 | |
| Year 6 | - | - | 110 | 1581 | - | 37 | 2217 | -2217 | |
| Year 7 | 200 | 800 | 87 | 707 | - | 33 | 1214 | -414 | |
| Year 8 | 500 | 2000 | 90 | 807 | - | 37 | 1334 | 665 | |
| Year 9-10 | 900 | 3598 | 83 | 903 | - | 88 | 1443 | 2155 | 8760 |
| **Coffee, irrigated** | | | | | | | | | |
| Year 1 | - | - | 110 | 1952 | - | 43 | 2595 | -2595 | |
| Year 2 | 300 | 1199 | 89 | 890 | 106 | 57 | 1538 | -339 | |
| Year 3 | 900 | 3595 | 102 | 962 | 118 | 87 | 1723 | 1875 | |
| Year 4-10 | 1600 | 6396 | 112 | 1143 | 132 | 126 | 2011 | 4385 | 14796 |

[a]
A= Crop, alternative and year
B= Yields, kg
C= Gross return = B * producer price (maize: 0.224 Z$, coffee: 3.998 Z$)
D= Labour, days
E= Inputs of fertilisers, pesticides and seed, Z$
F= Maintenance fee for coffee irrigation = 100 Z$ + 0.005*C
G= Transport, Z$
H= Total costs = D * labour price (5.45 Z$) + E + F + G
I = Net return = C - H
J= Present value of net return in year 1-10 = $\sum_{A=1}^{10} I / (1.10)^A$

The outcome of this analysis shows higher profits in coffee than in maize for all the three alternatives. Also, irrigated agriculture gives a substantially higher profit than the two other alternatives, both in case of coffee and maize production. Surprisingly, however, the present performance of maize production seems to give a higher profit than cultivation according to planning data. Planning data show a higher yield than present performance, but also a higher level of input. It seems as the yield increase that can be achieved, is not large enough to offset the costs of the increased inputs.

## 2.2 Soil and water conservation

Soil and water conservation practices were registered for each farm in the survey. (Table 2). Conservation practices were more common on coffee than on maize fields. This was particularly the case when it comes to highly demanding measures, like terraces.

The respondents almost unanimously indicated that motivations for conservation measures were to reduce soil erosion and nutrient loss from the field. Only 3 respondents out of 130 mentioned conservation of moisture for the crops.

**Table 2. The use of conservation practices in Honde Valley, according to survey data**

| Method | Maize (% responses) | Coffee (% responses) |
|---|---|---|
| contour ridges (permanent bank and channel structures) | 71 | 81 |
| terraces | 5 | 45 |
| ridges (contour tilling and planting) | 15 | 13 |
| basins, grass strip, mulch | 5 | 19 |

## 2.3 Gender division of labour

The respondents were asked which field operations were done by women and which operations were done by men. The answers to this question are presented in Table 3. When women and men both participated, both were added into the individual gender participation. The total percentages are therefore more than 100. In the case of maize marketing the total percentage is less than 100 because several farmers cultivated maize only for home consumption. Also pest and disease control in maize is less than 100% because some farmers did not apply any such control for maize. The results show that handling of chemicals is mostly the men's task while all other field operations were mostly carried out by women.

Eighty three percents of the respondents indicated that coffee production did not interfere with maize production, while the remaining 17% felt that coffee competed with maize for labour.

**Table 3. Participation in various field operations by gender in Honde Valley, according to survey data[a]**

| Operation | Maize | | Coffee | |
|---|---|---|---|---|
| | Women, % | Men, % | Women, % | Men, % |
| building of nursery | - | - | 64 | 56 |
| planting | 95 | 19 | 60 | 51 |
| fertiliser application | 79 | 36 | 72 | 38 |
| weeding | 96 | 21 | 93 | 21 |
| pest and disease control | 44 | 53 | 12 | 91 |
| other chemical control | - | - | 29 | 75 |
| harvesting | 95 | 21 | 97 | 21 |
| carrying coffee to pulpery | - | - | 91 | 22 |
| processing and drying | - | - | 87 | 28 |
| bagging | 97 | 7 | 83 | 33 |
| marketing | 49 | 28 | - | - |

a " - " indicates that the operation is not relevant for the crop in question

## 3. Discussion

### 3.1 Present value calculations of maize and coffee

The present maize cultivation gives a lower yield, but a higher profit than the planning data. It seems that the farmers have found a rewarding low input system for maize production. The low return from the planning data may be explained by recent increases in input prices, which have not yet been taken into account in the recommendations on use of inputs.

