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Agronomic valorization of the composts with olive waste

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Abstract

In the Mediterranean countries, olive waste, a co-product of the olive oil trituration process, presents a serious environmental problem because of their polyphenol charge, given the quantities rejected each year. In previous works, this waste has been co-composted with other substrates and has been transformed into non-phytotoxic substances in conformity with the French standard NFU44-051 due to their composition in nutritional elements like soluble sugars, proteins and mineral elements. This study examines the efficacy of these substances on radish and potato crops. To do this, seeds were sown on the plot. For each crop, 4 plots were planned: land amended with manure (M), NPK fertilizer (F), the vegetable water substance (VW) and the olive-pomace substance (OP) in addition to the vegetable water. The first three substances served as controls. A statistical study of correlation between the latter and those that characterize the soil after amendment was carried out.

The obtained results showed that there are two strong correlations between pH, organic matter, dry matter and soil moisture amended by the OW compost and, on the one hand, the morphological growth parameters of the two crops and, on the other hand, the parameters of their production.

Keywords: Olive waste, compost, crop, vegetative growth, production parameters, statistical analysis.

1. Introduction

Agriculture is one of the most important economic sectors in Morocco. It represents about 13% of the gross domestic product (GDP) [1]. This rate is not stable, it varies significantly between 11 and 18% due to climatic changes and unexpected pollution. In this respect, national programs have been developed, in particular the "Green Morocco" program. Indeed, the performance of this agriculture is related to multiple factors, including the extent and quality of agricultural land, climate, production techniques adopted by farmers, available technologies, support policies and particularly soil quality [2]. In fact, climate change is a source of worries that are reflected everywhere and in different domains, but are more accentuated in agriculture by limiting agricultural production yields [3]. This change is reflected in the presence of many phenomena such as the increase in atmospheric CO_2 which influences the photosynthesis of crop plants [4], heavy rainfall and other extreme weather events that can cause flooding and affect water quality, but also reduce the availability of water resources in some regions, as well as the disruption of the rainy season (heavy rains or showers, recurrent rain breaks, late onset and early end of wintering) [5]. To remedy this, the addition of fertilizers or an organic amendment would be an efficient and cost-effective solution. In fact, other types of fertilizers such as chemical fertilizers, green manures and compost, could provide the necessary elements except that commercial products are very expensive. On the other hand, they can cause long-term adverse effects on cultivated land by infiltration of groundwater, human activities or the alimentary chain on public health [6]. Furthermore, composting has been the center of interest for years for some researchers who have shown that composts made from waste products such as vegetable gardens [7], wine co-products [8],sludge from wastewater treatment [9], algae [10], olive waste are composed of several nutritional elements that can correct soil deficiencies and increase crop yields [11, 12]. Other researchers have shown that the incorporation of compost into the soil could combat soil surface degradation [13], which would favor reforestation processes by improving plant nutrition and growth, and especially increase plant potential for survival in times of dryness and rigidity [14]. The present work, carried out as part of a project financed by the Ministry of the Environment, had as its first objective the recovery of two environmentally harmful wastes (olive rind and olive pomace) by composting. A second objective was to test the efficiency of composts produced in a previous work on the cultivation of potatoes and radishes in plots.

2. Material and methods

2.1. Material

- **Matériel végétal**

  -Radish of the variety Raphanus Sativus National.

  -Potato of the variety variety Koruda.
- **Soil**: soil of the Faculty of Sciences Dhar El Mahraz (FSDM- Fez) not previously fertilized.
- **Soil Enriching Products**

Composts: two composts have been obtained from the former LIEME laboratory, being elaborated during the year 2018 with organic waste mixed either with single vegetable water (VW) or with vegetable water and olive pomace (OP) [14].

Manure: this is a bovine manure from a farm in the region of Séfrou.

Chemical Fertilizer: product marketed as NPK (10-15-12).

Manure (M), fertilizer (F) and compost (VW) were used as witnesses.

Irrigation water: water from faculty wells.

2.2. *Sampling*

Soil sampling was carried out, in accordance with the requirements of the AFNOR X 31-100 standard, by a spade using the systematic random square mesh method. Equal masses of soil samples were taken from each intersection of the mesh and the center of the mesh. All the samples (15 Kg) were mixed and homogenized by the quartage method to arrive at 500 g of sample for analysis. Experimentally, three replicates were made for each amendment and crop and the result is divided by the average of the three trials. For this purpose, the land was divided into plots of equal area, then into sub-plots and finally into separate meshes with a surface area of (0.5 x 1) m^2. Each mesh had a surface area of 1 m^2. The radish and potato plots were separated by (2 x 3) m^2 (Figure 1).

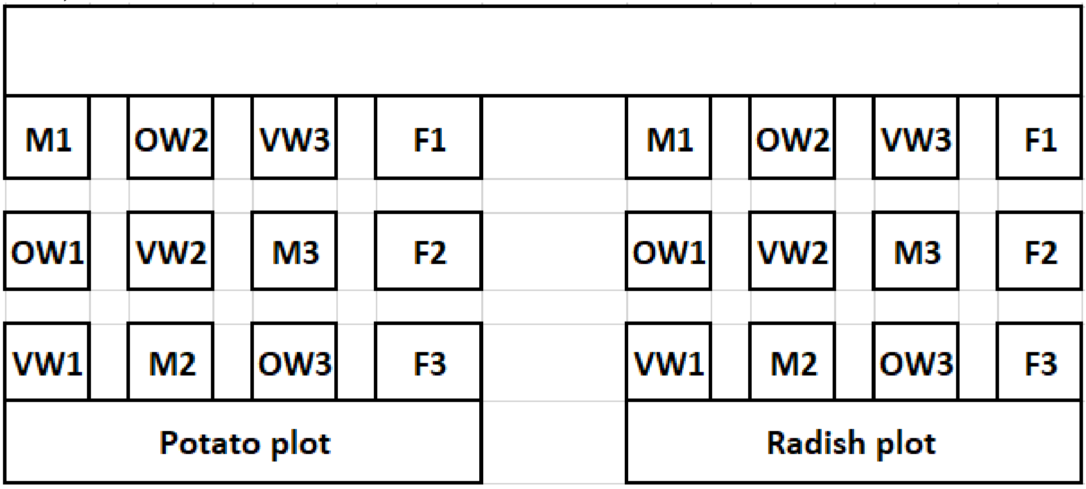

Figure 1. Cartography of the FSDM-Fès test land

2.3. *Software outils*

- Mesurim: Software for calculating the foliar surface area of crops (Sf). The method consists in sticking the sheet on a white paper, choosing a scale, photographing the sheet and then following the software's step-by-step operations.
- Statgraphics 18: has been exploited for statistical analysis of radish and potato growth and production parameters and those of the physico-chemical characterization of soil amended by manure or M or OW composts with a 5% alpha risk. Thus, in order to define the possible correlations between the different parameters, six matrices were established using the Pearson coefficient, which is based on the calculation of the covariance between two continuous variables.

