

ASSESSMENT OF THE AGRICULTURAL AND DOMESTIC WATER USAGE BY THE WOMEN OF N'HAMBITA VILLAGE, SOFALA PROVINCE, MOZAMBIQUE

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Abstract:

The research took place in rural central Mozambique, within N'hambita Village, located in the buffer area of Gorongosa National Park. The focus of the study was to assess the agricultural and domestic water usage by local people. Due to the fact that women of the households are mainly responsible for the water collection and the agricultural activities, the investigation has been conducted among the women of the village. In order to collect the social and environmental data, the methodology of the research was based on interviews, questionnaires, GPS mapping of water sources and observation of the water use. The people of the village rely on the three different water sources: boreholes, wells and the river Ripisse, which passes through the village. The Ripisse River is described like the seasonal river stream, which leaves the local people to irrigate their cultivations only from the wells and boreholes water. This research assesses the present water management practices of the village members, and investigates the potentials for the sustainable improvements.

Key words: Mozambique, rural water management, women

INTRODUCTION

According to the World Health Organization (WHO) three leading health problems in low-income countries are malnutrition, unsafe sex and unsafe water (Momsen, 2004). Mozambique is one of those low-income countries (World Bank, 2010) and two of those problems (malnutrition and unsafe water) are the ones directly related with the topic of this research. Scarcity of water affects the agricultural productivity, food availability and nutrition. Further on, the water quality (which differs depending on the water source used), is directly related with the human health, particularly affecting children and women, as they usually collect water, exposing themselves more frequently than men to the waterborne diseases and parasites. As stated in many researches (Hanjira et al, 2009) both quality and quantity of water, can be improved starting with the assessment of present water management practices in the community of the study area and then looking at the potentials for its improvements. This research assesses the water management practices of local people respectively, focusing on the agricultural and domestic water usage. In the following text the term domestic water is described as water used for all standard household purposes counting consumption, bathing and food preparation (WHO, 2003).

Gender issues in agriculture

The trend of increasing urbanization in sub-Saharan Africa is related with a strong migratory movement from rural to urban areas. This migration is lead by men while women use to stay in villages, taking care of children,

household and agricultural production. This general African context applies to this study case in Mozambique, where male migration to South Africa or other neighbour countries is evident and significant (Stock, 2004).

Despite the trend of increasing urbanization in sub-Saharan Africa, it is estimated that at least half of the poor people are expected to remain in rural areas by 2035, keeping smallholder farming functioning, underlining the importance of keeping the practice of local people, protecting their culture and customs, while considering agriculture (IFAD, 2001). Although nowadays, the researchers and policy makers are highly aware of the importance of considering social aspect when creating a plan for agricultural changes, they are still struggling to find the right way of doing that (Doss, 2001; Osbahr et al., 2008).

According to Boserup (1970) agriculture in sub-Saharan Africa is traditionally developed by women. Traditional division of labour in Africa assigns to women about 80% of agricultural labour, like fetching water, planting, weeding, harvesting, collecting wood, along with food processing or brewing beer (Lado, 1992). Further on, apart from agricultural work, women are also in charge of family livestock, household work and taking care of children.

In recent years, with more male migration to cities, the importance of women in agricultural workforce is increasing even more (Momsen, 2004) and time is becoming a scarce resource for women in Africa due to they hardly manage to fulfil their daily activities (Lado, 1992). Additionally, women have been excluded from modernization processes in agriculture due to the fact

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that trainings and agrarian reforms have been focused mainly on men. This particular practice has caused many failures of agricultural projects as the men are trained to conduct it, but in reality women are the ones working in the field. Irrigation, in particular, has also been less accessible to women caused by limited access to training and credit as well as not having any power structures in the local communities (Grieco et al, 1996).

Facing this situation, African women tend to cultivate smaller and poorer soil fields as they do not have control over land, they have restricted access to property, technology, education and credit, and their work is often undervalued and unrecorded. With less access to resources, African women rather often face various difficulties to feed their families and this can cause unsustainable practices as deforestation, less crop diversity or inadequate irrigation (Barret et al, 1995).

With all this in mind, this research is focused on water practices of local women, aiming to collect the data about the local water usage and to understand the problems they are facing. Further on, this research aims to assess N'hambita women's water management practices in order to estimate the most critical sectors and to suggest how to be locally improved.