On the other hand, the economic performance of present coffee production, as compared to planning data, is very poor. Coffee yields are generally low. The average from the survey was 334 kg/hectare, which includes some holdings where coffee is more or less neglected. According to Graaf (1986) Kenyan smallholders produce 540 kg/hectare and in Brazil, the largest coffee producer in the world, the average yield is 500 - 600 kg/hectare. The planning data, however, has a yield of 900 kg/hectare. There seems to be a strong case for adjusting the planning data at this point.

Results are strongly in favour of irrigation. The costs included in Table 1, however, are only what the farmers have to pay according to the rates in government managed projects. These rates do not cover the investments, indicating that irrigation projects are subsidised. A cost benefit analysis, including both the farmers and the government's costs and benefits, would have shown substantially higher costs. The present analysis tells us only that the project is financially beneficial to the farmers, not necessarily that it is socially profitable.

### 3.2 Soil and water conservation

Table 2 shows a much higher use of conservation practices in coffee than in maize. That might be because farmers have experienced more serious erosion on coffee fields than on maize fields. It is also possible that coffee fields are better cared for, because of high economic value. However, an even more likely explanation is that agricultural extension is more active in coffee than in maize. The survey showed that 92% of the households received training before they started cultivating coffee, and most of them confirmed that extension visits were still regular. Another reason for more soil conservation in coffee might be that these structures to some

extent are permanent, while some of the soil conserving structures in maize have to be made or maintained every year, resulting in a high labour demand.

### 3.3 Gender division of labour

It is shown in Table 3 that most of the field operations are carried out predominantly by women. The dominance of female labour can be explained by the fact that a large proportion of the men had off-farm employment, often at a long distance from home. However, it also seems clear that no gender is culturally totally excluded from carrying out any of the tasks.

There is a tendency of higher male participation in coffee cultivation than in maize production. This is not surprising. According to Ellis (1988 p. 173), in the African context there is often "specialisation in which women work in food crops for domestic subsistence and men in cash crops for market sale".

Male labour dominates only in tasks related to application of chemicals. This might be due to the equipment for spraying chemicals being heavy. Also, the use of technical facilities is culturally the domain of men.

## Summary

A smallholder coffee project has been implemented in Honde Valley, an area situated 200 km east-south-east of Harare, the capital of Zimbabwe. This paper assesses the cultivation of maize and coffee in the project area in terms of financial performance, soil and water conservation, and gender division of labour.

Primary data were collected by a questionnaire survey covering 150 households. A farm economic analysis was carried out by estimating the net cash flow of each year for a ten year period, and discounting the cash flows to present value.

The present profitability in maize cultivation was better than performance according to planning data, in spite of lower yields. However, the present profitability in coffee production lags far behind the planning data. The latter seems to be partly because of unsatisfactory management of the coffee plantations, partly because of over-optimistic planning data. The analysis indicates that a state managed irrigation project would be financially beneficial to the farmers. In all alternatives, coffee cultivation was substantially more profitable than maize.

Soil and water conservation practices are common, and they are more common in coffee than in maize fields. The main motivation for such practices is conservation of soil and nutrients rather than conservation of moisture.

Female labour was dominant in all field operations, except from application of chemicals. Male contribution was higher in coffee than in maize cultivation. Off-farm employment is assumed to be the main reason for low male contribution to farm activities.

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# Small-Scale Irrigation in Semi-Arid Areas:
## The Case of Nyahombe Resettlement Area and Mushandike Resettlement Irrigation Scheme, Zimbabwe

Mutsai Magadzire and Fred H. Johnsen

## Introduction

Zimbabwe has about 192,000 hectares of land under irrigation and there is enough water to irrigate another 200,000 hectares (Kandiah 1992). According to a review by FAO (1990) 80% of the irrigated area was utilised by large-scale commercial farmers and 12 percent in parastatal estates, leaving only 8% to be shared among resettlement schemes and communal small-scale irrigation schemes.

