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Effect of Water Regime and Organic Amendment on Agromorphological Parameters of Tomato (*Solanum lycopersicum* L.) Grown in the Open Field on Gleysol in Diabo Department, Central Côte d'Ivoire

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Authors' contributions

This work was carried out in collaboration among all authors. Authors NKR, KNJ and YJ-J designed the study, wrote original draft of the manuscript. Authors AKC and ZBGF contributed to the selection of PADMA tomato seeds and watering equipment. Author BS performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

The aim of the study was to improve the productivity of the PADMA 108 F1 tomato grown in the field on gleysol in the off-season by the combined application of a water regime and an organic amendment. The study took place in the off-season (July-August) in 2022 at Yomian-Kouadiokro (7°49N, 5°9W) in the Gbêkê region and Diabo department of central Côte d'Ivoire. The methodology consisted in clearing a hydromorphic fallow (a gleysol) of about 10 years and delimiting microplots in randomized Fisher blocks of 3 replicates. In each replication, 12 microplots of 5m2 were distributed in 3 blocks, each comprising 4 treatments (poultry manure and sawdust composts, NPK12-22-22 fertilizer and the no-fertilizer control). In each microplot, tomato seedlings were transplanted into 10 pots. At transplanting, fertilizers were applied as a basal fertilizer at a rate of 0.5Kg/pack (poultry droppings and sawdust) and 85g/pack of NPK at the foot of the tomato compared with the control. After planting, a regular watering of 60 liters of water was applied to each block using a watering can (10L), subjecting the seedlings to a specific watering regime of 7 waterings/week, 4 waterings/week and 2 waterings/week. The results showed a highly significant specific effect of watering 7 times/week and of the organic amendment (poultry droppings) on the agromorphological parameters with the highest values compared with the other treatments. On the other hand, the best values for tomato agromorphological parameters were obtained with the combined effect of watering 2 times/week with organic amendments (poultry manure compost), NPK 12-22-22 mineral fertilizer and sawdust compost to some extent. In conclusion, this study shows that to improve the productivity of the PADMA 108 F1 tomato in the ecosystem studied in the off-season, a watering regime of 2 waterings per week is appropriate, regardless of the type of treatment applied (organic or mineral fertilizers).

Keywords: Water regime; organic amendment; tomato; agromorphological parameters; Diabo-Côte d'Ivoire.

1. INTRODUCTION

Agriculture represents the key sector of the Ivorian economy, occupying more than 60% of the working population and providing on average 30-35% of the gross domestic product, (MINAGRI 2015). Although the success of this agriculture is, primarily, based on cash crops, the country has nowadays, opted for a more diversified agriculture. This diversification has resulted in the development of annual crops, including vegetable crops (PNIA 2017). Among these crops, the tomato (*Solanum lycopercicum* L.) has gained a place of choice with producers and consumers due to its biochemical properties, its nutritional contribution and perfect for a variety of dishes, salads and homemade sauces (Rao 2000). As a result, market gardening, in particular, tomato production has seen rapid development in recent years, rising from 31,241 tonnes in 2010 to 47,283 tonnes in 2020, with an average yield of 10,392 t/ha (MINADER 2022, FAO 2019). However, the development of tomato cultivation, like that of other vegetable crops in our tropical regions, is not without its constraints. Production is limited by insufficient arable land, natural soil infertility, low soil water retention capacity, high pest pressure, irregular rainfall due to climate change, and the low agronomic potential of local varieties. These constraints are a major concern for farmers when it comes to improving tomato yields. The use of chemical fertilizers, because of their immediate beneficial effect on the productivity of vegetable and vital crops, has been considered as one of the solutions for meeting the nutrient requirements of cultivated plants and increasing yields (Gala 2011). However, their abusive use in cultivation practices is not without consequences for the environment and people's health (Mulaji 2011). In contrast, organic soil improvers could be an appropriate solution for restoring soil fertility and improving market gardeners' productivity (Mukalay 2018). In addition, irregular rainfall manifested by water stress affects the physiological functioning of the plant, resulting in reduced growth and development of the crop (Nuhu 2013, Koffi 2009) and its productivity (N'Kouannesi 2005). Faced with these threats of continual soil impoverishment and rainfall variability, it seems more than necessary to find solutions aimed at preserving soil fertility and moisture to improve market garden yields. It is therefore opportune to set up cultivation techniques that would reduce the use of chemical products in favor of organic amendment and a program for adapting tomato cultivation to drought conditions. The aim of this study is to

determine the combined effect of the water regime and the use of organic fertilizers in improving tomato productivity in central Côte d'Ivoire.