Study area

The research has been conducted among the women of N'hambita Village, located in Sofala Province, central Mozambique - Africa. The N'hambita Village is situated in the buffer area of Gorongosa National Park (Figure 1), in the area where N'hambita Community Carbon Project (NCCP) is conducting the carbon sequestration activities with the local people.

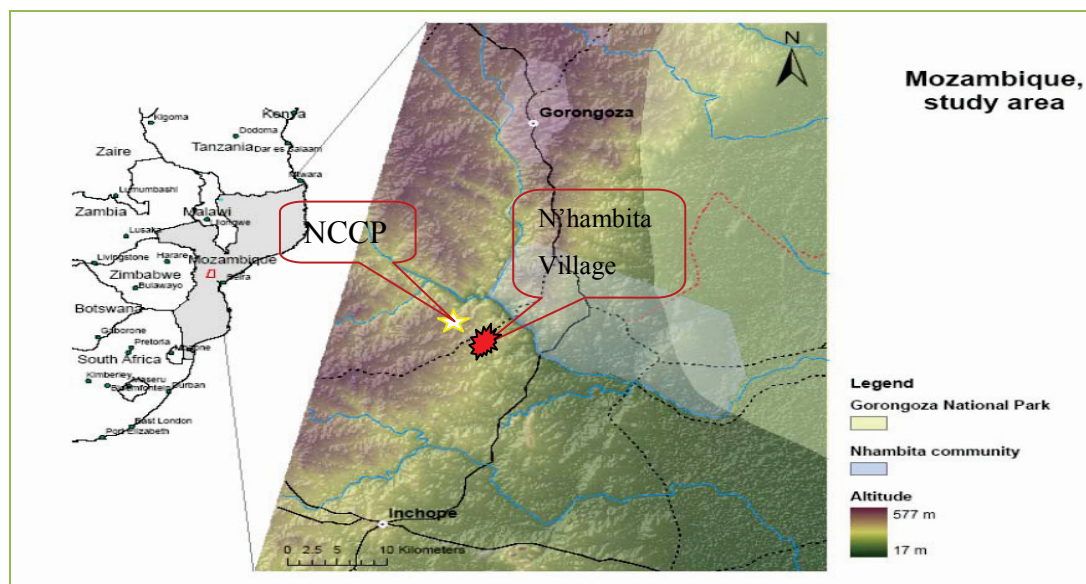


Figure 1. The N'hambita Community Carbon Project (NCCP) area, Sofala Province, Mozambique (*Source: NCCP*)

In the region, the tropical and subtropical climate is noticeable; characterising that during the wet season, communities and vegetation are well provided with water, while during the dry season water deficit affects the communities reliant on the seasonal river streams (interview - NCCP manager, 2009). Within the study area the main soil type is generally poor and sandy with a low fertility (Williams et al., 2008). Regarding the agricultural area, the local farmers distinguish *machambas* (rain fed agricultural fields) and gardens which are smaller than *machambas* and irrigated by farmers manually (field observation, 2009).

METHODOLOGY

The four-week field work has been conducted in April 2009, in purpose to collect qualitative and quantitative data. The methods used in the field are:

formal and informal semi-structured interviews, semi-structured questionnaires, field observation and GIS mapping of the N'hambita community water sources.

The formal semi-structured interviews have been conducted with the N'hambita Community President, the primary school director and two primary school teachers while informal interviews were carried out among randomly selected local women and NCCP technicians. The purpose of the interviews was to understand the social structure of the village, the role and power of the women in the village and relations between the women themselves.

The semi-structured questionnaires were focused only on the women of the N'hambita Village (NV) assuming that they are responsible for the water supply and agricultural activities within the NV as NCCP is located near and men are mostly involved in its activities. Of total

84 households of the N'hambita Village, 42 households (50%), were randomly sampled and represented in the interview by one adult woman of the household. The data from the survey questionnaires has been analysed using the descriptive statistics and graphical representations respectively. In order to summarise the patterns in the responses within the investigated groups, arithmetic means and frequency distributions were performed.

Furthermore, direct behavioural observation was undertaken in the N'hambita Village which focused on the women's behaviour in their everyday activities relating to the water usage within their households. Additionally, one meeting was organised in the primary school of the N'hambita Village, in order to investigate the social potential of N'hambita Village Women (NVW) in organising an association, meetings and networking. Additionally, the GPS coordinates of N'hambita Village water sources were collected in the field and the map (Figure 2) has been created by using Arc Geographical Information System (GIS) programme.