3. Methods

3.1. *Amendements Characterization*

All materials were characterized by measurement of the parameters: pH, electrical conductivity (EC), humidity (% H), dry matter (% DM), kjeldhal nitrogen (NTK), organic matter (% OM), total organic carbon (TOC), C/N ratio, fertilizing elements and metallic elements according to AFNOR standards [14]. The maturation of substances VW and OW evaluated by measuring their polyphenol content, humic acid formation (E4/E6) and germination index (GI).

3.2. *Irrigation water Characterization*

The well water was taken and analysed by measuring pH, Chemical Oxygen Demand (COD), ammonium (NH4+), sulphides (S2-), sulphates (SO_4^{2-}), nitrate (NO_3^-), nitrite (NO_2^-) and ortho-phosphate (PO_4^{3-}) ions in according with AFNOR standards [15].

3.3. *Plantation concept*

The potato and radish cultivation trials have been made after preparing the soil by reaping, refining, turning and amending with manure (M), fertilizer (F) or composts with vegetable water (VW) or olive waste (OW). The amendments were spread on the soil and incorporated by scratching/ hoeing in the first 5 to 10 centimeters of soil. The planting was completed after 10 days. For the radish, furrows traced and spaced 20 cm and the seeds placed in a line, 1.5 cm in depth. For potato, germinated tubers planted with a depth of 20 cm and spaced 25 cm apart.

3.4. Crop monitoring

The crops were accompanied by regular monitoring of morphological and production parameters up to the day of harvest, once a week for potato and twice a week for radish (Table 1).

Table 1. *Monitoring Parameters for Radish and Potato Crops*

Crops / ***Parameters***	***Radish***	***Potato***
Morphological parameters	- Leaf area - Number of leaves per plant	
	- Plant height	- Stems Height - Sheet length - Number of stems per plant
Production parameters	- Total yield - Calibre of vegetables	
	- Length of the root	- Weight per plant - Number of tubers per plant

The leaf area was determined by simulation with the Mesurim software and by the calculation [17] using the expression: $\mathbf{S_f = L.I.K\ (cm^2)}$.

With: **L**, **I**: length and width respectively of leaflet (cm), **K**: coefficient relating to the shape of radish and potato. It is 0.871 and 0.674 respectively [16]. The total yield was calculated by dividing the total weight (P) of the crop in Kg by the total area of the plot Sp: **Yield = P/Sp**

With: **P**: total weight of radish in each plot in Kg and **Sp**: plot area in hectare.

4. Results and discussion

4.1. *Physico-chemical characterization of materials*

The physico-chemical analysis of the soil studied (Table 2) shows that it is neutral, very saline, and rich in organic and mineral matter. It is also characterized by a high presence of sodium and potassium, a low concentration of magnesium and traces of phosphorus in comparison with the moroccan soil quality standard for agricultural use [17]. Table 3 indicates the potato and radish crop requirements for a good yield. Potatoes require a soil with a low acid pH that tends towards neutrality. This crop is relatively tolerant to salinity compared to other vegetable crops. However, high salinity can block water absorption by the root system. When the salt content is high, the wilting point is quickly reached. In this case, the wilting point should be washed away by irrigation with fresh water [18]. In addition, this crop is very nutrient consuming. For a production of 25T/ha, the soil needs 45 Kg/ha of phosphorus and 275 Kg/ha of potassium [19] and must be rich in organic matter [20].

Table 2. *Soil physico-chemical characteristics after 10 days of amendment*

Parameters	***Values***	***Soil quality for culture [17]***
pH	8,08	Moderately basic 7,8-8,5
EC mS.cm^{-1}	0,257	Not saline < 4 (dS/m)
H (%)	14,4	ND
DM (%)	85,6	ND
OM (%)	6,8	Very rich > 6
TOC (%)	3,57	ND
NTK (%)	2,15	ND
C/N	1,48	ND
Mineral elements and fertilizers mg/Kg		
Na	58010	ND
K	3560	Very rich > 100 (ppm de K_2O)
Ca	103,73	ND
P	6,19	Very low < 15 (ppm de P_2O_5)
Mg	0,61	ND
Metallic trace elements mg/Kg		
Cu	0,063	ND

Table 3. *Soil quality by crop requirements*

Parameters ***Crops***	***pH***	***EC (dS/m)***	***OM (%)***	**For a production of 25 tonnes of crop/ha**	
				P_2O_5 (Kg /ha)	*K_2O*(Kg /ha)
Potato	6-7	Very tolerant to salinity	> à 3%	45	275
Radish	6,5 - 7	-	-	50	80 à 180

The radish crop is not very demanding in terms of nutrients, since it requires between 80 and 180 kg of potassium per hectare, but it also reacts very well in the same pH range as potatoes [21]. The physico-chemical characterization of substances VW and OW (table 4) shows that they perfectly correspond to the requirements of standard NFU44-051 [22], particularly in terms of toxicity and their load of mineral elements calcium, potassium, phosphorus, magnesium and sodium which play an essential role in the development and growth of plants. The physico-chemical characterization of irrigation water (Table 5) reveals that well water complies with the Moroccan irrigation standard [23] and does not present any risk for the soil-plant system.

