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Research Paper

Physicochemical and Organoleptic Analysis of Tomato Irrigated with fish farms water; at URERMS-ADRAR. Algeria

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A R T I C L E I N F O

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A B S T R A C T

The objective of the developed system is to encourage efficient water management practices that optimize the usage of water by keeping crop health and yield intact through the implementation of an automated irrigation system. The study aimed to determine the impact of irrigation by fish farming on growth rates and concentrations of macro- and micronutrients in tomatoes.

Results indicated that irrigation with fish farm effluent significantly increased and effluent water, depending on its composition to feed the fish, can supply nutrients and increase the concentrations of these elements in tomatoes irrigated with this water with a refractive index = 1.3391 and a calorie value of 19.927 Calorie in the first sampling and 16.696 calories in the second sampling for 100 g for the year 2021 and for the year 2022 we have a refractive index = 1.3495 and a calorie value of 20.66 Calorie for 100 g. Here we show for the first time that is more than the standard norm (Cotte.2000) which is 18 Calories. Also, after carrying out microbiological analyzes, there is a total absence of pathogenic bacteria, as well as the organoleptic parameters are heading in the right direction where tomatoes irrigated by fish farming water is concentrated compared to the tomatoes irrigated by normal fresh water with Light red of 53 %, Cooked acid of 47 %, spherical form of 94 % and a pleasant smell of 88 %. Therefore, using fish farm effluent in irrigation provides water requirements for plants and also can improve the availability of nutrient elements for tomatoes.

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Abbreviations

FAO: Food and Agriculture Organization

A.O.A.C: Official Methods Of Analysis

AFNOR: Association Française De Normalisation

DM: Dry Matter.

OM: Organic Matter.

MM: Mineral Matter

GM: Greasy Matter

Prot: Protein

A: Acidity

RI: Refractive Index

pH: Potential of Hydrogen

O.J: Official Journal

Literature Review

As the world tends to new technologies and implementations, it is also a necessary goal to grow in agriculture. Much research is done in the field of agriculture. Most projects involve using the wireless sensor network to collect data from different sensors implemented in different nodes and send them via the wireless protocol. The collected data provide information on the various environmental factors. Monitoring environmental factors is not the complete solution for increasing crops. Many other factors reduce productivity to a greater extent [1] which provides little revenue [2], where the economy of our country Algeria still largely depends on agriculture [3].

Agriculture depends on rain which is not a sufficient source of water for whole irrigation for crops. The irrigation system helps to supply water to fields according to the moisture of the soil. Rain plays a vital role in irrigation; water supply is required because most of the fields are depends on the rain. In a conventional system, the farmer has to work properly and with full care of water supply for watering the crops, which depends on crop types. Insufficient watering causes ruin to plants. To provide the proper and needed amount of water for different regions and avert the water overflow at the sloppy areas and considering the situation of the farmer, the water irrigation system will be most useful for proper irrigation. The proper water supply system is the major examination in a cropping system. An irrigation process is useful to reduce water use for crops which is a much-required process. The need for a water irrigation system is to prevail over-irrigation and under-irrigation. Over-irrigation occurs because of bad distribution of water and chemical which fed to water pollution. Under irrigation proceed to increase soil salinity with the buildup of toxic salts on the soil surface in regions with high evaporation. To overcome these problems and to minimize manpower by smart irrigation system has been used. To Overcome these limitations new techniques are been implementing in the irrigation system, through which small amounts of water supply to the parts of the root of a plant. The plant soil moisture stress is cured by providing the proper amount of water resources frequently by which the moisture condition of the soil will retain better growth. That’s exactly where the agriculture industry is at right now. A growing population is demanding more food, but resources are running out. Meanwhile, climate changes are affecting agriculture in irreversible ways. Many breakthrough solutions are around the corner, but few farmers are prepared to adopt them to respond to global challenges [4]. The full concept of the water irrigation system is like traditional techniques of sprinkler or surface irrigation require half of the water sources. Even more specific amounts of water can be supplied for plants. The main objective of the research is to save water and reduce or minimize labor work in agricultural lands. Continuously Monitoring the status of sensors provides a signal for taking necessary action to implement the process and get the output of soil moisture sensor & provide water according to the need or requirement of the crop [5]. The tomato is, after the potato, the second most consumed fresh or processed vegetable in the world. According to this source, world tomato production has experienced strong growth since 1978 when it increased from 48 million tons to 74 million in 1992, and from 89 million tons in 1998 to reach 124 million in 2006. According to the Food and Agriculture Organization (FAO) (2013), China, the United States, and Turkey are the largest producing countries, with 48.58, 12.6, and 11 million fresh tomatoes per year. This production remains low to meet the needs of the population [6].

1. Introduction

Agriculture is multi-disciplinary and over time, agricultural science has grown as a means of addressing real life's multi-faceted problems. Agricultural science includes environment and natural resources management, among other disciplines. In recent years, using wastewater, such as fish farming effluent, has increased, especially in developing countries. [7] Therefore, this research aimed to investigate the effect of two types of irrigation water including well water and fish farm water situated in URERMS (Fig. 1).

Conventional agriculture no longer meets the expectations of citizens. On the one hand, the legislative framework for the protection of the environment is hardening, on the other, the consumer is gradually moving towards organic and local food and expresses the desire for a renewed link with the producer. This is the introduction of fish farming in an agricultural environment. The process involves developing the two activities, either side by side or sequentially, enjoying the benefits of each other. In general, integrated fish farming is recommended in rural areas, especially at the level of medium and small farms, for its significant contribution to protein. The integration of fish farming with agriculture has several advantages and gives an excellent opportunity for agriculture in the Saharan region of Algeria to use water resources more efficiently. It also helps introduce extra protein into their diet.

