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# Physical and Chemical Characterization of Watering Waters of The Dennabalo - Modia Marine Group at Faranah (Republic of Guinea)

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***ABSTRACT:*** *The research was carried out from march 15 to 30, 2018. The general objective of this research is the characterization of the irrigation water of the six (6) wells of the Dennabalo market gardening group from Modia to Faranah. This job is the determination of certain physics and chemics (Temperature, pH, Conductivity, Hardness, Turbidity, Nitrates and Nitrites). To achieve this objective, 12 water samples were collected in the six (6) wells of the site, and then transported to the laboratory of the Center for Environmental Studies and Research (CERE) of Gamal Abdel Nasser University of Conakry. to be analyzed. After analysis of the results, the results obtained are: Variable temperature from 24°C to 26.1°C, variable pH from 6.0 to 6.9, variable temperature from 24.5 to 159 NTU, the nitrate contents varying from 6.41 to 39.63 mg/l, the nitrites ranging from 0.005 to 0.1305 mg/l, the varied hardness of 9.98 to 16.75 mg/l and the varied conductivity between 17 and 29 µS/cm. The analysis of the results of the water of dosage of the field of the vegetable grouping is carried out by means of the physics and the chemistry of the watering of the cultures.*
***KEYWORDS****: Characterization, Water, Watering, Physical, chemical, vegetable*

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## I. INTRODUCTION

Water is an indispensable element in the life of living beings, especially that of humans and animals, having it available in sufficient quantity and of good quality, contributes to the maintenance of health [1]. Agriculture in general is a major consumer of water, globally, irrigation accounts for 70% of water withdrawals for 40% of world agricultural production and 20% of cultivated land [2], Demand from non-agricultural sectors, including the domestic needs of urban populations in developing countries, is expected to increase rapidly as a result of demographic changes, thus increasing competition between different uses of water. In addition, climate change induces high uncertainties about water availability in the future [3, 4]. In arid and semi-arid conditions, farmers are required to use different sources of water for watering their crops. On some sites, they use untreated wastewater, which may come from both households and industries [5, 6].

Among the sources in exploited waters, groundwater is traditionally the most used resource in market gardeners. In rural areas, water comes either from a surface water source (river, pond, marigot) or from a traditional well. The use of polluted waters for food or agricultural purposes is a health hazard. According to the WHO (2008), 10 to 25 million deaths, including 5 million children due to diarrhea, can be attributed to lack of water and poor sanitation [7]. Almost all of the water points in the aquifer are for drinking water supply and irrigation of agricultural land. To be used water must meet certain standards that vary according to the type of use [8]. The fresh water that is essential to our needs represents only 1% of the total seas and oceans on earth. It is thus a capital, limited and fragile because it is threatened by a growing consumption and by multiple pollutions [9].

In sub-Saharan Africa, 42% of the population still lacks access to good quality sources, and well water is increasingly being used to facilitate access to water. In general, irrigation water used in urban and peri-urban areas are all water of unsuitable quality for irrigation of fresh vegetables. The use of water from certain rivers for the irrigation of market garden areas has disastrous consequences for the health of consumers and is a source

of diarrheal diseases. That is why the water of irrigation must have a physicochemical and microbiological quality adequate. It should also be ideally exempted from products that can cause adverse effects on crops [10].

At present, agricultural intensification has been accompanied by the misuse of agrochemical inputs and the reckless pumping of groundwater, which is becoming less and less abundant and of poor quality. Yet the over-exploitation of these resources, coupled with the phenomenon of drought, leads inevitably to the degradation of soils and waters, which result in problems of salinization, sodification, deterioration of the soil structure, waterlogging and nitric pollution.

In most African cities, agriculture is essentially based on market gardening. The city of Faranah is not on the fringes of this agricultural activity that supports a significant number of indigent people. This activity is practiced all year round because of the permanent demand for market garden produce. But if this farming is practiced without problems in the winter season, it is not so in the dry season.