4.2. Maturity test

The maturity tests for M and OD substances (Table 6) reflect that they are characterised by germination indices higher than 50 and E4/E6 ratios higher than 5. This demonstrates their maturity and stability, the presence of humic acid (E4/E6), and therefore the absence of phytotoxic effect.

Table 4. *Physicochemical characteristics of substances VW and OW*

Amendements / *Parameters*	*OW*	*VW*	*M*	*Standard NFU44-051*
pH	7,95	7,63	8,57	6,5-8,5
EC(mS.cm^{-1})	2,69	4	3,87	ND
H (%)	16,7	12	20	>30
DM (%)	83,3	88	80	>30
OM (%)	56,65	62,95	74,68	>20
TOC (%)	29,82	33,13	37,72	ND
NTK (%)	2,59	3,15	2,97	0,88
C/N	11,51	10,51	12,7	>8
Polyphénols (mg/L)	6,5	7,5	0	ND
Mineral elements and fertilizers mg/Kg				
Na	8505	36225	10485	ND
K	88680	8410	85460	ND
Ca	14,83	7,79	6,71	ND
P	1,75	3,52	2,39	ND
Mg	2,9	2,2	3,16	ND
Metallic trace elements mg/Kg				
Cd	0,08	0,085	0,085	3
Co	0,038	0,06	0,06	ND
Al	2,31	0,73	1,11	ND
Cr	0,04	0,9	0,34	120
Cu	0,04	0,14	0,48	300

Table 5. *Physico-chemical composition of well water*

Parameters / ***Water***	pH	NO_3^- (mg/L	NO_2^- (mg/L)	NH_4^+ (mg/L)	SO_4^{2-} (mg/L)	S^{2-} (mg/L)	PO_4^{3-} (mg/L)	DCO (mg d'O_2/L)
FSDM water	7,11	0,8	0,011	1,087	0,5	0,076	0,22	93,05
NM Irrigartion water [23]	6,6 à 8,4	1,5	-	-	250	-	-	-

Table 6. *Maturation tests for amendments VW, M and OW*

Parameters / ***Organic amendments***	*OW*	*VW*	*M*	*NFU44-051*
GI (%)	71,45	60,61	0	> 50
E_4/E_6	3	2,33	0,2	< 5

4.3. Culture of radish

Radish growth was monitored by measuring morphological parameters; plant height, number of leaves per plant and leaf area amended by four types of organic amendments (OW, VW, M and F). Radish production parameters were controlled at the end of the harvest by measuring total yield, caliber and root length.

4.3.1. Morphological parameters

4.3.1.1.Plant height

Figure 2 shows the effect of soil improver application on plant height as a function of time. Analysis of these results shows that plant height in the first few weeks was the same for all amendments except manure. The difference begins to be slightly noticeable from the sixth week of seeding when the greatest height was observed for the radish amended by the VW compost (18.67 cm). This is principally due to its high magnesium content; a micro-nutrient essential for chlorophyll (green pigment), photosynthesis and energy transfer.

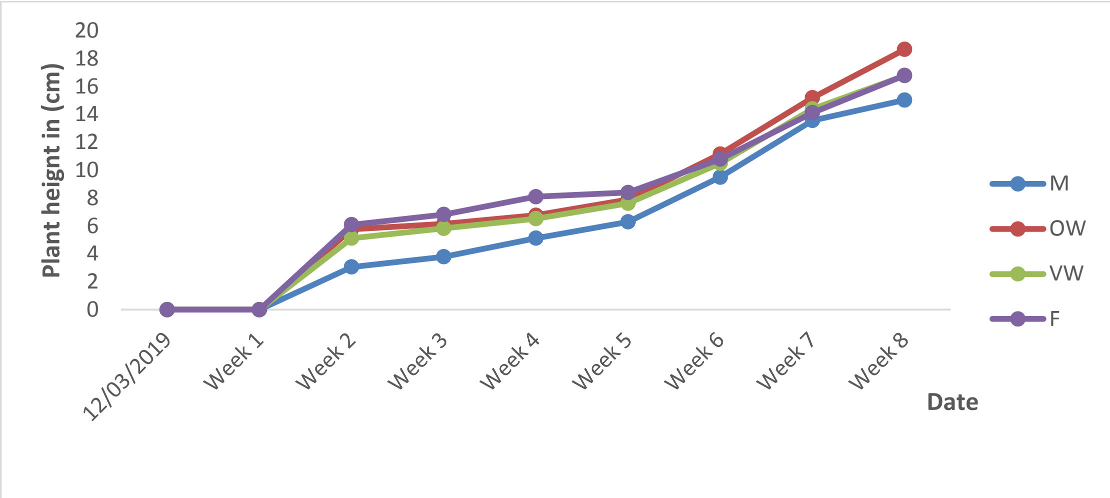

Figure 2. Height of the radish plant as a function of time

4.3.1.2.Number of leaves per plant

Figure 3 illustrates the effect of adding the amendments on the number of leaves per radish plant. The highest number was obtained for soils amended with either vegetable water substance or fertilizer. This is due to the high phosphorus and sodium content of this substance.

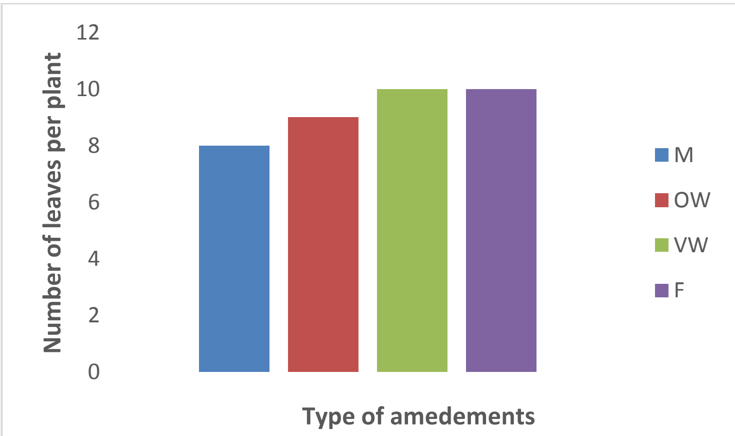

Figure 3. Number of leaves per radish as a function of the type of amendment

Indeed, the presence of phosphorus plays a physiological role at several levels and participates in the growth and color of plant leaves. It facilitates the synthesis of carbohydrates and their storage and participates in the transfer of energy in the plant. Although sodium is not an essential element for the plant, it helps in the metabolism and synthesis of chlorophyll. It also participates in the opening and closing of the stomata, which also contributes to the regulation of the intense hydric balance.