Increasing attention is paid to the importance of irrigation for small-scale farmers as a means of improving food security and increasing income. Severe droughts and high population growth in Zimbabwe has contributed to this concern. Smallholders who may be subject to food insecurity are generally found in communal areas and in resettlement areas, such as Nyahombe and Mushandike.

Nyahombe Resettlement Area and Mushandike Resettlement Scheme are located in the Chiredzi District of Masvingo Province in Zimbabwe. While Nyahombe is based on rainfed farming, Mushandike is an irrigation scheme.

The altitude of Nyahombe Resettlement Area is 620 m. Rainfall is low and erratic, the mean annual rainfall of the nearest meteorological station is 373 mm, falling from mid-November to mid-April. A preliminary soil survey indicates that approximately 200 hectares of the area is suitable for irrigation. At present the area suitable for irrigation in the Nyahombe area is being cultivated by 38 households. Each farmer is allocated 5 hectare net arable land and a provision of 10 livestock units.

Mushandike Resettlement Irrigation Scheme is located at an altitude of 875 m. The mean annual rainfall averages 520 mm with frequent dry spells during the rainy season. The soil is shallow to moderately shallow, often with a high contents of stones. Each family within the Mushandike scheme has been allocated 1.5 hectare net irrigated land.

Plans also exist for an irrigation scheme in the Nyahombe area. Experiences from the Mushandike irrigation scheme are used to evaluate the costs and benefits of irrigation in Nyahombe. The physical, climatic and social conditions of the two areas seem to be similar enough to make such a comparison valid.

The objective of this study is to assess the costs and benefits of irrigation to the farmers under the given conditions.

## 1. Materials and methods

### 1.1 Data collection

A questionnaire survey was carried out in Nyahombe and Mushandike. The questionnaire included basic household data, attitudes towards irrigation and current agricultural practices. The survey of current practices included crops cultivated, yields, farm implements, use of labour, amounts and costs of purchased inputs, use of credit and sources of income apart from crop production.

The questionnaire was pre-tested on 5 respondents within the study area. Necessary adjustments were made. The main survey included 38 farmers within the proposed irrigation scheme in Nyahombe and a sample of 37 households within the Mushandike Scheme. The sample in Mushandike was picked randomly among those households who were first settled in the area, in 1986, assuming that these farmers had gained enough experience on irrigated farming, and that their yield had stabilised.

### 1.2 Statistical analysis

Statistical analysis was employed to test for differences between the rainfed farming (Nyahombe) and irrigated farming (Mushandike). The statistical tests were executed by the MINITAB program.

In cases of nominal data, a chi-square test was used to test hypotheses of the class:
$H_0$: $P_N = P_M$ versus $H_1$: $P_N \neq P_M$
where $P_N$ is a frequency count for Nyahombe and $P_M$ is a frequency count for Mushandike.

In cases of continuous data on income sources other than crop production, a two sample t-test was carried out to test hypotheses of the class:
$H_0$: $\mu_N = \mu_M$ *versus* $H1$: $\mu_N \neq \mu_M$
where $\mu_N$ is an expected value for Nyahombe and $\mu_M$ is an expected value for Mushandike.

### 1.3 Economic analysis

Based on averages from the survey data, gross margins were calculated for each crop within the rainfed farming system and the irrigated system. These gross margins were combined according to the area devoted to each crop in an average farm of each scheme. Fixed costs were deducted in order to arrive at the net family income from crop production. Labour was not considered, because the farms in each of the areas were given a specific size which was assumed to fit with what could be managed by family labour. Other income sources were recorded, so that the two schemes could also be compared in terms of total family income.

## 2 Results

2.1 Analysis of nominal data

The outcomes of the statistical analysis of nominal data are summarised in Table 1. The results show no significant difference between the farmers on rainfed land and those on irrigated land with respect to the type of management preferred. A vast majority in both groups wanted to maintain rainfed farming in addition to an irrigated plot, and there was no significant difference between the farmers in this respect. Although the tendency seemed to be slightly in favour of main emphasis on food crops in the rainfed area and cash crops in the irrigated area, this tendency was not significant.