In fact, agriculture in the dry season is confronted with a crucial problem of lack of water, since it is essentially based on watering from the waters of traditional wells of variable depth and these waters generally contain quantities of water. natural organic materials such as chemical and biological substances, but also organic compounds from various pollutant releases (pesticides, fertilizers, herbicides, etc.) or intensive agricultural practices. Hence the merits of this research, whose objective is to proceed to the physicochemical characterization of the watering water of the six (6) wells of the market gardening group Dennabalo-Modia.

## II. MATERIALS AND METHOD

### 2.1 Materials

#### 2.1.1 Presentation of the site

The administrative region of Faranah is the central part of the country that stretches between Fouta Djallon, Guinea Forestier and Haute Guinea. It is located at 8°50 and 12°00 north latitude and 9°15 and 11°29 west longitude. It covers an area of 40122 km² for a total population of 942733 inhabitants in 2014. It is mostly rural (80%) (Figure 1).

The climate as a whole is of the Sodano-Guinean type with the alternation of two seasons: rainy and dry. The relief is not very rough. The soils are ferritic, clay-silty and hydromorphic. The hydrographic network is dominated by the Niger River and its tributaries. The average annual rainfall varies between 1200 mm and 1700 mm. Temperatures are generally high. They oscillate between 27°C and 30°C on average. The relative atmospheric humidity varies between 69 and 85% on average. The region is mainly agropastoral with significant agricultural potential whose valuation still suffers from low water control (3.81% of areas) and the use of traditional methods giving low yields [11].

The study site was located using a GARMIN 64 GPS. This site is located north of the city of Faranah 5 km from the city center. It covers an area of 4508 $m^2$ (Figure 1). In this site, six (6) wells are used for watering crops. The different depths of these wells (I ; II ; III; IX ; V and VI) are respectively: 2.60 m; 2.20 m; 1.32 m; 1.46 m ; 1.35m ; 1.90 m. The cultivated crops are onions, eggplant, tomato, okra and potato.

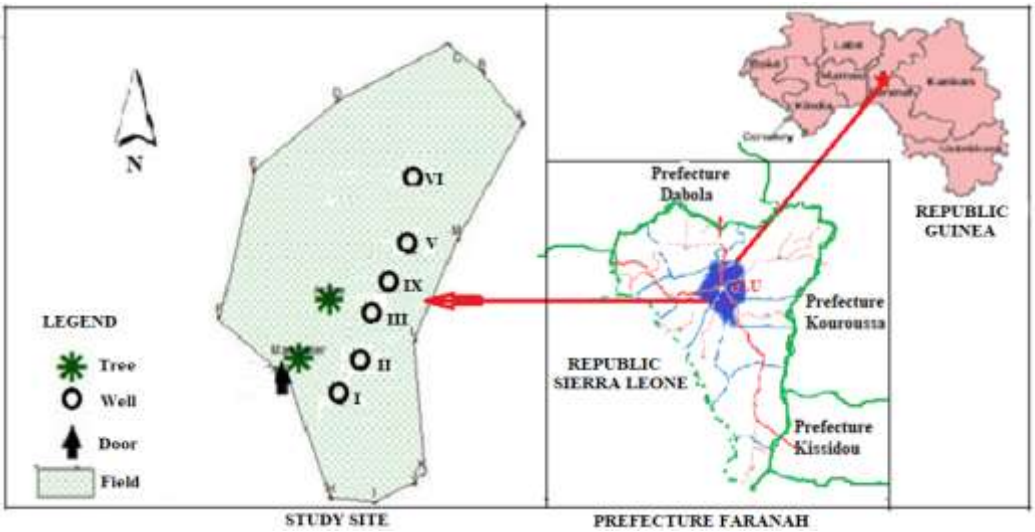


**Figure 1**: Presentation of the site

**2.1.2 Analytical material**

The materials used for the analysis of the samples are: graduated thermometer (temperature), PH/Cl (pH) pooltest, Wagtech conductivity meter (Conductivity), DR/850 colorimeter (hardness, turbidity, nitrates and nitrites), 25 ml vats (sample size), coolers (sample storage), plastic bottles (water containers), mark (sample labels), pills (reagents), polyethylene water containers (hold samples at initial temperature).

