

**THE IMPACT OF FARM WATER SUPPLY ON SMALLHOLDER
INCOME AND POVERTY ALLEVIATION ALONG THE
PACIFIC COAST OF NICARAGUA**

A CASE FOR LOW COST TECHNOLOGY SOLUTIONS

J.J. van der Zee, A. Fajardo Reina, and H. Holtslag

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Summary

Poverty and abject poverty in the sub humid and semi arid tropics of 9 municipalities surveyed along the Pacific Coast of Nicaragua amounts to respectively 65% and 28%, and occurs most frequently on farms of up to 7 ha. The presence of a well on properties in this range raises income by as much as a third, whilst the use of a rope handpump raises this once again by an average of 18%. A major part of the income generated on these farms is derived from the so called patio which can be roughly compared to a kitchen garden. Given the right conditions which include access to a market, patio development, including the vicinity of a well with a handpump and a low pressure irrigation system, can be a permanent solution to poverty. Related investment costs of drilling and the purchase of equipment can be recuperated within a year always provided that low cost technology is available. Without these producers are less prone to take the risk. Horticulture as a specialization outside the patio context is as yet not an option. At the moment production is less than 1% of agricultural production, including dairy and livestock production, for reasons of the high cost of water. However, this may change with the introduction of the motor rope pump which brings back acquisition and operational cost to less than half.

Introduction

The Nicaraguan NGO, CESADE (Centro de Estudios y Acción para el Desarrollo) has been active in the dry tropics of Central America since 1987. The dry tropics are here defined as the part bordering the Pacific Ocean below 400m asl. Strictly speaking this area belongs to the semi arid and sub humid tropics, however, due to unreliable rainfall during the first four months of a rainy season lasting from early May to early November as well as a higher frequency of occurrence of "El Niño" the past two decades, local inhabitants refer to it as the "dry tropics".

CESADE's mission concerns poverty alleviation (and if possible economic growth) of rural smallholders under ecosustainable conditions. Its premise is that sustainable agriculture is not possible without a viable natural environment, whilst a viable environment is not possible without adequate food security. Its approach is centred on the use and application of low cost technology. Amongst other themes its so called "water package" includes hand drilled wells with the "stone hammer method", widespread use of the "rope pump", and low pressure drip irrigation. With regard to the rope pump, CESADE during the past twelve years has been one of the two principal organizations amongst several others instrumental in the distribution and installation of a total of 40,000 units of various types in Nicaragua alone

Identification of options for rural development

CESADE, during the past 3 years, has been engaged in a systematic semi detailed analysis of physical environmental and socio economic trends, including the interrelationships between their attributes, in municipalities where it implements development projects. The purpose of this work is to gain improved efficacy regarding its

policies and their adjustment to local reality and conditions if necessary. So far the information for 9 municipalities has been completed (see map attached). This includes the identification of options, their potential, limitations, and (environmental) management criteria as well as an approximate idea of costs and benefits for each alternative. As part of this work the relationship between poverty and the presence of water and a pump on the farm was analysed, and what impact this has on farm income. As a second objective an analysis was done to identify the conditions for small scale irrigation with emphasis on kitchen gardens, horticulture, and fruits, including bananas and plantain. Table 1 shows the size of the field samples taken, which from a statistic point of view must be considered quite adequate.

TABLE 1: SOCIO- ECONOMIC FIELD SURVEY SAMPLE

Municipalities	No. farms	Sample (%)
San Francisco de Cuapa	408	53
La Paz Centro/Nagarote	613	15
North of Chinandega	1245	15
Total	2261	

Poverty

Poverty means different things to different countries. For example, poverty in Nicaragua cannot be compared with poverty in Africa or Europe. For this reason Table 2 has been included in order to give an impression of what are considered basic local needs. As for the cost of food, this is based on a daily intake of 2250 kcal for each person in a household of 6. .

**TABLE 2:
MINIMUM ANNUAL BASIC NEEDS
- 3 ADULTS AND 3 CHILDREN -**

Cash requirements	C\$
Food and house cleaning 52 x 190	9,880
Health	2,400
Schooling 2 children	3,600
Clothes 4 ½ x 500	2,250
Transport 12 x 120	1,440
Agricultural inputs	3,000
Subtotal	22,570
Requirements in kind (supplied on farm)	
Minimum food production	4,784
Farm inputs (animal feed)	2,520
Opportunity cost house rent	1,200
Opportunity cost water	480
Opportunity cost firewood	400
Minimum cost electricity	520
Subtotal	9,904
TOTAL	32,474

Note: 1) US\$1.- equals C\$14.2 (Córdobas). **2)** Expenditure as related to line items and the total of C\$32,474 in Table 2 reflect averages of real expenditure of the 2261 families surveyed, and further closely corresponds to the poverty line established by the Government of Nicaragua and UNDP.