These proteins were not lacking in the diet. The main constraint was not having access to protein, but rather whether it could be obtained at affordable prices. The situation is deteriorating the natural populations of fish in fresh waters are declining rapidly and the price of fish is rising. However, farmers are beginning to consider the possibility of raising fish for home consumption as well as for sale. This breeding is carried out in fully or partially enclosed spaces (ponds, concrete or plastic basins, traps or cages, etc.).

Irrigation has long played a key role in feeding expanding populations and is undoubtedly destined to play a still greater role in the future. It not only raises the yields of specific crops, but also prolongs the effective crop-growing period in areas with dry seasons, thus permitting multiple cropping (two or three, and sometimes four crops per year) where only a single crop could be grown otherwise. [8] It is subject to the climatic conditions of the region of Adrar-Algeria, longitude 0.2642° E, latitude 28.0174 ° N, and 258 m altitude. The development phases of tomato cultivation are inspired by the practice of farmers in the region.

2. Materials and methods

2.1 Fish Farms water sampling and storage

Water is very precious for every living organism on this earth. The available fresh water to man is hardly 0.30% to 0.50% of the total water available on the earth and therefore its judicious use is imperative. In today's scenario, unplanned urbanization, rapid industrialization, and indiscriminate use of artificial chemicals cause heavy pollution in aquatic environments leading to deterioration of water quality and depletion of aquatic fauna including fish. [9]

Agriculture is the single largest consumer of water of the freshwater on earth, 65% to 75% is used for irrigation. Worldwide, over 250 million ha of land is irrigated, representing about 20% of the world's arable land, which produces over one-third of the global food supply. About 79% of irrigated land in developing countries has contributed to the increased crop yields of the Green Revolution. The scarcity of freshwater is becoming an increasing problem primarily in the arid and semi-arid regions of the world. However, the majority of the agro-industries are water-based and a considerable volume of wastewater is discharged from different operational units of these industries in the environment either treated or inadequately treated forms which leads to several problems of surface as well as groundwater pollution. In much of the world, the increase in crop yield has slowed due to increasing water scarcity and increasing global population, the gap between the supply and demand for water is widening and has reached such alarming levels that in some parts of the world it is posing a threat to human existence. Scientists around the globe are working on new ways of conserving water.