2. METHODOLOGY

2.1 Presentation of the Study Site

The work was carried out in Yomian-Kouadiokro (7°49'58.9'' N, 5°9'54'' W), a village located in the commune and sub-prefecture of Diabo, in central Côte d'Ivoire (Fig. 1). The Diabo sub-prefecture area was chosen because it is rich in agricultural activities, notably market gardening. It is an equatorial climate zone, in transition between sub-equatorial and sub-tropical climates, known locally as the Baouléen climate. There are four seasons, including two dry seasons (the long season from November to February and the short season from July to August) and two rainy seasons (the long season from March to June and the short season from September to October). The rainfall regime is therefore bimodal, with annual precipitation reaching 1.200 mm for an average temperature of around 27°C and relative air humidity of 70% (Amani 2010). Vegetation is essentially herbaceous, colonized by Imperata cylindrica (Kouakou 2016) and the soil cover that formed our substratum in this study is the hydromorphic soil cover (Gleysols) due to the heavy exploitation of this area for market garden crops.

2.2 Plant Material

Seeds of the improved tomato PADMA 108 F1 were used as plant material in this study (Fig. 2). The choice of this variety was guided by the local availability of seeds, its tolerance and resistance to disease, its good early production and its uniform, rounded fruits with a red color at maturity. The PADMA 108 F1 tomato is a short-cycle variety (75-80 days). It is known for its excellent adaptation to hot, humid climates, its high-yielding quality and for its firmness, ensuring excellent post-harvest firmness. It is also highly appreciated for its flavorful, versatile taste, perfect for a variety of dishes, salads and homemade sauces.

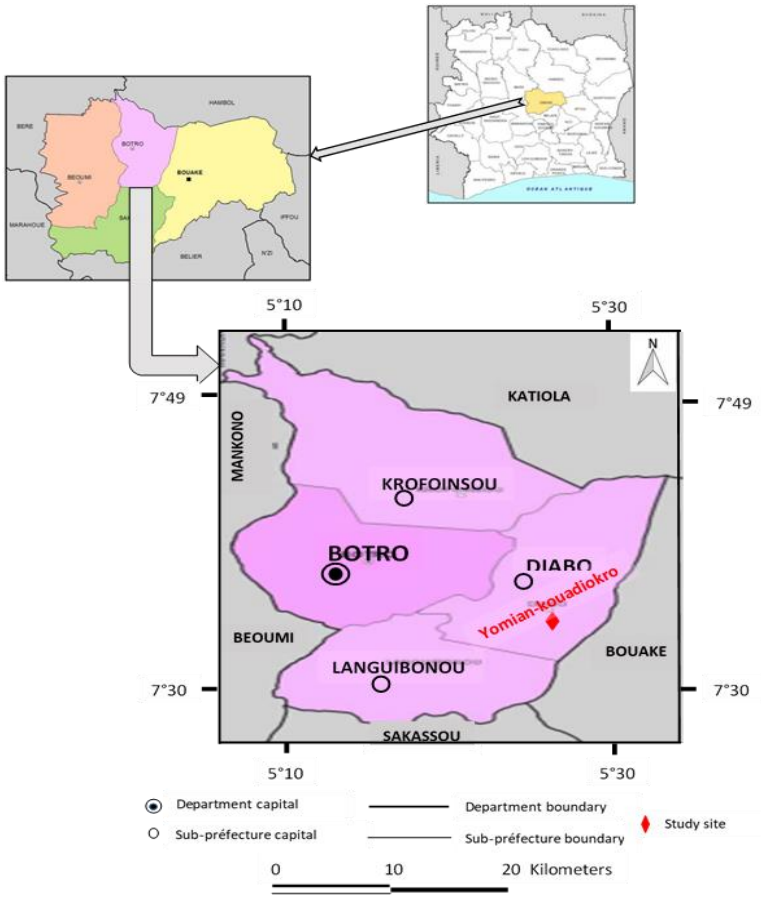

Fig. 1. Administrative map of the Diabo sub-prefecture, showing the study site

Fig. 2. PADMA 108 F1 tomato (A = fruit and B = seed)

2.3 Fertilizing Materials

This consisted of organic fertilizers (poultry droppings and sawdust) and NPK 12-22-22 mineral fertilizers (Fig. 3):

The poultry droppings used came from a poultry farm close to the study site at yomian-kouadiokro. Sawdust was collected from a sawmill in the Diabo sub-prefecture. These organic fertilizers were used because of the interest most market-garden farmers in the Diabo sub-prefecture place in them as organic soil fertilizers. Poultry droppings, like the sawdust sampled, were piled and composted for eight months, with a view to reducing the volume of waste through decomposition and accelerating mineralization to make nutrients available to the plant. At the end of the composting process, the resulting composts (poultry droppings and sawdust) were dried and sieved to remove impurities, then packaged before use.