Table 3 shows the state of poverty in the 9 municipalities surveyed. Based on farm income alone, poverty amounts to 77% and abject poverty (absolute poverty) to 54%. The poverty line as defined in Table 2 corresponds to family income less than C\$32,474.- Abject poverty corresponds to family income less than C\$17,500.- Based on total income, poverty and absolute poverty amount to respectively 65% and 28%. The difference between farm income and total income represents income from off farm employment. The state of poverty in these 9 municipalities is considered a fair representation of poverty in the remainder of the dry tropics of Nicaragua.

TABLE 3: % ABJECT POVERTY AND POVERTY BASED ON FARM INCOME AND TOTAL INCOME OF FAMILIES SURVEYED

Municipalities	Based on Farm income		Based on Total income	
	<17,500	< 32,500	< 17,500	< 32,500
S. Tomás	48	87	30	77
S. Pedro	29	78	24	73
S. Francisco	17	59	10	51
Cinco Pinos	45	71	21	60
Villanueva	70	89	27	79
Somotillo	61	84	41	77
S. F. de Cuapa	59	75	25	35
LPC/NAG	48	61	23	48
Weighted average	54	77	28	65

Farming represents a complex system, composed of attributes that are complex systems by themselves. These attributes are: climate, soil, water, land form, scale of operations (incl. size of the farm), capital, product(s), technology, management, market, land tenure, and the quality and credibility of institutional involvement. As can be seen from Table 4, in the dry tropics of Nicaragua under present conditions of minimum capital investment as well as minimum skills and technology, the size of the property is the determining cause of poverty. This does not have to be necessarily so. For example, soil improvement alone by means of an organic approach and environmental rehabilitation can double or treble yields within the space of three to four years. As part of this process the availability of water can double this again. As a last point it is perhaps worth mentioning that contrary to popular opinion the present lack of security about land tenure plays only a minor role in current investment strategies of rural producers.

TABLE 4: FARM INCOME ACCORDING TO PROPERTY SIZE WITH AND WITHOUT A WELL

Poverty in Manzanas (Mz)	North of Chinandega			La Paz Centro and Nagarote		
	Well	No well	% incr.	Well	No well	% incr.
0 – 1				9,084	7,295	25
1 – 2	10,503	7,702	36	11,973	10,127	18
2 – 4	17,387	13,508	29	28,963	15,043	93
4 – 6	22,317	16,887	32	19,397	12,331	57
6 – 10	24,879	19,649	24	25,020	22,797	10
10 – 20	21,575	24,814	-11	33,925	22,364	52
20 – 30	36,901	28,677	29	35,931	16,687	115

Impact of water on farm income under present conditions

The impact of water in terms of farm income can clearly be seen in Table 4. In the 6 municipalities that conform the North of the Province of Chinandega and the the 2 municipalities in the Province of León, La Paz Centro and Nagarote, poverty still prevails on properties larger than 30 mz. (21 ha). The same applies for the Municipality of San Francisco de Cuapa (Province of Chontales). However, in the North of Chinandega poverty disappears from 20 mz.(14 ha) upwards when there is a well, whilst in La Paz Centro and Nagarote this already occurs at 10 mz. (7 ha). Unfortunately wells in San Francisco de Cuapa amount to less than 5% of the sample taken. For this reason no reliable analysis was possible.

TABLE 5: FARM CATEGORIES WITH AND WITHOUT A WELL NORTH OF CHINANDEGA

Farm (Mz)	No. farms with a well	%	No. without a well	%
0 – 2	13	7	177	93
2 – 4	27	13	186	87
4 – 6	16	22	57	78
6 – 10	27	33	55	67
10 – 20	42	44	54	56
20 – 30	17	55	14	45
> 30	27	49	28	51
	169	23	571	77

Table 5 shows the percentage of farm owners who have a well and those who don't. Though these figures do not take into account the differences between terrain, lithology, and depth of the groundwater table, it is clear that the smallest land owners can ill afford the cost of constructing a conventional well, which lies between C\$3000.- and C\$14,000.- When taking into account the economic benefits of farm watersupply, the case for the introduction of low cost technology like the stonehammer method is self evident.

Impact of the rope handpump

In the North of Chinandega 23% of the rural population owns a well, whilst 11% own a well without a pump, and 12% a well with a pump. In La Paz Centro and in Nagarote well owners amount to 72.5%, whilst 32% own a pump. In each instance approximately half the wells are thus fitted with a pump. In 88% of all cases this concerns the manual rope pump. Half of these are the conventional version; the other half consists of the so called "KIT" model, the bicycle pump, the "Bometran" which is driven by animal tracción, and the wind rope pump (a wind mill). In the latter case these make up only 4% of the total. For the "Bometran" this amounts to 2%.

As yet there is no analysis available to differentiate between the impact of the rope handpump as related to the different farm categories with a well on the property. However, on average in the range from 0-30 mz. (0-21 ha) this amounts to C\$3124.- or US\$220.- in addition to the difference between the presence of a well and no well at all.

The role of water and the rope handpump in a strategy for poverty alleviation

The impact of water is proportionally highest for the smallest categories of farms with the lowest incomes. For families living in absolute poverty this may mean a change of status, though they'll still be poor, and for the poor an opportunity to rise above the poverty line.