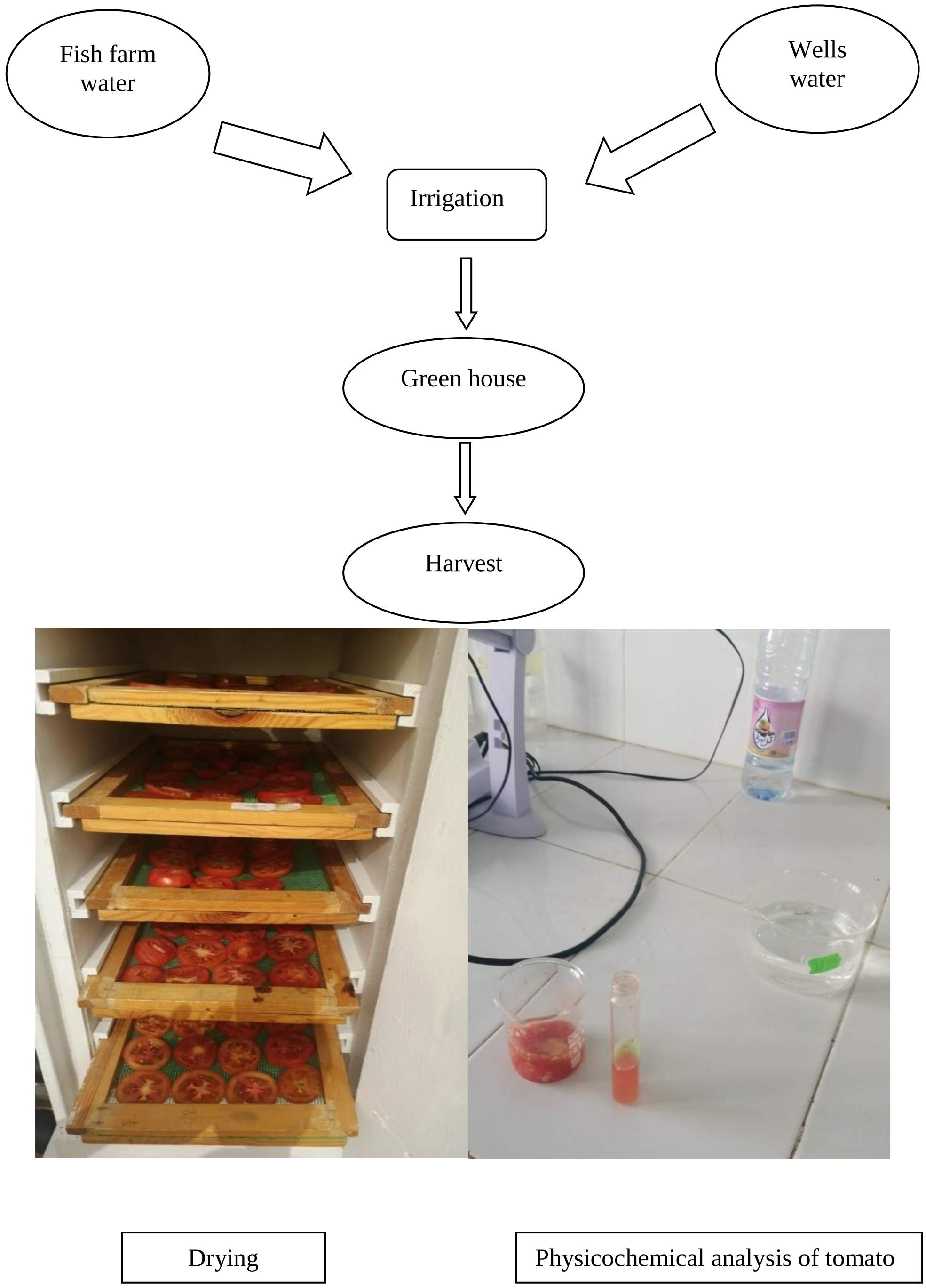

Figure 1. Mind Map of the System Study

Figure 2. Agricultural greenhouse at URERMS – ADRAR-Algeria

Figure 3. PV System at URERMS – ADRAR-Algeria

Figure 4. Fish farming at URERMS ADRAR-Algeria

Figure 5. Agricultural greenhouse at URERMS – ADRAR-Algeria

Table 1. Fish farms' water indicators

Parameters	Optimal	Measured
T°	27°	18°
pH	6.5-8.5	8/23°C
O_2	5mg/l	-
CO_2	10mg/l	-
σ	-	6.8ms/23°C
NH_3	0.05mg/l	-

2.2 Tomato cultivation conditions

Tomatoes are a food of high nutritional density: a derisory caloric intake, a wealth of water, an abundance of vitamins, minerals, and trace elements, fibers present in the grains and the skin. Nutritional and caloric values of the tomatoes per 100 g of raw tomatoes are given in Table 2.

Tomatoes characteristics:

- ✓ Rich in water;
- ✓ Rich in antioxidants;
- ✓ Source of vitamin C;
- ✓ Low in calories;
- ✓ Source of fiber.

Figure 6. The study of the nutritional value of tomatoes theoretically.
Source: Tomatoes cultivated at URERMS ADRAR-ALGERIA.

2.3 Biochemical analysis

The tomato is one of the most important vegetables in the world due to its nutritional, economic, and social values; it is particularly important in human nutrition due to its antioxidant properties. The physicochemical analysis of the tomatoes cultivated at the URERMS ADRAR-ALGERIA; sample (I and II) and the evaluation of their compliance with the standard required of the fresh tomatoes and also compared with other irrigated by freshwater [10], [11], [12].
The Physicochemical analysis contains several tests.

Table 2. Nutritional value of tomatoes

Nutrients	Average content
Energy	19.30 kcal
water	94.10 g
Protein	0.86 g
Carbohydrates	2.49 g
Lipids	0.26 g
Dietary fiber	1.20 g
Calcium	8.14 mg
Chloride	51 mg
Copper	0.029 mg
Iron	0.12 mg
Iodine	0.20 µg
Magnesium	10.10 mg
Manganese	0.066 mg
Phosphorus	26.60 mg
Potassium	256 mg
Selenium	< 10 µg
Sodium	3.22 mg
Zinc	0.087 mg
Beta carotene	449 µg
Vitamin E	0.66 mg
Vitamin K1	7.90 µg
Vitamin C	15.50 mg
Vitamin B1 or Thiamin	0.039 mg
Vitamin B2 or Riboflavin	0.019 mg
VitaminB3 or PP or Niacin	0.65 mg
Vitamin B5 or Pantothenic acid	0.21 mg
Vitamin B6	0.082 mg
Vitamin B9 or Total Folate	22.70g

2.3.1 Determination of moisture content

The Dry Matter content is determined by the Official Methods Of Analysis (A.O.A.C) method (1980). Dry empty crucibles in an oven for 15 minutes at 105°C; Tare the crucibles after cooling in desiccators; Weigh 5g of sample in each crucible to an accuracy of 0.001g and place them in the spray oven at 105°C for 24 hours; Remove the crucibles from the oven, place them in the desiccators and after cooling, the operation is repeated until a constant weight is obtained (using the drying time of 30 minutes).

Expression of results: $\mathbf{H\% = (M_1 - M_2) / M_2 * 100}$

H%: Humidity **M_1:** Mass of the crucibles + material before staving **M_2:** Mass of the assembly after curing.

The Dry Matter content is calculated as follows: **Dry Mater %= 100 − H%**

2.3.2 Determination of ash content and organic matter (Association Française De Normalisation /AFNOR, 1972)

The quantity of sample (05g) is introduced into an oven for 24 hours at 105°C then into a muffle furnace (Nobertherm) for 4 hours at 550°C.

$$\mathbf{OM\% = (M_1 - M_2 / M_1) * 100}$$

OM%: Organic Matter. **M_1:** Mass of the crucible + test portion. **M_2:** Mass of the crucible + ashes.

The ash content **(Cd)** is calculated as follows: **Cd = 100 − OM (%)**

2.3.3 Determination of water activity

Water activity is measured by Aw-meter by enclosing approximately 2g to 5g of sample in a component cell of an AWX 3001EBRO screen electronic device. After a minimum of 1h30, the reading is made on the display screen.

2.3.4 pH determination (Association Française De Normalisation /AFNOR, 1970)

Place a quantity of tomato in a beaker and crush it manually; Determination of the pH value by the pH meter.