4.3.1.3. Leaf area

Figure 4 shows the monitoring of radish leaf area as a function of time. The highest leaf areas were obtained for radishes amended with the OW substance or fertilizer. The low areas correspond to the soil amended by manure due to the rapid dehydration of the plants.

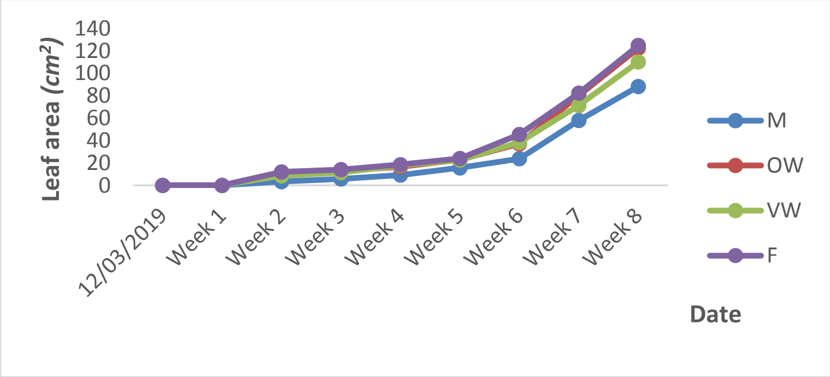

Figure 4. Radish leaf area as a function of time

The other amendments helped the leaf of the plant to store water. Indeed, the leaf area determines both the quantity of water used by the plant in the form of transpiration and the quantities of carbon fixed by the photosynthetic route. It also determines resistance to dryness.

4.3.2. Production parameters

At the end of the harvest, radish root length, caliber and yield were measured.

4.3.2.1.Root length

Figure 5 shows the effect of adding different types of amendments on the length of the radish root. The substances VW and OW acted on the underground growth of radish compared to manure, but to a lesser degree than fertilizer.

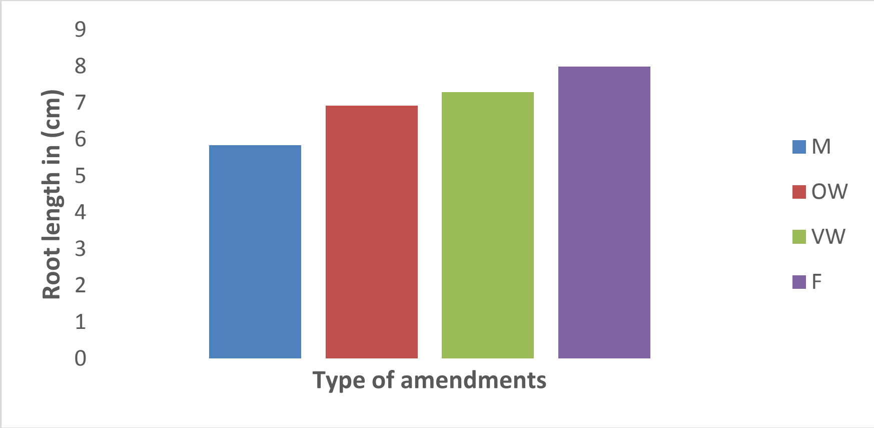

Figure 5. Radish root length as a function of amendment type

This can be attributed to the low level of phosphorus in VW and OW, a nutrient responsible for root stimulation, flowering and fruiting.

4.3.2.2.Caliber

Figure 6 shows the effect of the amendments on radish caliber in terms of length and diameter.

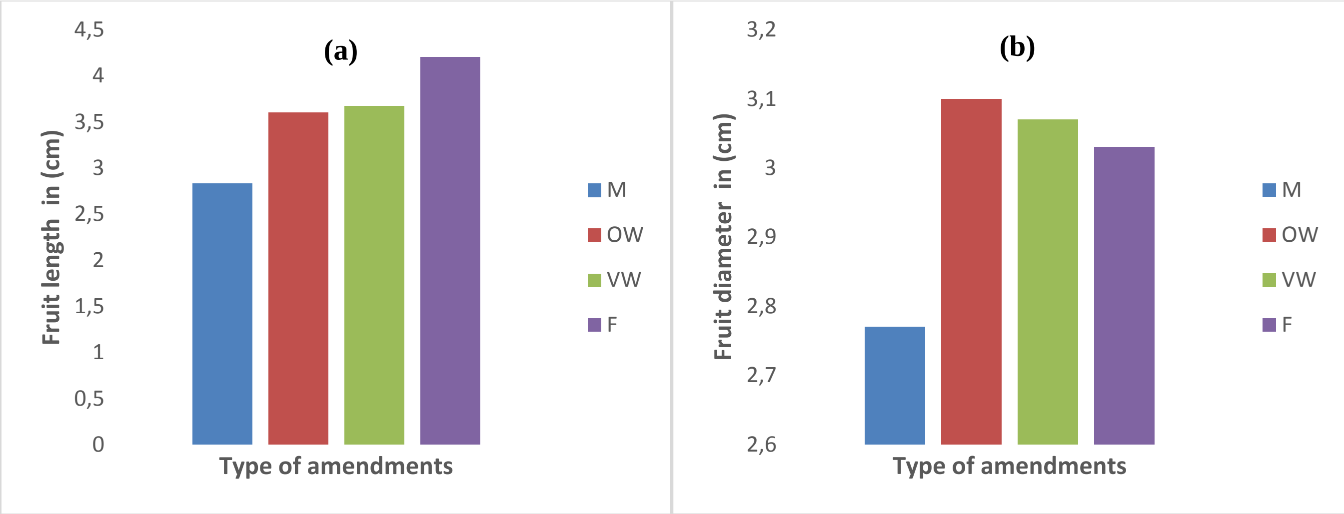

Figure 6. Comparative effect of length (a) and diameter as a function of the type of amendment (b)

The analysis of the results reflects that the OW substance improved the production parameters through its richness in elements essential for vegetative growth, calcium and potassium. For calcium, it participates in the constitution of plant cell walls by stiffening them and promotes the growth of young roots in synergy with the other elements. While potassium plays an important role in regulating, plant water and controls the concentration of ions within the cells, as well as the transport of sucrose to the roots. In terms of length, the highest value was noted for soil amended with fertilizer (F) and the lowest for soil enriched with manure (M). The substances OW and VW have effects on radish length comparable to fertilizer.