There was a significant difference between the two areas with respect to labour. While the farmers in the rainfed area relied mainly on household labour, the most important source of labour in the irrigated area was casual labourers. There was also a significant difference between the two samples with respect to credit from the Agricultural Finance Cooperation. While most of the farmers in the irrigated area had such loans, this was not the case in the rainfed area. Finally, the farmers in the irrigated area were significantly more aware of environmental hazards connected to irrigation, particularly waterborne diseases, than the farmers in the rainfed area.

**Table 1. Outcome of analysis of some essential nominal data comparing farmers in rainfed area with farmers in irrigated area. * indicates significance at 95% confidence level.**

| Parameter | Responses | Frequency in rainfed area, % | Frequency in irrigated area, % | Chi-square |
|---|---|---|---|---|
| Type of management preferred | Government | 16 | 24 | 2.347 |
| | Farmer managed | 29 | 38 | |
| | Combination of both | 55 | 48 | |
| Maintaining dry-land farming | Yes | 92 | 81 | 1.972 |
| | No | 8 | 19 | |
| Food crops *versus* cash crops | Food crops | 58 | 49 | 0.644 |
| | Cash crops | 42 | 51 | |
| Credit from Agric. Finance Coop. | Yes | 39 | 86 | 17.710* |
| | No | 61 | 14 | |
| Awareness of environmental impacts | Waterborne diseases | 21 | 57 | 14.203* |
| | Pesticide hazards | 24 | 27 | |
| | None | 55 | 16 | |

2.2 Income from crop production

*2.2.1 Crop production under rainfed conditions*

Gross margins of the various crops under dryland conditions are calculated in Table 2, based on averages from the questionnaire survey in Nyahombe. The farmers in this area rely on animal manure, therefore the cost of fertiliser is not considered. Pesticides are used only for cotton. Marketing costs are considered only for sunflower and cotton because the other crops are mostly for home consumption.

Based on the gross margins in Table 2, the farm budget of an average farm is calculated in Table 3.

**Table 2. Gross margin calculations of various crops under rainfed conditions. All figures except yield and price are given in Zimbabwean dollar (Z$) per hectare.**

| | Maize | Sun-flower | Sorg-hum | Millet | Ground-nut | Finger millet | Cotton |
|---|---|---|---|---|---|---|---|
| Yield (tons/hectare) | 1.7 | 0.9 | 0.90 | 0.80 | 1.12 | 0.65 | 0.76 |
| Price (Z$/ton) | 224 | 486 | 211 | 243 | 766 | 287 | 1090 |
| Gross output | 381 | 437 | 190 | 194 | 858 | 187 | 828 |
| Seeds | 57 | 30 | 20 | 10 | 100 | 30 | 15 |
| Pesticides | 0 | 0 | 0 | 0 | 0 | 0 | 204 |
| Packing material | 0 | 5 | 0 | 0 | 0 | 0 | 4 |
| Transport | 0 | 43 | 0 | 0 | 0 | 0 | 18 |
| Total variable costs | 57 | 78 | 20 | 10 | 100 | 30 | 241 |
| Gross margin | 324 | 359 | 170 | 184 | 758 | 157 | 587 |

**Table 3. Calculation of farm budget for an average 5 hectare farm under rainfed conditions.**

| | Total area for the sample (hectare) | Average area per 5 hectare farm (hectare) | Gross margin (Z$/hectare) | Income per farm (Z$) |
|---|---|---|---|---|
| Maize | 88 | 2.32 | 324 | 752 |
| Sunflower | 29 | 0.76 | 359 | 273 |
| Sorghum | 16 | 0.42 | 170 | 71 |
| Millet | 15 | 0.39 | 184 | 72 |
| Groundnut | 25 | 0.66 | 758 | 500 |
| Finger millet | 13 | 0.34 | 157 | 53 |
| Cotton | 4 | 0.11 | 587 | 65 |
| Sub total | 190 | 5.00 | --- | 1786 |
| Implements | --- | --- | --- | - 90 |
| Net return | --- | --- | --- | 1696 |

*2.2.2 Crop production under irrigated conditions*

Gross margins of the various crops under irrigated conditions are calculated in Table 4 based on averages from the questionnaire survey in Mushandike. Land preparation and irrigation are provided by the project management at a fixed price per hectare. Seeds and fertilisers are purchased for all crops, and pesticides are used for maize and cotton only. The irrigated production is far more market oriented than the rainfed farming, hence marketing costs are included for all crops.