2.3.5 Determination of sugar content (Dubois 1956 method) [13]

2.3.5.1 Determination of the content of reducing sugars (glucose)

a) Preparation of the sample: 1g of tomato was mixed with 300 ml of distilled water and 3g of $CaCO_3$ and then the mixture was heated for 30 min until boiling with continued stirring afterward filtered. After cooling the mixture, complete with distilled water up to 1 liter (1000 ml) of the solutions, after adding a small amount of lead acetate afterward filtered.

b) Dosage: After the 2^{nd} filtration, we had a filtered extract from which we took 01ml which we mixed with 01ml of phenol (5%) and 05ml of concentrated H_2SO_4 with continued stirring. The tubes are kept for 5 min at 100°C after staying in the dark for 30 min. Then we read the O.D related to the wavelength 490 nm by UV-VIS spectrophotometer.

2.3.5.2 Determination of total sugar content

We took 5 ml of our product, to which we added 5 ml of HCl (2N); We heat to 100°C in a water bath for 30 min and after cooling we take 1 ml of this extract and proceed to the dosage of the sugars contained, as for the reducing sugars already presented as well as the reducing sugars obtained by hydrolysis of sucrose, therefore these are the total sugars.

Sucrose = (Total sugars – Reducing sugars) *0.95

0.95 is a correction factor (the correlation between the experimental and the calculation model).

2.3.6 Determination of Brix rate and refractive index

Clean the blade of the device using drops of distilled water and Joseph paper; Calibrate the device with distilled water whose refractive index is equal to + 1.33; Clean the refract meter blade using Joseph paper; Place a few drops of syrup on the refract meter blade and set the darkened chamber circle clear in half; Read the results on the eyepiece scale, taking into account the ambient temperature, so the value displayed must be corrected according to the temperature; Clean the refract meter blade, always using Joseph paper; An analysis by a refract meter was carried out to know the sugar content dissolved in this solution.

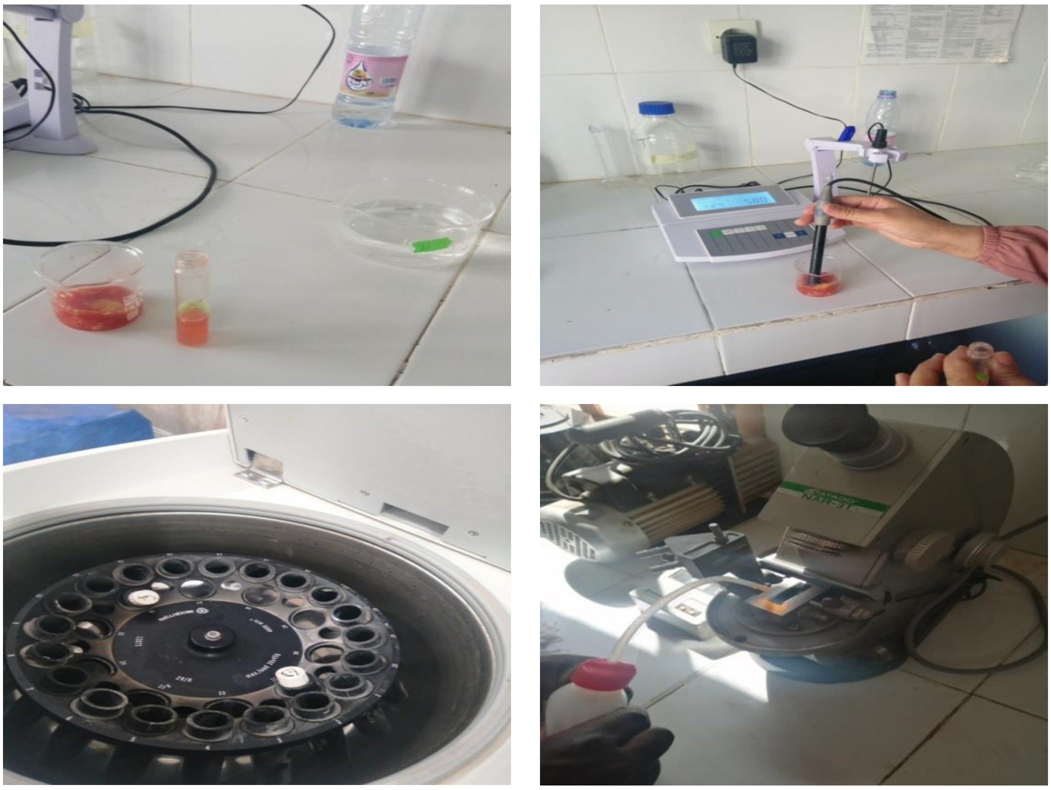

Figure 7. Physicochemical analysis

2.3.7 Determination of fat content

The determination of fact content is determined by (NF EN ISO 734-1, 2000), according to the following formula:

$$GM\% = \frac{(W2-W1)}{W3}*100$$

W is the weight of the ball.

2.4 Microbiology Analysis

2.4.1 Preparation of culture media

The culture media used for the count of total germs, Coliforms; Yeasts, and molds are respectively the following:

- Standard Plate Count Agar (PCA).
- Bile Crystal Violet Lactose Agar (VRBL).
- Sabouraud agar (OGA).

2.4.2 Numbering technique (UFC): [14]

The technique consists of four consecutive steps: Serial preparation of tenth dilutions; Seeding. Incubation ; Colony counting and interpretation of results. [15]

a) Preparation of the dilutions:

➢ Thinners:

-Buffered peptone water: preparation of the stock suspension.

-Try tone-salt: Preparation of decimal dilutions.