RESULTS AND DISCUSSION

The results and discussion part consists of four sectors (demographic data, water sources, water usage and sustainable practices in water management within N'hambita Village) divided in accordance with the field data.

Demographic data

The group of N'hambita Village women (NVW) consists of 42 interviewed women, presenting her household and family. The characteristic of many African families is that several culture groups permit polygamy (Aryeetey-Attoh, 2003), which is also widely practiced in the study area, where is quite common to find households with one man and two or more wives.

The average age of interviewed N'hambita Village women is 33, while the life expectancy for inhabitants of Mozambique is only 48 (UNICEF, 2010). The average family size counts 6 members, mainly children, where statistical data showed that in average family of N'hambita 4 children go per 2 adults. It is important to notice that in a quarter of the families the interviewed woman is the only adult of the household, sometimes taking care and being responsible for up to 6 children. It is also estimated that one-sixth of all households in developing countries are headed by women, but this proportion use to be higher in southern Africa (Momsen, 2004). The attention is focused on the fact that these households are among the poorest because they use to have less working adults than male-headed households, as occurs in the case study presented.

Water Sources

The inhabitants of N'hambita Village are relied on different types of water sources: river streams, wells and boreholes. As it can be seen from the figure (Figure 2), three seasonal river streams Ripisse, N'hambita and Nhamatuze are present of which the Ripisse River is located centrally and possess the best water capacity, which is the reason why it is mostly used to supply water to the local people. The seasonal river streams are not wider than 2 or 3 meters in the wet season, with a characteristic to dry out during the hot period. The Pungwe River, on the other side, is characterized as a constant river stream, frequently flooding the surrounding area, and some people of the southern N'hambita fetch irrigation water from the Pungwe River during the dry period and seasonal Ripisse River dries out (Figure 2).

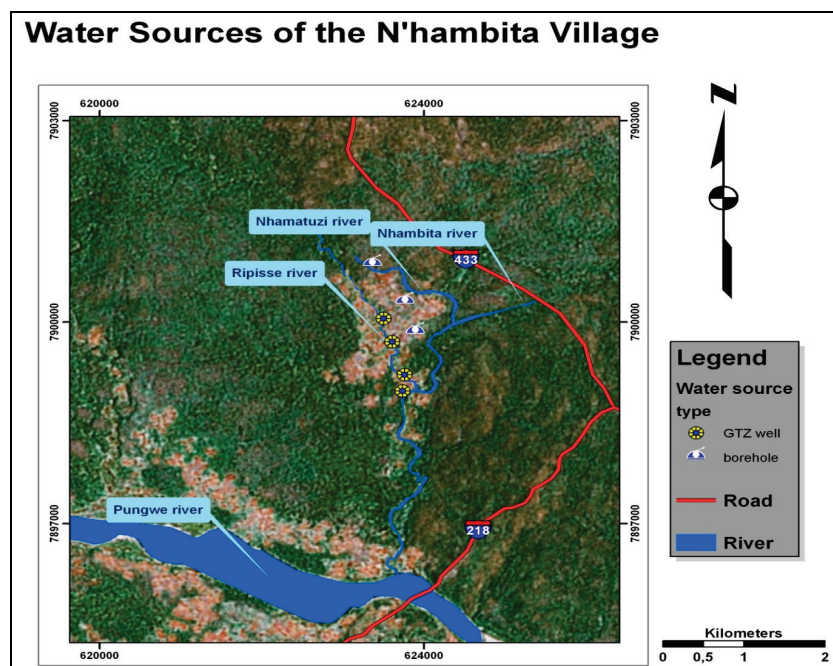


Figure 2: Map of the N'hambita Village, locating wells, boreholes and rivers (field data)

In addition to river streams, four wells and three boreholes are constructed by external organizations (NCCP, German Organisation for Technical Cooperation (GTZ), UNICEFF and INFRAFURO) and as seen from the map (Figure 2), those are equally distributed within N'hambita Village, allowing the local people to approach the water sources easily.

As frequently assumed, the water from the deep wells and boreholes is clean regarding the bacteriological aspect, reducing the cases of diarrhea and cholera in the area respectively (Banks et al. 1998, Reimann et al. 2003). In the case of N'hambita Village, there is a differentiation in water quality between wells and boreholes. The wells are constructed on the bank of the Ripisse River, assuring natural filtration of the river water, before it is fetched from the wells. The quality of that water mainly depends on human behaviour and contamination of the wells'

surrounding which enters directly inside the well with the rain drainage, impacting the water quality. On the other side, the water from boreholes has better quality as it is a groundwater and surface contamination does not reach the water easily.