Based on the gross margins in table 4, the farm budget of an average irrigated farm is calculated in Table 5. The farm budget is based on the recommended rotation. The total annual crop area is twice the farm area because with irrigation the farmer will cultivate summer crops (cotton and maize) and winter crops (wheat and beans).

**Table 4. Gross margin calculations of various crops under irrigated conditions. All figures except yield and price are given in Z$/hectare.**

| | Maize | Beans | Cotton | Wheat |
|---|---|---|---|---|
| Yield (tons/hectare) | 5.5 | 1.4 | 3.0 | 4.4 |
| Price (Z$/ton) | 224 | 1600 | 1090 | 458 |
| Gross output | 1232 | 2240 | 3270 | 2015 |
| Land preparation | 70 | 70 | 70 | 70 |
| Seed | 57 | 90 | 15 | 100 |
| Compound fertiliser | 138 | 92 | 110 | 162 |
| Ammonium nitrate | 126 | 63 | 42 | 84 |
| Pesticides | 5 | 0 | 204 | 0 |
| Packing material | 20 | 11 | 10 | 12 |
| Transport | 264 | 67 | 72 | 211 |
| Irrigation cost | 90 | 55 | 90 | 55 |
| Interest on credit | 55 | 44 | 62 | 58 |
| Total variable costs | 825 | 492 | 675 | 752 |
| Gross margin | 407 | 1748 | 2595 | 1263 |

**Table 5. Calculation of farm budget for an average 1.5 hectare farm under irrigated conditions.**

| | Average area per 1.5 hectare farm (hectare) | Gross margin (Z$/hectare) | Income per farm (Z$) |
|---|---|---|---|
| Maize | 0.5 | 407 | 204 |
| Beans | 0.5 | 1748 | 874 |
| Cotton | 1.0 | 2595 | 2595 |
| Wheat | 1.0 | 1263 | 1263 |
| Sub total | 3.0 | --- | 4936 |
| Implements | --- | --- | - 90 |
| Net return | --- | --- | 4846 |

2.3 Income sources other than crop production

In both samples, the respondents were asked about other income sources than crop production. The hypothesis was that the farmers in the rainfed area, having less income from crop production, would devote more effort to other income generating activities. Hence, they could possibly compensate for their lower crop production. The outcome of the analysis is summarised in Table 6. Farmers in the rainfed area earn more from beer brewing than farmers in the irrigated area, while the opposite is the case for craft making. These are the only significant observations.

Although the statistical analysis is not very convincing, based on averages from the survey the farmers in the rainfed area have a larger income outside crop production than the farmers in the irrigated area.

The total income for the two groups of farmers is presented in Table 7. On average, farmers in the irrigated area get most of their incomes from crop production while farmers in the rainfed area earn most of their income by other activities. It is evident, however, that in terms of total income farmers in the irrigated area are better off than those in the rainfed area.

**Table 6. Income from various sources outside crop production, comparing farmers in rainfed area with farmers in irrigated area. * indicates significance at 95% confidence level, ** indicates significance at 99% confidence level.**

| Income source | Rainfed area, mean income (Z$) | Irrigated area, mean income (Z$) | t-value | p |
|---|---|---|---|---|
| Livestock sales | 1642 | 785 | 1.31 | 0.19 |
| Off-farm employment | 380 | 565 | - 0.08 | 0.94 |
| Craft making | 30 | 180 | - 2.02 * | 0.047 |
| Beer brewing | 87 | 40 | 4.66 ** | 0.000 |
| Gold panning | 527 | 296 | 1.65 | 0.10 |
| Gold panning | 2666 | 1866 | | |

**Table 7. Total family income in rainfed area compared to irrigated area (Z$)**

| Income source | Rainfed area | Irrigated area |
|---|---|---|
| Crop production | 1696 | 4846 |
| Other incomes | 2666 | 1866 |
| Total | 4362 | 6712 |

# 3 Discussion

## 3.1 Discussion on nominal data

Farmers in irrigated and rainfed areas did not differ significantly in their preference of management system (table 1). The tendency in both areas was towards a combination of government and farmer management. The reluctance of farmers to take full responsibility may partly be because of lack of confidence in their own managerial skills, partly because government management also involves subsidies by a water tariff that does not cover the full cost of irrigation.