➢ Procedure:

Preparation of the mother suspension: Weigh in a stomacher bag a mass m (25) representative of the juice of tomatoes. Add an amount of thinner equal to 9* m. This quantity is measured in mass with an uncertainty of ± 2% [16].

Preparation of decimal dilutions: Dilutions are always carried out under aseptic conditions [17].

b) Inoculation and incubation:

In the case of counting yeasts, and molds, the inoculation was done on the surface, and the count of total germs and total Coliforms were made in depth.

1. Surface inoculation. 2. Deep inoculation.

The incubation of the inverted boxes was done in an oven incubator at a temperature and a well-determined time.

c) Reading and interpretation:

Reading is done by visual counting. In all cases, only dishes containing 20 to 300 colonies are used. The number of colonies obtained per box makes it possible to go back to the starting microbial concentration, and according to:

- When a dish has no colonies, we conclude: "less than 1 germ per ml".
- When the number of colonies is for all the dilutions lower than 20, we conclude: "Less than 20 germs per gram or ml".

• When the number of colonies is between 20 and 300, we calculate: the average number of colonies represented as a weighted average from two successive dilutions, as follows:

$N = \Sigma c / 1.1 d$ (NF V 08 – 102, 1998) [17]

Where: **c:** number of colonies in the dishes of two successive dilutions.

d: dilution rate corresponds to the first dilution retained.

2.4.3 Search and enumeration of fecal Streptococci

In tomatoes, group D Streptococci or fecal Streptococci are sought and counted in a liquid medium by the MPN technique (most probable number).

The technique in a liquid medium uses two consecutive tests, namely:

- The presumptive test: reserved for the search for Streptococci on Rothe medium,
- The confirmation test: reserved for the actual confirmation on EVA medium, of the tubes found positive in the presumptive tests.

Incubation: Incubation takes place at 37°C for 24 hours.

Reading: Are considered positive, the tubes presenting at the same time:

- A microbial disorder,
- A whitish or purple pellet at the bottom of the tube

The final reading is also carried out according to the prescriptions of the Mac Grady table, taking into account only the positive or negative EVA tubes.

2.5 Organoleptic analysis

2.5.1 Organoleptic Evaluation of Fruit Quality

The organoleptic qualities of the fruits were evaluated by sensory analysis, in sessions attended by untrained volunteer tasters without specialized knowledge. A total of 20 tasters (04 women and 16 men) were invited to complete the analysis questionnaires at the tomato-tasting sessions. The tasting started at 11:00 and ended at noon, and each participant could drink or eat one hour before the tasting. Before each evaluation, testers had to rinse their mouths with mineral or distilled water.

3. Results

3.1 Tomato cultivation physicochemical characterization

The physicochemical analysis of the tomatoes cultivated at the URERMS ADRAR collected on 03/18/2021, 05/30/2021, and 04/11/2022 the first and the second sampling of the year 2021 at the last sampling of the year 2022; and the evaluation of their compliance with the standard required of the fresh tomatoes and also compare with other irrigate by fresh water.

3.1.1 The calorie value of tomatoes:

For Carbohydrates, 1g gives 4 calories

For Protein 1g gives 4 calories

For 1g which gives 9 calories so: 3.75 * 4 + 0.121 * 9 + 0.91 * 4 = 19.927

For 100g of tomatoes, we have 19.927 calories

For the 2nd sample 05/30/2021

Calorie value of 100g which gives 16,696 calories

Table 3. Physicochemical analysis

Sampling	Tomato irrigation source			Cote 2000 standard
	Fish farming water cultivation1	Fish farming water cultivation2	Freshwater	
Water %	94.19	92.35	93.42	93.5
DM%	5.80	7.64	6.58	-
OM%	4.31	5.87	-	-
MM %	0.76	1.76	-	0.74
Sucre %	3.75	3.10	4.57	3.60
GM %	0.121	0.171	0.105	0.30
Prot. %	0.91	0.69	-	0.95
A %	0.28	-	0.19	-
pH	4.68	5.20	4.75	-
RI	1.3391	1.472	1.3386	-
Calories value	**19.927**	**16.696**	-	**18**

Cotte, 2000: Study of the nutritional value of tomato pulp in ruminants: Thesis for obtaining the degree of Veterinary Doctor - Claude Bernard University of Lyon1, P. 135.
DM: Dry Matter. OM: Organic Matter. MM: Mineral Matter. GM: Greasy Matter Prot: Protein A: Acidity RI: Refractive Index

Table 4. Physicochemical analysis

Sampling type	Tomato is irrigated by fish farming.	Tomato irrigated by Freshwater	Cote.2000 standards
Water %	93.08	93.67	93.50
DM%	6.92	6.33	6.50
OM%	6.40	5.80	
MM %	0.52	0.53	0.74
AW	0.930	0.948	
Sugar %	3.90	2.70	3.60
GM %	0.22	0.16	0.30
Prot. %	0.77	0.56	0.95
A %	6.50	6	
pH	5.04	5.30	
RI	1.3495	1.344	
Calories value	**20.66**	**14.48**	**18**

Cotte, 2000: Study of the nutritional value of tomato pulp in ruminants: Thesis for obtaining the degree of Veterinary Doctor - Claude Bernard University of Lyon1, P. 135.
DM: Dry Matter. OM: Organic Matter. MM: Mineral Matter. GM: Greasy Matter Prot: Protein A: Acidity RI: Refractive Index