Regarding the research data (presented in Table 1), it can be concluded that the water from N'hambita's wells is not potable if not previously treated, and that wells are not efficiently maintained by local people. Furthermore, the wells are not protected on the top and local people contaminate the surrounding area, bathing or washing cloths next to the wells. On the other side, the boreholes are main suppliers of potable water; all have been found in a good condition, successfully maintained by the people. The table 1 presents the boreholes and wells marked on the figure 2, presenting them numerically by starting from number 1, in direction North-South.

<i>Water source:</i>	<i>Organization constructing and year:</i>	<i>Water quality:</i>	<i>The state of the water source:</i>
BOREHOLE1	NCCP, 2007	No taste, no colour, no smell.	Borehole in usage, with installed pump, surrounding clean.
BOREHOLE2	UNICEFF, 2007	No colour, no taste, no smell, potable water.	Located next to school, and mainly used by local people. Pump is installed. Surrounding clean.
BOREHOLE3	INRAFURO from Beira, funded by NP Gorongosa, 2007	Transparent, potable water, no colour, no taste no smell.	Water source in a good state, in usage. Surrounding area-clean.
WELL 1	GTZ, 2003	The water is not transparent, small animals are present and eye visible. The water is colored: light brown-red.	Depth 2,5m to reach the water. The well is not covered on the top allowing animals to enter inside, as well as to leaves and garbage. The well is surrounded with garbage.
WELL 2	GTZ, 2003	The water is not transparent, without visible animals.	Depth 1m to reach the water. Not protected on the top. Inside are two plastic containers to fetch the water. The well is in active use.
WELL 3	GTZ, 2003	Water is described as very dirty, not transparent and nearly muddy.	Depth 3m to reach the water. Inside of the well found one snake and several bamboo branches, there is no path which leads to the well. This well is in the worst condition.
WELL 4	GTZ, 2006	The water is lightly brown colored, no swimming parasites visible by eye.	The well is protected on the top, the simple pump is installed. The well in active usage.

Table 1. The characteristics of N'hambita Village's boreholes and wells

Although drinking water sources are available for the local people, the main difficulty they are facing is related to irrigation water availability. As the gardens are not placed near the water sources, the NVW have to walk relatively long distances in order to fetch the irrigated water. Additionally, as the Ripisse River dries out seasonally, they have to wait in long queues in order to fetch water from the wells and boreholes, and frequently they are not able to fetch more than essential amount of domestic water (interview data, 2009).

Water usage

In order to assess the usage of the agricultural and domestic water in N'hambita Village, the interviewed women described their daily practices regarding potable water usage, laundry and body washing, irrigation and water given to domestic animals. The women were requested to share information of their average daily

water consumption for all activities mentioned above, as well as to clarify the water sources they use and the walking distance to water sources they pass.

Domestic water usage

Following the common traditional pattern in Africa, as already mentioned in introduction, in this case study women are in charge of bringing domestic and agricultural water. This is very hard and time consuming task that women and children, mainly girls, perform at all ages. The distance they have to walk to get water depends on the water use and amount of fetched water. The closest distance to the drinking water source is 50 m while the longest distance to the source they have to walk is 2000m. In addition to that, they carry up to 160l of water (domestic and agricultural) in average daily.

<u>Water sources:</u>	<u>Water Usage:</u>	<u>Percentage of households using this water source (%):</u>	<u>Average distance to the water source (m):</u>	<u>Average amount of water used daily (l/day):</u>
Ripisse River	Drinking and cooking	14	224	57
	Laundry and body washing	74	296	No data
Borehole	Drinking and cooking	83	349	52
	Laundry and body washing	19	374	75
Well	Drinking and cooking	3	150	40
	Laundry and body washing	7	583	50

Table 2. Domestic water usage in N'hambita Village

As the results show (Table 2), the average amount of drinking and cooking water, used daily in the households, does not differ so much among different water sources and also doesn't change so much with average walking distance to the water source. The interesting finding is that the women of N'hambita distinguish very well the quality of water, and they choose to walk longer distance in aim to fetch a drinking water from the borehole (instead of choosing closer water source – well or the river). As the results demonstrate, 83% of women decide to walk long distance to the borehole in order to fetch clean drinking water for their families (Table 2 – marked yellow), what is in accordance with the Mazvimani's findings in Botswana (Mazvimani et al, 2006).