As can be seen from tables 6 and 7 a major part of the income obtained from these small properties comes from the so called "patio". A patio can be compared to a kitchen garden, but is not the same. It's an area around the farm house varying between 900-1800 m2, surrounded by fruit trees, firewood species, and shrubs. Within the area one finds a dozen or so of chickens, a few pigs, herbs like basilicum and mint in flowerpots, the washing area, the social area, and perhaps a well and a latrine. The patio in general is the domain of women.

TABLE 6: PATIO AS A % OF FARM INCOME FOR DIFFERENT CATEGORIES GROUP 3 MUNICIPALITIES LA PAZ CENTRO AND NAGAROTE

Category Mz	Av. Income patio (C\$)	Av. income Livestock (C\$)	Av. income Crops (C\$)	Av. income C\$	% patio Total
0 – 5	10,041	8,015	3,467	21,523	47
5 – 15	10,688	19,804	4,075	34,567	31
15 – 30	10,694	23,635	4,020	38,349	28
30 – 50	10,336	29,077	9,307	48,720	21
50 – 100	10,031	43,446	11,257	64,734	15

The previous example corresponds to a patio income of approximately C\$4,000.00.- However, given the right conditions, income can be significantly higher. An average patio income of C\$10,500.00.- in Table 6 is related to good soils, sufficient space, a well with a pump, two local- and one metropolitan markets with good access roads at less than 30 km, and producers (Group 3 in Table 6) who derive their income almost exclusively from the farm. Well developed patios (approx. 25%), with incomes up to C\$30,000.00, are characterised by a poultry component and 5-10 pigs as a basis, fruit trees as the next component, and irrigated vegetables as the final stage of development. The availability of water and a pump in this scheme is essential. Differences between well developed patios without water and the latter may range from C\$8,000.00.- to C\$15,000.00.-

TABLE 7: PATIO INCOME AS A % OF FARM INCOME SAN FRANCISCO DE CUAPA

Rango	Av. patio (Mz)	Av. income	% farm income
0 – 1	0.23	2,379	40
1 – 2	0.20	3,403	37
2 – 6	0.22	5,834	40
6 – 10	0.23	5,016	29
10 – 30	0.26	5,611	19
30 – 50	0.29	3,176	9
50 – 100	0.23	4,932	4

TABLE 8: PATIO INCOME (C\$) MUNICIPALITIES NORTH OF CHINANDEGA

Municipality	Well	No well
Cinco Pinos	6,528.21	3,285.34
San Francisco	7,057.89	3,873.45
San Pedro	3,617.24	3,171.26
Santo Tomas	4,429.38	3,370.51
Somotillo	4,690.10	2,873.73
Villa Nueva	5,649.22	2,615.04
Weighted av.	5,262.00	2,999.00

Patio development as a means for poverty alleviation has been tried in Nicaragua by various organizations during the past 10 years. Success has been limited, due to an emphasis on gender issues whilst forgetting the need for information regarding the socio-economic and geographic conditions for its development, technical know how, and low cost solutions. Prospects nevertheless remain good, provided one knows where and how.

Based on the information from CESADE's data bank of the 9 municipalities it can be shown that under the right conditions a patio of 1,800 m² with a well, pump, a rudimentary low pressure irrigation system, and a groundwater table of no more than 10m (quite common on the Pacific Coast of Nicaragua) can easily produce an annual gross income of

C\$48,960.00.- (US\$3500) at an investment cost of C\$11,722.00.- (US\$837), and a recurring annual cost of C\$10,650.- (US\$760), labour not included. Daily labour requirements are 3 hours a day. Patio development around the city limits of Managua, León, and Chinandega offers the best potential in the struggle against poverty, given that a sizeable proportion of the poor and very poor are concentrated here. Good soils and water are further abundant, and ready markets for produce available. Selección of the right beneficiaries for a programme of this kind must be limited to those of proven vocation. Normally these amount to about 50% of all land owners.

The future of horticulture

Horticulture in the dry tropics of Nicaragua outside the patio sphere hardly plays a role in the rural economy with the exception of the Province of Rivas where water tables of less than 5 m are common. Vegetables consumed in the cities are generally imported from Guatemala and Costa Rica, though onions, cabbage, carrots and potatoes are produced in small areas not belonging to the dry tropics respectively above 500 m asl. and 1,100m asl. There is also a good market for fruits like avocado and plantain (cooking banana).

As mentioned earlier, the costs of irrigation don't justify the expense when using the traditional motor pumps that can reach to 7m below the surface and submergible pumps driven by electricity, whilst users of the rope handpump limit their efforts to approximately half an hour. The introduction of the motor rope pump, presently in stage of development, may change all that. This pump driven by a 1.5 HP engine (more is not needed) operates effectively to depths of 30m at half the running and maintenance costs of conventional motor pumps or electric pumps, and is ideal for the irrigation of plots up to 3 mz. (2.1 ha). Its envisaged purchasing price, including installation, is approximately US\$400.- Provided it performs under field conditions as expected, this will mean a revolution for smallholders and larger farms alike.

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