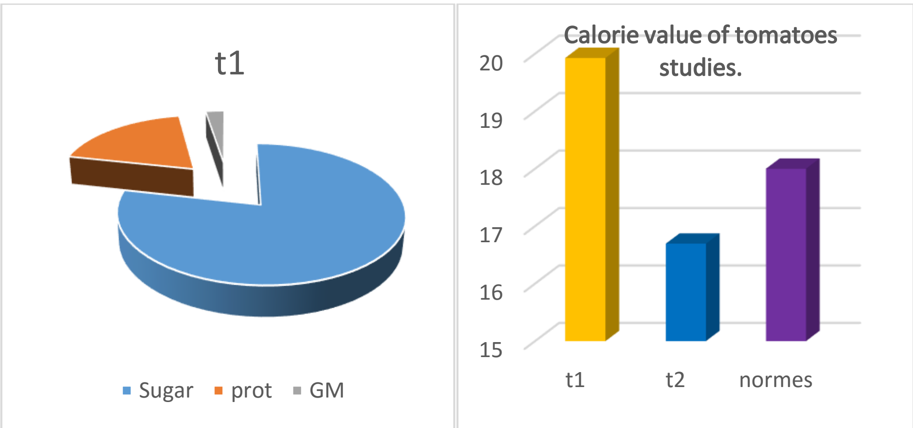

Figure 8. The calorie value of tomatoes

3.1.2 The calorie value of tomatoes:

For Carbohydrates, 1g gives 4 calories

For Protein 1g gives 4 calories

For Fat 1g which gives 9 calories so: 3.9 * 4 + 0.22 * 9 + 0.77 * 4 = 20.66

For 100g of tomatoes, we have 20.66 calories

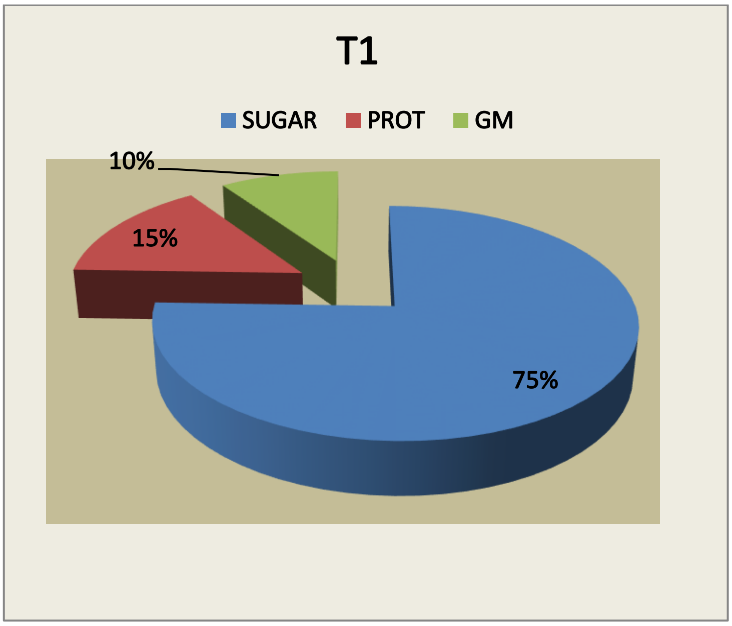

Figure 9. The calorie value of tomatoes

3.2. Tomato cultivation microbiological characterization

The microbiological analysis of the tomatoes cultivated at the URERMS ADRAR collected on 04/11/2022, and the evaluation of their compliance with the standard required of the fresh tomatoes and also compare with other irrigated by fresh water.

Table 5. The microbiological analysis

Sampling	G.T	Yeasts	Molds	clostridia	Fecal coliforms	Total coliforms
URERMS Tomatoes	17	35	Abs	abs	abs	abs
O.J Norm's	5.10^6	10^2	10^2	-	-	-

Analysis carried out at the E.S.S Laboratory of URER.MS ADRAR-ALGERIA: Tomato fruits are rich sources of vitamins and minerals that are good for human health. On the other hand, they are rich in trace elements, such as copper, manganese zinc, selenium, and vitamins C, B6, E, and folic acid **[18], [19].** It was discovered that through the neutralization of free radicals, these trace elements play a vital role in protection mechanisms. **[20]** According to the results obtained after carrying out microbiological analysis, there is a total absence of pathogenic bacteria in the two samples, even though the irrigation by fish farming water contains pathogenic or hygienic pollutants.

3.3 Tomato cultivation Organoleptic characterization

3.3.1 Tomatoes irrigated by ordinary freshwater

1. Color:

- Red: 12 %
- Light red: **59 %**
- Orange: 29 %

2. Taste:

- Cooked acid: 18 %
- Acid: **59 %**
- Low acidity: 23 %

3. Form:

- Spherical: **88 %**
- Elongated: 00 %
- Cherry tomatoes: 12 %

4. Smell:

- Pleasant: **100 %**
- Unpleasant: 00 %

3.3.2 Tomatoes irrigated by fish farming water

1. Color:

- Red: 41 %
- Light red: **53 %**
- Orange: 6%

2. Taste:

- Cooked acid: **47 %**
- Acid: 12 %
- Low acidity: 41%

3. Form:

- Spherical: **94%**
- Elongated: 00%
- Cherry tomatoes: 6%

4. Smell:

- Pleasant: **88%**
- Unpleasant: 12%

4. Study of Drying Kinetics of Tomato in a Solar Dryer

4.1 Tomato collected on 05/30/2021

Figure 10. Tomatoes drying at URERMS ADRAR- ALGERIA

4.2 Tomato collected on 05/24/2022

Figure 11. Tomatoes drying at URERMS ADRAR- ALGERIA
(The two samples were irrigated with fish farms and freshwater)