The mineral fertilizer used was NPK 12-22-22. It is often used for its immediate beneficial effect on vegetable crop productivity.

2.4 Nursery Set-Up and Maintenance

The nursery was set up in trays previously filled with potting soil and consisted in burying the seed grains one by one in each tray containing the potting soil. After sowing, the nursery was lightly moistened and placed under a shade to protect it from the sun's rays and accelerate seed dormancy and germination. The nursery was watered daily to prevent the seedlings from wilting, and lasted approximately 3 to 4 weeks before transplanting.

2.5 Experimental Set-Up, Crop Establishment and Maintenance

In order to facilitate rooting and promote the growth and development of the cultivated plant, a hydromorphic fallow plot measuring 405 m^2 (27 m x 15 m) and over 10 years old was cleaned with a machete and cleared of plant debris, ploughed and weeded with a daba, before staking out the boundaries of the microplots, which were laid out in completely randomized Fisher blocks of 3 replicates separated by a 1.5 m row, each with 4 treatments (poultry manure-

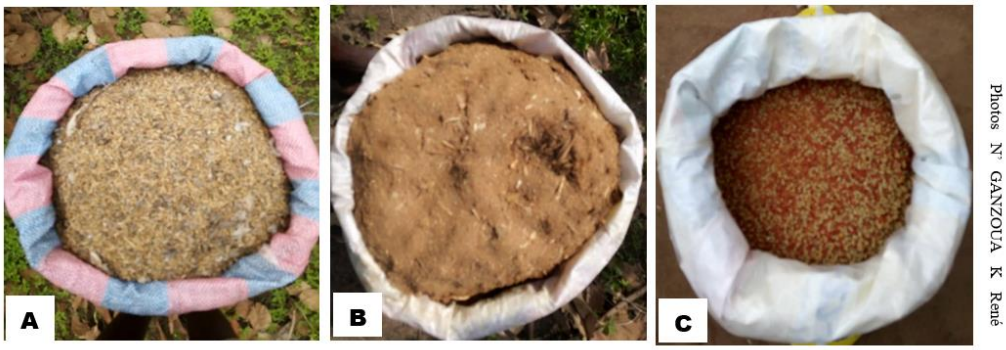

Fig. 3. Fertilizers used (A : Compost from poultry droppings ; B : Compost from sawdust : C : NPK 12-22-22 fertilizer