4.3.2.3. Total yield

Figure 7 illustrates the radish production yield as a function of amendment type. On plots amended with manure, the yield is 12.5 t/ha. While in plots amended with OW, VW or fertilizer the yield is 23.5 t/ha, 18.25 t/ha and 20.64 t/ha respectively.

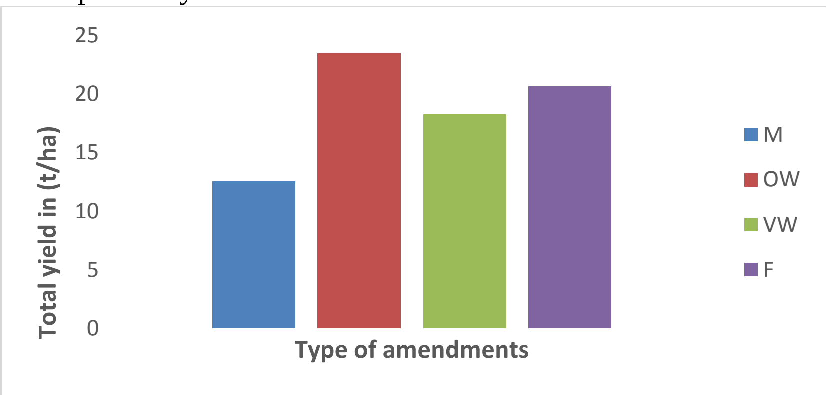

Figure 7. Total yield of radish as a function of amendment type

The positive effect of the OW substance on the radish yield is due to its richness in nutrients and fertilizing elements specifically N, P, K, Ca and Mg; elements that contributed to the growth of the plants and favored their vegetative activity, which translates into improved yield in production.

4.4. Culture of potato

Potato growth was monitored by measuring several morphological parameters; leaf area, stem height, leaf length, number of leaves per plant and number of stems per plant on soils amended with three organic amendments (OW, VW and M) and chemical fertilizer (F). As for the production parameters, they were

measured at the end of the harvest by total yield, weight per plant, number of tubers per plant and caliber.

4.4.1. Morphological parameters

4.4.1.1. Leaf area

Figure 8 shows the evolution of potato leaf area as a function of time. Analysis of the results shows that this parameter changed from the first week of potato growth regardless of the type of amendment used. Indeed, the addition of the OW substance considerably improved the leaf area compared to the other amendments with an optimum value of 21.3 cm^2. Furthermore, these results can be explained by the presence of several micronutrients that favored plant growth, such as phosphorus, a factor in the early flowering, fruiting and resistance to pests.

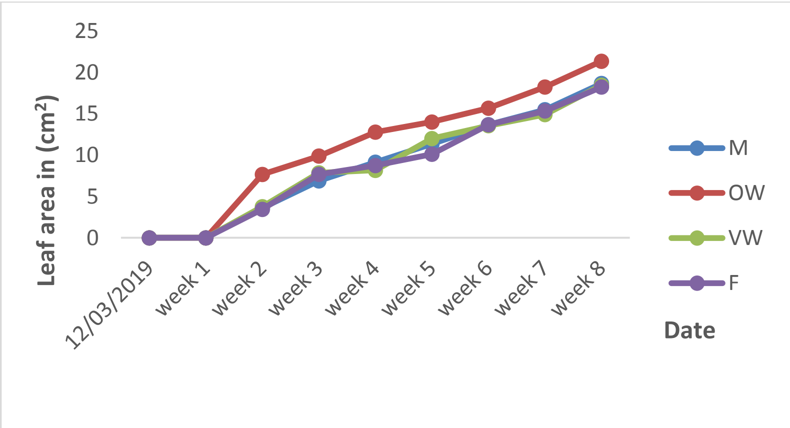

Figure 8. Evolution of potato leaf area as a function of time

Calcium richness also played a primordial role in this evolution because this element attributed to the activation of enzymes and the creation of bonds between cell walls, which ensured healthy plant growth. In addition, the coloring of the potato flowers was very intense thanks to the presence of potassium, which participated in the rigidity of the stems and gave them more resistance to diseases.

4.4.1.2. Stems Height

Figure 9 shows the height of the stems as a function of time of the potato cultivation regardless of the type of amendment.

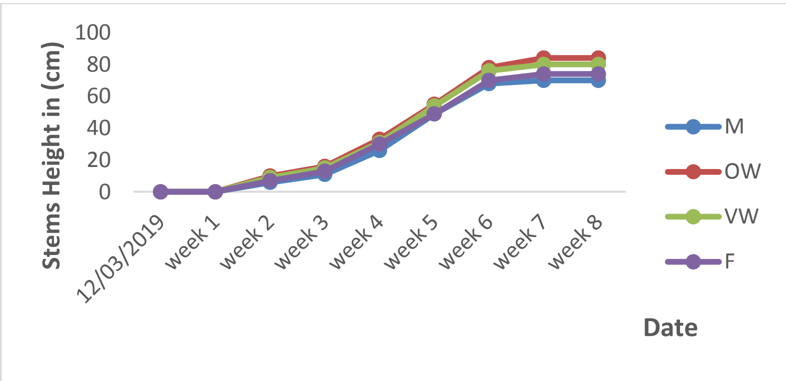

Figure 9. Height of potato stems as a function of time

The favorable effect of the addition of OW on stem height is explained by the fact that the latter contains polyphenols, which have been degraded by enzymes, which can in turn contribute to the mobilization of minerals for plant growth [24].