Table 6. The thickness of 0.50 cm and 1 cm for 05/26/2022 at the E.S.S Laboratory of URER.MS ADRAR-ALGERIA:

Thickness	freshwater	fish farming water	freshwater	fish farming water	freshwater	fish farming water
	0,50 cm 1st Key	0,50 cm 2nd Key	1 cm 3rd Key	1 cm 4th Key	1 cm 5th Key	1 cm 6th Key
11H	0.313	0.339	0.366	0.379	0.386	0.388
12H	0.219	0.272	0.334	0.349	0.364	0.370
13H	0.143	0.218	0.306	0.322	0.345	0.353
14H	0.033	0.099	0.238	0.258	0.299	0.317
15H	0.026	0.059	0.206	0.223	0.273	0.296
16H	0.023	0.034	0.175	0.195	0.246	0.273
17H	0.020	0.031	0.152	0.173	0.229	0.257
09H	0.021	0.023	0.046	0.064	0.135	0.178
10H			0.037	0.056	0.123	0.167
11H			0.032	0.046	0.110	0.155
12H			0.027	0.036	0.095	0.137
13H			0.019	0.020	0.016	0.026

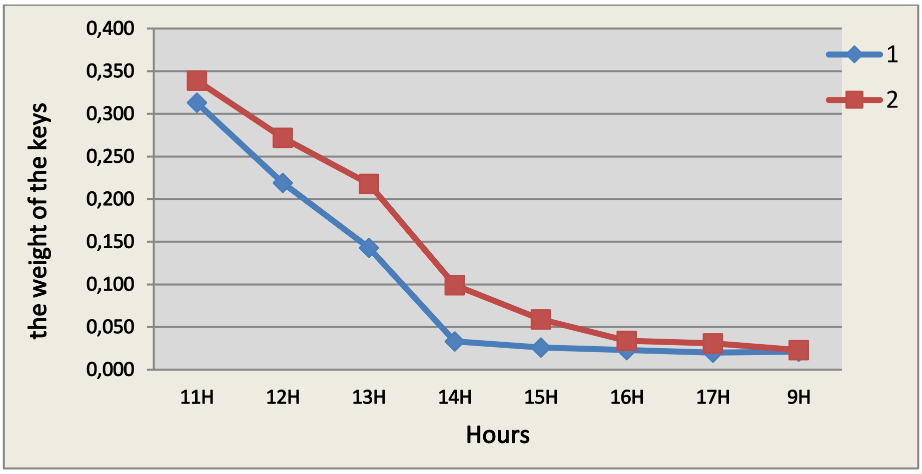

Figure 11. Study of Drying Kinetics of Tomato in a Solar Dryer for a Thickness of 0.50cm

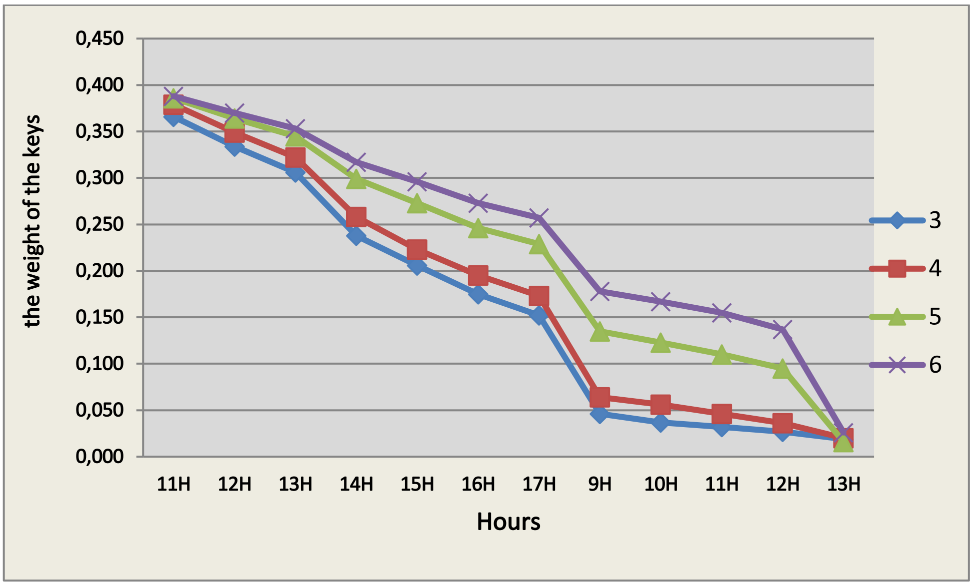

Figure 12. Study of Drying Kinetics of Tomato in a Solar Dryer for a Thickness of 1cm

5. Discussion

The results of the Concentrations of Macro- and Micronutrients in Table 3, Showed that tomatoes irrigated with fish water had the highest concentrations of water=94.19%, GM=1.12%, Protein=0.91%, and highest Refractive Index (RI= 1.3391) for the first sampling of (03/18/2021) the same as for the second sampling of (05/30/2021) water=92.35%, GM=0.17%, Protein=0.69%, and highest of Refractive Index (RI= 1.472).

The results in Table 5, indicated that the microbiological analysis carried out on tomatoes reflects the presence of yeasts which supports acidic environments while the presence of aerobic germs is due to the unsanitary conditions of the irrigation water or the storage medium, but most important it is the absence of pathogenic germs. The results in Table 5, showed that the microbiological criteria are satisfactory. Using water of low quality for irrigation could negatively affect crop yield [21]. Although fish farm effluent is considered low-quality water, it could be a source of irrigation water and a source of organic materials as well, that could be used for fertilization of crops.