Although NVW walk longer distance to fetch the potable water, the majority of the women (74%) decide to go to the closest water source (Ripisse River) in order to do body and laundry washing. As those women practice the laundry and body washing directly on the banks of Ripisse River and due to that they were not able to estimate the amount of water used in that purpose. Another 26% of the women, who fetch the water from the boreholes and wells, estimated that in average they use 75 l/day (from the boreholes) or 50 l/day from the nearest wells.

Additionally, as the Ripisse River is passing directly through the village, it is easily reachable and the most practical to do the washing for many households (Figure 2). On the other side, while the up-stream inhabitants directly pollute the water stream (by using detergents and shampoos for washing) the down-stream inhabitants use the same stream as a drinking water. As the river stream is rather narrow, the auto-purification process is not efficient enough and chemicals are evidently consumed by the downstream inhabitants (Simeunovic et al, 2006).

Concerning health indicators, only 26% of population in rural areas in Mozambique use improved drinking-water sources (Unicef, 2010). In N'hambita Village 67% of households use to treat drinking water for consumption after advice given by the clinic, the school

staff or the NCCP staff. In that purpose the N'hambita Village women use mainly chlorine, while some women still use the traditional practice to boil the water before usage. Additionally, when treating drinking water the NVW distinguish between borehole water (1 bottle top of chlorine per 20l of water), and water from wells or the rivers (3 bottle tops of chlorine per 20l of water). The percentage of N'hambita inhabitants who treat drinking water is significantly higher than an average national value, and that is the most probably related with the close presence of the NCCP project and the health facilities like the clinic, in the area.

Agricultural irrigation water usage

Although N'hambita Village inhabitants mostly rely, in agricultural irrigation, on the surface water streams (Ripisse River-73% and Pungwe River-10%), 7% of the NVW use GTZ wells while, 10% of them get irrigation water from boreholes (Figure 3).

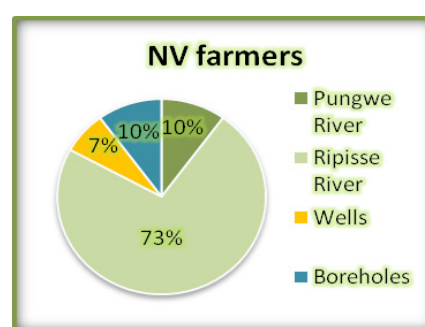


Figure 3. The agricultural water usage in N'hambita Village (filed data)

The average distance that NVW walk to fetch the water is 317m, but this average is influenced with a four values of 1- 1,5km. The most frequently NVW have to walk less than 100m and that is mainly when they use Ripisse River as a water source, due to the fact that the gardens are located close to the river's banks. The irrigation problem enlarges during the dry season, when

the river dries out completely, leaving local people to search for alternatives as: to dig traditional wells in the dry river or to use water from the wells and boreholes (located away from the gardens).

In average NVW use 173l of irrigated water per day in order to supply their gardens with water. In that purpose they do not have any developed technology, irrigating the gardens manually. Because of that, the socio-environmental potential to implement drip irrigation systems (DIS) in the village has been investigated by using social and environmental data gathered in the area.

The IPCC (Hegerl et al., 2007), predicts that long periods of droughts will affect the area of sub-Saharan Africa, and especially the rural communities dependent on small river streams, are likely to feel the impact of the climate change (Sanchez, 2000). The need to improve the irrigation practice within those communities is obvious, but the way of implementing the appropriate technologies must be chosen carefully and in accordance with the social and environmental potential of a particular area (Lockie et al, 2005).

Concerning the access to cultivated land the majority of women have *machamba* or garden or both. But according to women's answers (one third of women declare not being able to produce enough food) the land they possess does not ensure feeding the family. The reason can be related to: the small size of plots, very low usage of fertilizers (only 4 women declared to use some kind of fertilizers), or the not efficient traditional manual irrigation practiced in gardens. Another reason for food struggling in the area can be linked to family size and high proportion of children per adult in families' composition.