4.4.1.3.Sheets length

Figure 10 shows the response of each amendment to the length leaves of the potato. Analysis of the results shows that the highest value is that obtained by the soil amended by the OW substance (14.1 cm).

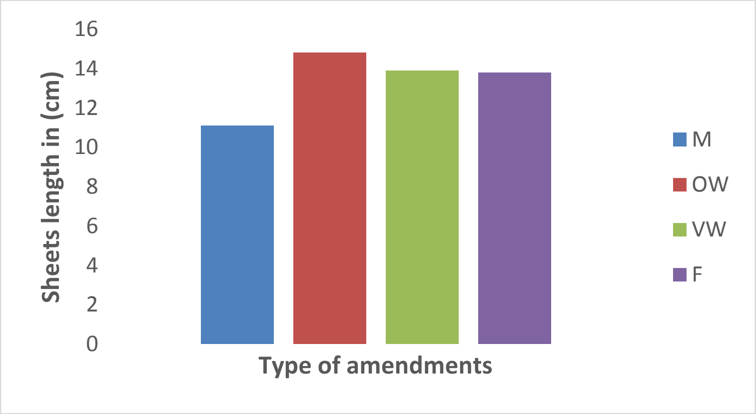

Figure 10. Potato sheets length as a function of amendment type

This significant result is most probably due to the composition of the nutrient OW substance, which enriched the soil with organic substances by promoting vegetative growth. These elements are principally potassium, which guarantees the presence of the enzymes entering into the catalysis of protein synthesis, adenosine 5' triphosphate (ATP), whose role is to ensure the transfer of energy into the cells and the maintenance of ionic equilibria on either side of the cell membranes by allowing the passage of sodium and potassium ions against their respective electrochemical gradients, as well as in photosynthesis. In addition, this parameter could also stimulate phosphorylation enzymes and inhibit respiration enzymes.

4.4.1.4.Number of leaves per plant

The results of counting the number of leaves per plant for the amendments used are shown in Figure 11. The best value was recorded for the plot amended with the OW substance (117 leaves/plant). On the other hand, plots amended by manure and chemical fertilizers recorded the same value (104 leaves/plant). However, the notable action of the OD substance can be determined by the possession of several nutrients that contributed to plant growth, such as magnesium and copper. Indeed, magnesium promotes the assimilation and migration of phosphorus in the plant and in the seeds to form phytine and lipids and stimulates the formation of fruits and seeds.

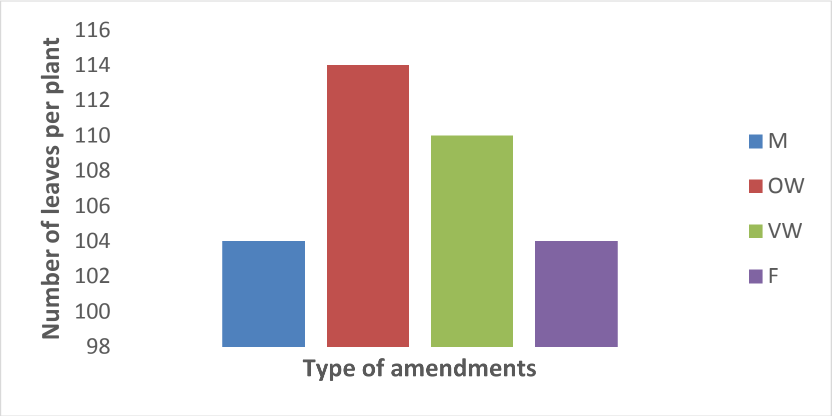

Figure 11. Number of potato sheets as a function of amendment type

Furthermore, copper played an undeniable role at the time of flowering, particularly during floral initiation, and participated in the synthesis of lignin, which in turn allow the cell wall to be connected to the cellulose network via hemicelluloses and contribute to the reinforcement of each cell wall [25]. Nitrogen also had an

important action on the abundant potato leaves, their development and photosynthesis.

4.4.1.5. Number of stems per plant

The potato has two types of stems: aerial stems of circular or angular section on which the leaves are placed, and underground stems or runners, on which the tubers appear. Figure 12 shows the number of stems obtained by the different types of amendments.

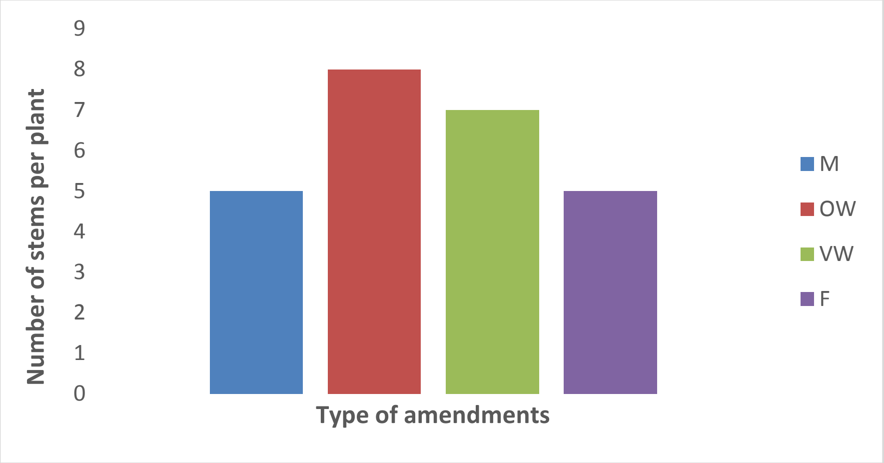

Figure 12. Number of potato stems as a function of amendment type

The highest was noted for the substance OW (8 stems) because of its richness in mineral elements, particularly calcium, which maintains the structure of the walls and stabilizes the cell membranes. This nutrient directly influenced the saline balance of plant cells and activated potassium to regulate the opening and closing of stomata that allow water circulation [26].