**2.2 Method**

The method adopted for this research is based on the collection of samples (sampling) and their laboratory analyzes. Data processing was done using Arc-View and Microsoft Excel software.

**2.2.1 Sampling**

Water samples were collected on 18/03/2018, from 8 am to 12 noon. We used 1.5liter PET plastic bottles and an indelible marker for the annotation of the initial collection points. Twelve (12) samples were taken from six (6) different wells, including two (2) samples per well, (one sample before water use and one after use).

The 1.5-liter plastic bottles are then rinsed with water three times and then completely filled to the end. They are closed so as to avoid interfering reactions with the air. The containers containing the samples are labeled and stored in the coolers containing the frozen water packets.

**2.2.2 Analysis of samples**

Samples transported to the laboratory of the Center for Environmental Studies and Research (CERE) of Gamal Abdel Nasser University of Conakry for their analysis. The determination of the temperature and the electrical conductivity was carried out by the potentiometric method; pH by the colorimetric method; hardness, turbidity, nitrate and nitrite by the volumetric method. Figure 2 shows some experimental steps in the course of this research.

*Investigations with group members*

*Sample collection and on-site temperature determination*

*Labeling of samples*

*Preparation of the samples*

*Determination of conductivity*

*Determination of turbidity*

**Figure 2:** Experimental steps in the course of the study

## III. RESULTS AND DISCUSSIONS

### 3.1 Results

Table 1 highlights the results of the analyzes carried out on the irrigation water of the market gardening group Dennabalo de Modia to evaluate their quality.

**Table 1:** Results of the physical and chemical parameters of irrigation water from the Dennabalo market garden estate from Modia to Faranah

| Wells | Temperature (°C) | pH | Turbidity (NTU) | Nitrates (mg/l) | Nitrites (mg/l) | Total hardness (mg/l $CaCO_3$) | Conductivity (µs /cm) |
|---|---|---|---|---|---|---|---|
| I | 26.00 | 6.90 | 53.50 | 6.41 | 0.0006 | 9.98 | 17.00 |
| II | 20.05 | 6.50 | 118.50 | 39.63 | 0.1305 | 16.75 | 29.00 |
| III | 24.75 | 6.00 | 24.50 | 11.72 | 0.005 | 15.50 | 25.50 |
| IV | 24.00 | 6.70 | 73.00 | 22.10 | 0.089 | 15.78 | 26.50 |
| V | 25.00 | 6.70 | 89.00 | 17.90 | 0.031 | 13.20 | 24.00 |
| VI | 26.10 | 6.40 | 159.00 | 34.92 | 0.1405 | 13.52 | 24.00 |
| Average | 24,32 | 6,53 | 86,25 | 22,11 | 0,0661 | 14,12 | 24,33 |

Figures 2; 3; 4; 5; 6; 7 and 8 respectively show the evolution of the different study parameters (Temperature, pH, Turbidity, Nitrates, Nitrites, Total hardness and Conductivity) of the watering water of the domain of the vegetable group Dennabalo the Modia.