The results in Table 4, Showed that tomatoes irrigated with fish farming water had the highest concentrations of water, GM, and Protein, 0.22, 0.77 respectively, and the highest Refractive Index (RI= 1.3495), Dry matter content in tomatoes usually varies from 5% to 7.50% [22]. Depending on the irrigation and fertilization conditions, the average values of the dry matter content were found to range between 4.20% and 6.60% [23]. By basing on the results of Table 4, we note that the percentage of water and dry matter in the two samples is in conformity with the standards of (COTTE 2000) which is equal to 93%, We also note that the percentage of dry matter in tomatoes irrigated by fish farming water is higher than the percentage of dry matter irrigated by ordinary fresh water, because it is rich on organic matter and mineral salts due to the conditions which provided the tomatoes, the nutrients contained in the water of the fish farming water, and this alone is enough to explain the richness of the tomatoes irrigated by fish farms since they contain a high percentage of organic and mineral components, and this has materialized in the results of the sugars, proteins and Lipids; 3.64%, 0.22% and 0.77%, respectively, compared to tomatoes irrigated with ordinary fresh water 2.70%, 0.16% and 0.56%, respectively, and what was embodied by the value of the refractive index (RI) of the material which shows the extent of the dissolved substances in the sample, i.e. the dissolved components in the solution, which indicates the richness of this substance soluble in water, and in support of what we explained by the richness of tomatoes irrigated by fish farming showed that the soluble substances have a value of 1.3495 compared to tomatoes irrigated by ordinary fresh water 1.344, and what was embodied by the acidity value of tomatoes irrigated by fish farming (pH=6.5) and for tomatoes irrigated by normal fresh water (pH=6), these values are supported by what we said and explained by the richness of tomatoes irrigated by fish farming water, and accordingly we conclude that the nutritional value of tomatoes irrigated with fish farming water (20.66 cal) is higher compared to tomatoes irrigated with normal fresh water (14.48 cal) according to (Cotte.2000), where the optimization of irrigation in tomato culture can influence the dry matter content, with variations between 4.20% and 5%. Here we show for the first time that the results are more than the standards norms (Cotte.2000). Our results confirm that many quality elements contribute to the overall quality of fruits and interact with others to provide the general parameters of high-quality tomatoes.

From the Organoleptic test of tomatoes, we conclude that tomatoes irrigated by fish farming water are concentrated compared to the tomatoes irrigated by normal fresh water with a Light red of 53 %, Cooked acid of 47 % with a spherical form of 94 %, and a pleasant smell of 88 %. Fruit color is an important quality feature of tomatoes. The color changes during the ripening of tomatoes from light red to dark red are consistent with the breakdown of chlorophyll and the synthesis of carotenoid pigments. This pigment synthesis is closely correlated with the initiation and acceleration of ripening, and the red color of the fruit results from a higher accumulation of lycopene. This important compound, lycopene, is considered by researchers to be an essential carotenoid in tomato fruit (80%-90%), followed by β-Carotene (5%-10%) [24]. The choice of a rational method of drying and the type of dryer meets the requirement to obtain a finished product with the specified characteristics in the operation of the dryer, which has technical and economic indicators of reliability, low emission of gases into the atmosphere during operation or is to achieve total elimination. The dynamic equilibrium state in the drying and wetting processes is at its highest will be. During drying, the water vapor pressure on the surface of the material decreases and equilibrates tends to moisture. In the process of wetting, we observe the reverse process, that is, the water vapor pressure at the surface of the material increases and tends to equilibrium moisture. Moisture in a material is a mass on the surface that separates the phases from its permeability, and the flow of gas from the separating surface to the core - convective diffusion account. The diffusion of moisture in the material is not only the moisture retention gradient but rather under the influence of the temperature gradient. It is very difficult to express the diffusion in a material analytically. It is known that the speed of the drying process is the form of contact of moisture with the material and it depends on the mechanism of diffusion of moisture. Drying process kinetics with moisture retention of the material or change of average humidity after a certain period described. Typically, a drying curve is used to find the drying rate experimentally is constructed, and then a differential drying speed curve is formed.

6. Conclusion

In the present research, we compared two types of irrigation based on their capability to increase land and water equivalent ratios by using land and water resources more efficiently. Between the two-studied irrigation, we found that irrigation with fish farm effluent could attain the highest yield of the two studied.

The fish farm effluent water, depending on its composition to feed the fish, can supply nutrients and increase the concentrations of these elements in plants irrigated with this water. High concentrations of important elements probably stimulate plant growth in the fish farm compared to the other. According to the results, plant growth was satisfactory in irrigation with fish water. Therefore, the fish farming system could be noticeable as a source of irrigation in agriculture, especially in areas that suffer from water scarcity. The correspondence between the morphological characteristics of the fruits, the chemical content of the fruits in useful alimentary, nutritional, and healthy components, and the commercial traits and overall gustatory qualities of the fruits are of great importance for the success of new tomato cultivars. The results obtained based on the analyzed genotypes indicate that the modern breeding of tomatoes for the commercial aspect of the fruit, the composition traits related to nutritional or bioactive properties, as well as the organoleptic parameters are heading in the right direction.

Finally, the success of tomato breeding projects is closely linked to adequate knowledge of the market and consumer requirements, but also of the users, processors, and the preferences and needs of growers.

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