According to the environmental indicators, N'hambita Village does not have the potential to implement the drum kit drip irrigation system (demanding 500l of water daily and covering the garden area of 250m²), as farmers will not be able to fetch enough water to run DIS properly. Additionally, most of the local people declare that they do not have the sufficient garden area to install the system. Although, the environmental potential is not able to support drum kit drip irrigation system implementation within NV, it is sufficient for the other types of drip irrigation systems (DIS). The bucket kit DIS is recommended and appropriate to irrigate small gardens by filling the water container with 40 L of irrigated water (Sijali, 2001, Turner, 1994).

Even though N'hambita Village has additional water sources such as wells and boreholes to be used even when seasonal river streams of the village dry up, the sources are too far away from the gardens and frequently occupied in a dry period, not allowing people to fetch a lot of water and irrigate their gardens (interview - local farmer, 2009).

Regarding social aspect, it can be concluded that women have a strong potential to improve the garden

production, as they are responsible for agricultural activities and water supply. Taking into account the traditional water scarcity coping, it is recommendable to keep the garden area small, but with installed water saving technology which will to improve food production and will not demand a great deal of water (Van Koppen, 2007). Another social advantage of NV is related to its closeness to NCCP, assuring the farmers' easy access to information regarding DIS and additionally NCCP can also be seen as an additional market where the NV farmers can sell their food.

Sustainable practices in water management within N'hambita Village

The people of rural Africa have developed many strategies how to use the water in the most sustainable way, as they do face the water scarcity from day to day (Hoko et al, 2006). In this assessment, two sustainable practices (rain harvesting and water recycling) are distinguished and described by the local people.

Rain harvesting

In the N'hambita Village 33% of the interviewed women collect the rain water which they use in different purposes: bathing cooking, irrigation and drinking. Those women declared that they heard about rain harvesting from many different sources as: God, mother, father, people from the village or they stated to develop idea by themselves, without an external influence.

On the other side, the NVW who do not practice rainwater harvesting mentioned lack of a house roof as the main reason (as the roof is widely known to facilitate the rain water collection (interview- local people, 2009)

Reuse of water

Only 3 women of 42 were familiar with the term of water reuse, stating that they use the water several times in different purposes before throwing it as a waste. Most of the women are not familiar with a water reuse, but a part of that they practice it constantly. The most common practice among NVW is to throw already used water to domestic animals or to water plants around the house.

CONCLUSIONS

Investigating domestic and agricultural water usage within the N'hambita Village it has been concluded that in that area the water collection is normally considered as women's task, and in that purpose this research has been conducted among the local women. This study, as many previous studies focused on water usage (Batchelor, 1994), demonstrates that putting rural women in the centre of sustainable agricultural development has to be priority when improving irrigation and efficiency in water usage (Van Koppen, 2007).

As demographic data demonstrate, the polygamy is present in the area and some men-headed households are operated by several adult women, while on another side

some households are women-headed only. Additionally, average household have four children, what has been found as one reason for food scarcity.

The local people are relied on the several seasonal river streams and additional water sources (wells and boreholes) constructed by external organisations. Regarding the domestic water usage, the interesting finding has been found in the sector of bathing and laundry washing, as the local people avoid maintaining their water sources, discharging chemically polluted water directly to water sources (wells and Ripisse River stream). On the other side, the NVW distinguish water quality between different water sources, and choose to walk longer distances in order to fetch the better quality drinking water. As consulted by local clinic, majority of NVW treat drinking water with chlorine before usage.

The critical point in the N'hambita Village water management has been found in the sector of agricultural irrigation during the dry season when the seasonal river streams dry out completely. In that period the agricultural irrigation is rather weighted and relied mostly on the wells and boreholes, causing people to wait in a long cues in order to fetch water. As the local people do not have access to any kind of irrigation technology, their vegetables are frequently under water stress.

As stated in the Shaw findings (Shaw, 1987), the most important condition for successful adoption of new technology in rural areas is to adopt technology that is desired by local farmers. Due to that fact, the first step toward DIS implementation in seasonal river stream's dependent communities (as N'hambita Village) is to investigate the local farmers' desire for using this technology as well as their willingness to organise an association where they could discuss all their doubts and issues, and even initiate the usage of credit loans offered by many external organisations (Pretes, 2002).

The research results showed that the NVW expressed willingness to improve their agricultural practices, in order to be more food secure. Although the new technology is desired by local people it is recommended to be careful when implementing DIS in the area. Also it is highly recommended to investigate social, environmental and economical potential of the N'hambita Village before starting drip irrigation system implementation.

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