**Figure 3**: Average temperature values of irrigation water

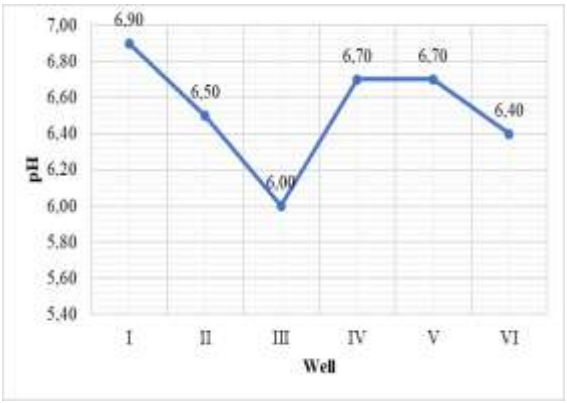


**Figure 4**: Average pH variation of irrigation water

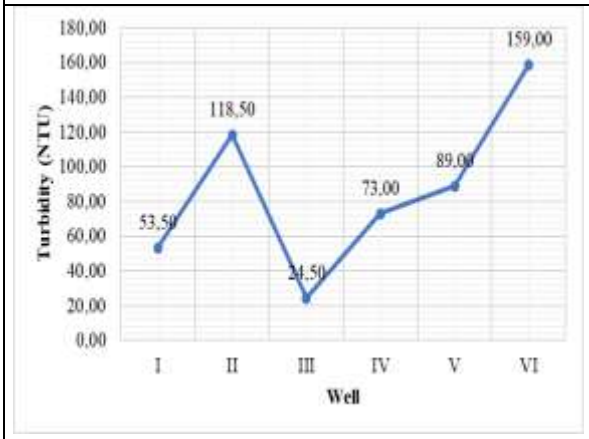


**Figure 5**: Average variation in turbidity of irrigation water

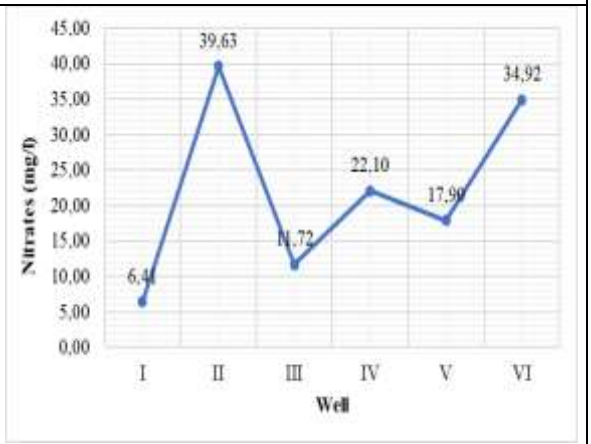


**Figure 6**: Average variation in nitrate levels in irrigation water

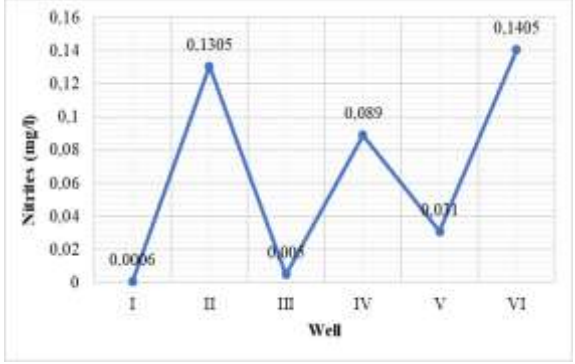


**Figure 7**: Average variation in nitrite levels in irrigation water

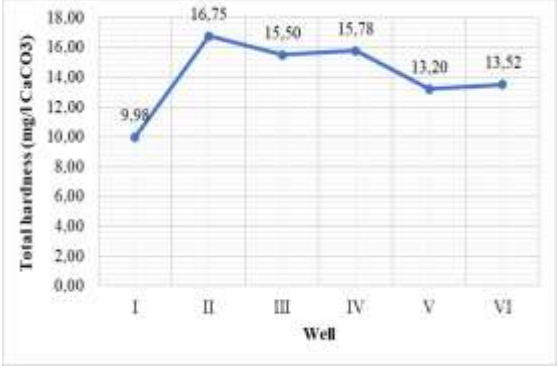


**Figure 8**: Average variation in the hardness of irrigation water


**Figure 9**: Average variation in the conductivity of irrigation water

### 3.2 Discussions

Table 1 shows the degree of fluctuation of the various parameters in the irrigation water of the domain of the market gardening group Dennabalo-Modia. It can be noted that among the parameters, turbidity is the most fluctuating parameter. On the other hand, the nitrite content remains the least fluctuating parameter.

#### 3.2.1 Temperature

The figure 3 shows that the average temperature values recorded vary between 24 and 26,1°C. However, the warmest waters were found in well 6 and the colder ones were found in well 4 while the other wells had intermediate values. This slight variation in temperature is due to the exposure of some wells to solar radiation. However, these average temperature values are relatively lower than 35°C, considered as an indicative limit value for water intended for irrigation [12]. This allows us to deduce that these waters are acceptable for watering crops.