4.4.2. Production parameters

4.4.2.1. Weight per plant

Figure 13 shows the effect of soil conditioner application on weight per potato plant. A manifest result, 0.718 kg/plant, was recorded for soil amended with OW followed by VW, chemical fertilizer F and manure M with 0.632, 0.603 and 0.49 kg/plant respectively.

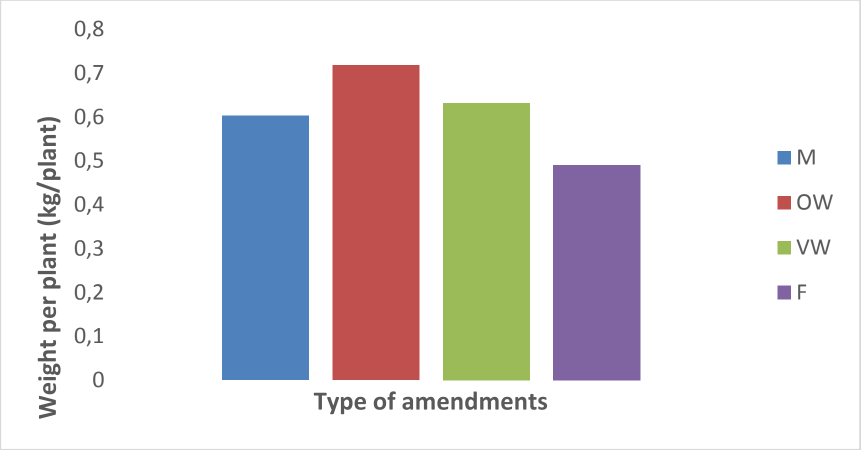

Figure 13. Weight per plant of the potato as a function of amendment type

The substance OW has, moreover, developed the quality of the yield due to its richness in fertilizers and micronutrients, especially copper, which has contributed to protein synthesis, notably chlorophyll, and in photosynthesis. This helped crop growth by increasing soil fertility.

4.4.2.2.Number of tubers per plant

The results of the number of tubers per potato plant are shown in Figure 14.

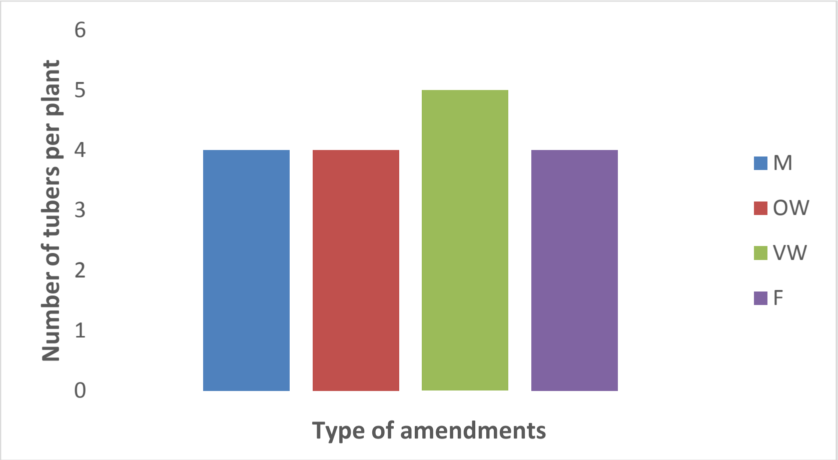

Figure 14. Number of tubers per plant as a function of type of amendment

Analysis of the results shows that the plots amended with substance M recorded the highest number of tubers (5 tubers/plant). The other plots recorded the same value (4 tubers/plant). This could be explained by its richness in organic matter, which has been mineralized to give the plant the nutrients responsible for its production, especially potassium, which has participated in the activation of several enzymes that control protein formation and manage the opening of stomata, thus having a direct impact on photosynthesis [30].