In both areas, most farmers were in favour of maintaining a rainfed plot in addition to an irrigated plot. The farmers seem to prefer a diversified system, consisting of irrigated farming, rainfed farming, livestock and other income-generating activities. The irrigated plot offers security for the household in years of drought. FAO (1987) found that small-scale farmers in semi-arid regions increase their effort on irrigated plots during droughts.

The farmers in both areas were asked whether they would give higher priority to food crops or cash crops in the irrigated plot. The distribution of the answers was close to fifty-fifty, and the responses did not differ significantly between the irrigated and the rainfed area (Table 1). This observation points out that the low emphasis on the staple crop, maize, in the rotation decided by the project management in Mushandike irrigation scheme, may be questionable.

Most farmers in the irrigated area have agricultural credit, while most farmers in the rainfed area have not. The Agricultural Finance Cooperation has given credit to a vast majority of farmers within the irrigation project, but only to a minority within the rainfed area. This difference is statistically significant, and can be seen as an indication of better developed extension and other government services in the irrigated than in the rainfed area.

There was a significant difference between the farmers in the irrigated and the rainfed area on the most important environmental impact of irrigation (Table 1). Most farmers in the irrigated area mentioned waterborne diseases, while majority in the rainfed area were not aware of any impact. These results confirm that farmers who have practised irrigation for some years would be more aware of the negative impacts than those who do not have experience with irrigation. Chandiwana et al. (1988) reported increase of schistosomiasis following the introduction of irrigation in Mushandike.

## 3.2 Discussion on household income

The figures for net return from crop production (Tables 3 and 5) come out strongly in favour of irrigation. The net return from a farm of 5 hectares of rainfed land is Z$ 1696, which is only slightly above the national minimum agricultural wage of Z$ 1440. A 1.5 hectare irrigated farm yields a net return of Z$ 4846, which is more than three times the minimum agricultural wage. In addition to the advantage of increased income, there is also the benefit of supporting more than three times as many families per unit of irrigated land, compared to rainfed land.

In the rainfed areas, activities outside crop production seem to give more income than crop production (Table 7). Diversion into these other activities can be seen as a coping strategy to compensate for low levels of crop production. On average, the farmers in the rainfed area also had larger income from other activities than the farmers in the irrigated area. However, this income was far from enough to outweigh the higher income from crop production in the irrigated area.

The economic analysis seems to confirm the observations by Rukuni (1985), who reported that almost all the extension agents he surveyed held the opinion that their irrigation scheme was beneficial to the farmers providing all year round fresh food, increased yields and increased purchasing power.

## Summary

Nyahombe and Mushandike are two resettlement schemes in Zimbabwe. While Nyahombe is based on rainfed farming, the farms in Mushandike are irrigated. Plans are underway to establish an irrigation scheme for Nyahombe. This study compares farm economics of the two areas in order to assess the costs and benefits of irrigation to the farmers under the given conditions.

A questionnaire survey was carried out at household level in both areas. The analysis of data included statistical and economical methods. The rainfed area and the irrigated area were compared by chi-square tests for important nominal data and t-tests were employed for data on income sources outside crop production. Farm budgets for both areas were worked out to find the differences in economic performance.

Farmers responses in the rainfed area were not significantly different from those in the irrigated area concerning type of irrigation management preferred, whether they wanted to keep a rainfed plot in addition to an irrigated one, or in their priority of food crops *versus* cash crops. However, credit from the Agricultural Finance Cooperation was significantly more common in the irrigated area than in the rainfed area. Also, the farmers in the irrigated area were significantly more aware of environmental impacts of irrigation than those in the rainfed area.

The net return of crop production to a farming family was found to be Z$ 1696 for a 5 hectare farm in the rainfed area and Z$ 4846 for a 1.5 hectare farm in the irrigated area. Family income from activities other than crop production was Z$ 2666 in the rainfed area and Z$1866 in the irrigated area. The farmers in the rainfed area seem to compensate their lower income from crop production by emphasising other activities more than the farmers in the irrigated area. However, the income from those activities was far too low to outweigh the large difference between the two areas in income from crop production.

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