#### 3.2.2 pH

Figure 4 shows that the pH values of the studied waters vary from 6.0 to 6.9, including 6.0 for well 3 and 6.9 for wells 1. This variation can be explained by the influence of runoff water generally responsible for various materials of different origins. These values are within the pH range of groundwater (5 to 7) and are acceptable for annual watering of vegetable crops [13, 14].

#### 3.2.3 Turbidity

Figure 5 shows a large fluctuation in the turbidity of the analyzed waters. The values vary between 24.5 NTU for well 3 and 159 NTU for Well 6. This difference is due to the topographic position of the market garden with respect to the alluvial supply sources on the one hand and on the other hand to the nature of the soil

structure on which the water surface of the well rests. These turbidity values indicate that the waters of the wells of the market gardening group Dennabalo are colored [15], which indicates the presence of particles suspended in these waters [16].

### 3.2.4 Nitrates

Figure 6 shows a large fluctuation of nitrate levels. Well 1 has the smallest value 6.41 mg / l and Well 2 has the highest value 39.63 mg / l whereas the other wells have intermediate values. This fluctuation is explained by excessive use of fertilizers around wells. The water nitrate values remain below the maximum values indicated for the water quality used in irrigation, including 50 mg / l for surface water and 100 mg / l for groundwater [17]. Thus, the waters studied have no risk of pollution by nitrates.

### 3.2.5 Nitrites

Figure 7 shows that the waters have low nitrite concentrations. These low concentrations could be explained by the fact that the nitrite ion (NO2-) is an intermediate compound, unstable in the presence of oxygen, whose concentration is generally much lower than that of the two forms which are bound to it, nitrate ions and ammonium. The concentration of Nitrites varies between 0.005 to 0.1305 mg / l. These values are less than 1 mg / l [18].

### 3.2.6 Hardness

Figure 8 shows that average hardness values range from 9.98 mg / l to 16.75 mg / l. This variation is a function of the lithological nature, the aquifer formation and their composition in magnesium and calcium carbonate [15].

### 3.2.7 Conductivity

Figure 9 shows that the watering water of the market gardening group Dennabalo is characterized by an average conductivity which oscillates between 17 and 29 µS/cm, which reflects to waters very weakly mineralized. This low mineralization depends on the amount of dissolved salts, due to the temperature that acts on natural water, on the one hand and the rate of dissolution of certain rocks that release cations and anions in the basin river.

## IV. CONCLUSION

At the end of this study, the values of the physical and chemical parameters of the irrigation water of the maraicher Dennabalo group were determined in order to characterize them.

The measured parameters led to the following conclusions: the water temperature varies from 24°C to 26.1°C, with an average of 24.96°C; the water of irrigation of the field studied is characterized by a slightly acidic pH; the turbidity of the water varies from 24.5 to 159 NTU, with an average of 71.7 NTU, the presence of particles suspended in water; the nitrate contents of the watering water show that these waters are of good quality; the nitrite contents show very low values, which means that there is less pollution in these waters, which is one under the action of an active self-purification; the hardness values show a weak mineralization in calcium and magnesium of the waters.

The physical and chemical analyzes showed very satisfactory results for the watering of vegetable crops. Despite the strong agricultural activity around the area, well water is still safe from pollution by nitrates and nitrites. This study thus reveals that the irrigation water of the Dennabalo maraicher group has good physical and chemical characteristics for irrigating crops.

## REFERENCES

[1]. CAMARA T. (2017), “Etude de la qualité physico-chimique et bactériologique des sources d’approvisionnement en eau dans la ville de Conakry”. Thèse de doctorat, Université Gamal Abdel Nasser de Conakry 298 p.

[2]. MAAPRAT-CGAAER (2012), “L'eau et la sécurité alimentaire. Face au changement global: quels défis, quelles solutions? Contribution au débat international”, Ministère de l'agriculture, de l'alimentation, de la pêche, de la ruralité et de l'aménagement du territoire” - Conseil général de l'alimentation, de l'agriculture et des espaces ruraux.