4.4.2.3. Tuber caliber

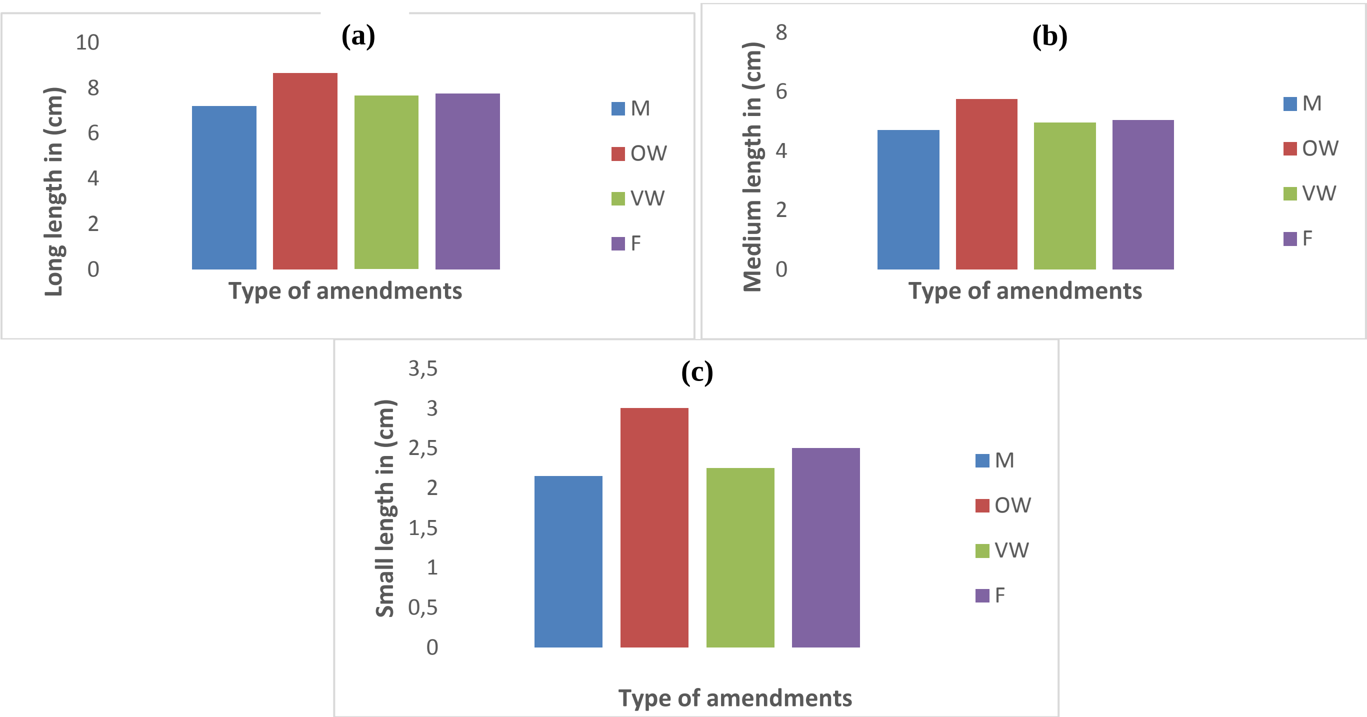

Figure 15. Caliber of potato tubers as a function of type of amendment long length (a), medium length (b), small length (c)

Figure 15 shows the potato caliber results as a function of the type of amendment. The values show that the soil amended with the OW substance stimulated well the development of potato caliber compared to the other amendments (VW, M and F). The production rates of the different lengths, large (7.1-8.9 cm), medium (4.8-5.9 cm) and small (2.1-3 cm), of the potato obtained by the OW substance are 28.36%, 28.11% and

30.30% respectively, compared to 22.95%, 24.69% and 25.25% obtained by chemical fertilizer F. This seems to be due to the composition of the OD substance in polyphenols which could accumulate and actively participate in plant defense [30]. Their mode of action is related to their antibacterial power, their involvement in strengthening plant cell walls and their ability to modulate and induce host defense reactions [27]. In addition, DO is richer in potassium, calcium and aluminum. The latter element is, in fact, directly related to plant roots as it is usually found in the most mobile known chelated form $Al(OH)_2^+$ or incorporated in the organic matter of the OW substance. In the presence of calcium, it improves phosphorus assimilation by the plant [30].

4.4.2.4.Total yield

After harvest, total crop yield (Figure 16) was remarkably influenced by the type of amendment applied to the soil.

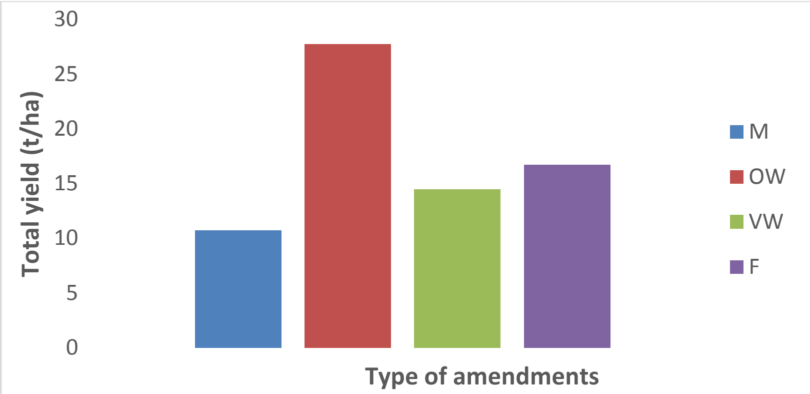

Figure 16. Total potato yield as a function of amendment type

The soil amended with the substance OW had the highest yield (27.71 t/ha); a higher value than that enriched with chemical fertilizer (F), with substance (VW) and manure (M) having productions of 16.71 t/ha, 14.5 t/ha and 10.72 t/ha respectively. These results are consistent with the good quality of the OW substance and its high organic and mineral matter content and are comparable to those found by Hachicha S and al, 2006 [28]; indicating that the application of a compost based on olive waste could increase the yield of potato production from 31.5 t/ha to 35.4 t/ha compared to 30.5 t/ha using bovine manure. In addition, they corroborate those of Aftiss F, 2017 [29, 31, 32]; who proved in 2017 that organic compost with vegetable water improves the production of the same crops.

4.5. Statistical analysis

The results of the statistical analyses show two types of correlation for the OW amendment; one between the morphological parameters of growth; precisely the number of leaves per plant, plant height, root and leaf length, number of stems per plant with pH, organic matter, dry matter and soil moisture. And the other, exists between the production parameters such as total agricultural yield, calibers and weight per plant with the same soil characterization parameters. This is due to the richness of the substance added by potassium, phosphorus and calcium, which have improved the composition of the soil in terms of organic matter, ensuring an increase in the content of fundamental fertilizing elements that promote vegetative growth and crop yield.

5. Conclusion

The study carried out on testing the efficacy of two substances produced from olive waste on the radish and

potato crops, showed appreciable improvements in the morphological parameters of plant growth and production of the two crops. The best results were recorded for the OW substance and the chemical fertilizer. These substances provided the crops with an additional dose of the organic matter necessary to increase carbon and nitrogen, which favored the foliage and subsequent growth and root formation of radish and potato tubers. This confirmed the important role of this substance in soil fertilization for both crops and for all parameters studied. In conclusion, VW and OW substances have a very beneficial effect on the crop in terms of growth, caliber and yield. These results were proved statistically by noting the possible correlations between the main physicochemical parameters of an organic amendment and, on the one hand, the morphological parameters of radish and potato cultivation and, on the other hand, their growth parameters. The composting of olive-growing waste has therefore led to an organic fertilizer, which can promote the presence of the necessary nutrients in the soil and thus could replace chemical fertilizers and phytotoxic products phytotoxics which degrade soil quality and reduce crop yields. This is a real opportunity for those involved in the production of vegetable oil or its equivalent to develop this recovery process for their waste. This will be an economic, profitable and sustainable solution in agriculture:

- Economic and financial by creating jobs and resources, the production of raw or secondary materials for agriculture and the olive industry, and the impact on the cost of waste management ;
- Technical and organizational by researching and innovating processes that speed up the production of composts and by defining a legal and regulatory framework for waste to be recycled and compost quality standards ;
- Social by training the farmers and producers of recoverable waste, which will contribute to the fight against social marginalization and poverty.

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