[3]. Troy B., Bachelier B., Jaskulké E., Mangé P., (2010), ‘’Document d’orientation stratégique de la foundation” FARM sur l’eau 2008-2010, Fondation FARM.

[4]. BERROUCH H.,(2011), “Etude de la qualité des eaux d’irrigation et du sol dans le périmètre de Saâda (Région du Haouz). Mémoire de fin d’études, Université Cadi Ayyad”, Faculté des Sciences et Techniques Gueliz Marrakech

[5]. N’Ddiaye AD., Kankou MOSAO., SARR AD et LO B., (2009), “Caractérisation Physico-chimique des eaux usées Rutes de la Ville e Nouakchott (Mauritanie)”, Rev. Ivoir. Sci. Technol., 14, pp 97-109.

[6]. N’Diaye AD., Kankou MOSAO., (2014), “Characterization of treated wastewater reusedfor agriculture in the vegetable farming area of Sebkha in Nouakchott, Mauritania”, Larhyss Journal, n°17, pp. 91-100.

[7]. Maoudombaye T., Ndoutamia G., Seid Ali M., Ngakou A. (2015), “Etude comparative de la qualite physico-chimique des eaux de puits, de forages et de rivieres consommees dans le bassin petrolier de Doba au Tchad”, ARHYSS Journal, n°24, , pp. 193-208.

[8]. Hammoumi ne., Sinan M., Lekhlif B., et Mahjoub LE., (2012), "Évaluation de la qualité des eaux souterraines pour l'utilisation dans l'eau potable et l'agriculture : plaine de Tadla, Maroc", Afrique SCIENCE 08(1) 54-66.
[9]. Jaouad E. A., Sanae K., Namira E. A., Abderraouf H., (2007), "Analyse de la qualité physico-chimique des eaux souterraines de la communauté des Mzamza, au voisinage des eaux usées. Casablanca, Maroc", Afrique SCIENCE 03 (1), pp. 109-122
[10]. Hammoumi ne., Sinan M., Lekhlif B., et Mahjoub LE., (2012), "Évaluation de la qualité des eaux souterraines pour l'utilisation dans l'eau potable et l'agriculture : plaine de Tadla, Maroc", Afrique SCIENCE 08(1) 54-66
[11]. Ministère de la Sante, Direction Régionale de la Santé de Faranah, (2015), "Annuaire Statistique Sanitaire", Rapport, 109p.
[12]. BELGHYTI D., BOUCHOUATA O., BOUNOUIRA H., (2009), "Caractérisation physico-chimique des eaux usées d'abattoir en vue de la mise en œuvre d'un traitement adéquat : cas de Kénitra au Maroc". Afrique SCIENCE. 05(2). pp 199-216.
[13]. NDOUNLA J., (2007), "Caractéristiques biologiques et physico-chimiques de l'eau de consommation et influence du mode d'approvisionnement sur la santé des populations".
[14]. Centre de Reference en Agriculture et Agroalimentaire du Quebec (CRAAQ)., (2003), "Guide de production des annuelles en caissettes". Québec, Canada. CRAAQ, 45 P.
[15]. DOUAOUI A., HARTANI T., (2007). "Impact de l'irrigation par les eaux souterraines sur la dégradation des sols de la plaine du Bas-Chéliff. Tunis", Tunisie. 50p.
[16]. BRINIS N., (2010), Caractérisation de la salinité d'un complexe aquifère en pays aride. Cas de l'aquifère d'El-Outaya Région nord-ouest de Biskra, Algérie. Thèse doctorat sciences en Hydraulique, Université Mohamed Kheider-Biskra. Biskra, Algérie. 218 p.
[17]. REMINI B., (2010), "La problématique de l'eau en Algérie du nord. Département des Sciences de l'eau et de l'environnement". Larhyss Journal, N° 08. pp 27- 46.
[18]. BLARD S., (2005), "Les techniques de traitement des eaux chargées en arsenic, Fluor et Plomb". Paris, France. 60p.

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