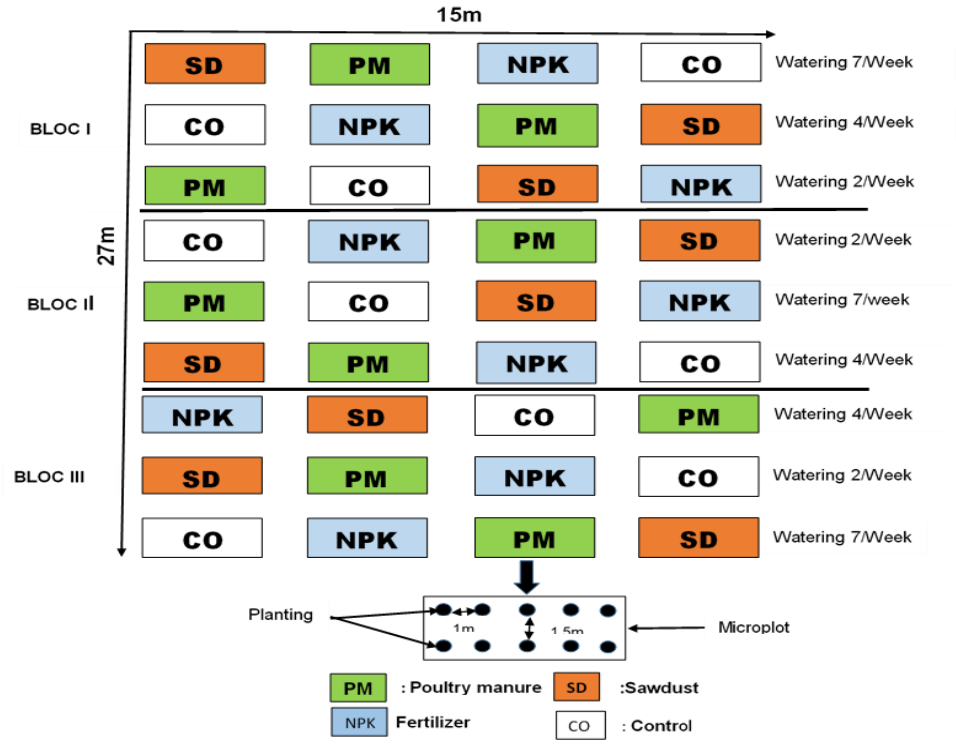

Fig. 4. Schematic diagram of the experimental set-up

PM, sawdust-SD, mineral fertilizer-NPK12-22-22 and fertilizer-free control-CO). In each replication, twelve (12) microplots of 5 m^2 (5 m x 1 m) corresponding to the treatments and spaced 1 m apart were distributed. In each microplot, tomato seedlings (PADMA 108 F1) were pricked out in 10 pots spaced 1 m apart. At transplanting, fertilizers were applied as basal fertilizer at a rate of 0.5 kg poultry droppings compost per stake, 0.5 kg sawdust compost per stake and 85 g NPK within a 0.5 cm radius of the tomato plant. All these applications were compared with a control without fertilizer, according to the experimental set-up below (Fig. 4). After planting and fertilizer application, a water regime was also applied to the different microplots of each replication. Each microplot was regularly watered with 60 liters of water using a watering can. The frequency of watering was 7 times a week, i.e. 1 watering every day of the week; 4 times a week, i.e. 1 watering every other day; and 2 times a week, i.e. 1 watering every third day. Weeding and hand weeding were carried out as needed to eliminate weeds and prevent their proliferation. Phytosanitary treatment was carried out with maneb (75 g in 16 L of water) as a preventive measure, and as a curative measure, the field was treated with Lambda-cyhalotrin 25g/L (40 ml in 16 L of water) and mancozan 80 WP (mancozeb) to prevent and control the presence of pests from the 20th day after transplanting the plants until the end of the experiment. A fence was built around the field to protect the tomato plants from animals.

2.6 Data Collection and Analysis

During the development cycle of the tomato, growth and development parameters were determined only at the maturity stage and concerned:

- span, measuring the distance between the outermost lateral leaves
- Plant height, measured with a tape measure on the stem from the soil surface to the plant apex,
- the number of branches and fruits on the plant by simple counting.
- Fruit weight by simple weighing.

The data collected for each crop were entered and sorted using Excel office 2019 spreadsheet and subjected to analysis of variance using STATISTICA 7.1 software. For each variable studied, means were compared taking into account water regimes, fertilizers (organic and mineral) and varieties through a 3-factor analysis of variance (ANOVA 3). The significance of the test was determined by

comparing the probability (P) associated with the statistic at the threshold α = 0.05. When a significant difference was observed between traits, the ANOVA was completed by the Smallest Significant Difference (SSD) test, which allows us to identify homogeneous groups.

3. RESULTS

3.1 Effect of Water Regime on Variation in Agro-morphological Parameters

The different types of watering applied to tomato plants during growth and development significantly affected growth and yield parameters (Table 1). With regard to growth parameters, watering significantly (P<0.05) affected the height and spread of tomato plants, except for branching, which had non-significant values (P>0.05). Explicitly, there was a significant difference (p < 0.010) in height and span with an overall mean of 31, 36 cm for height and 12.47 cm for span. The greatest height (36.17 cm) and span (13.58 cm) of the tomato plant were noted with watering 7 times a week, while watering 4 times a week and 2 times a week had heights (29.50 cm) and (28.42 cm) respectively, which are also statistically identical heights. Similarly, the spread was smaller (11.58 cm) with twice-weekly watering and intermediate (12.25 cm) with 4-times-weekly watering. Yield parameters (fruit number and weight) were also affected by the watering regime, with statistically significant values (P<0.05) and an overall average of around 13 fruits per tomato plant for an average fruit weight of 3.33 grams. Fruit number and weight were highest with 7-times-weekly watering, with an average number of 17.50 fruits per tomato plant and an average fruit weight of 4.92 grams. The 4-times-a-week and 2-times-a-week watering treatments had statistically identical values, with 11.08 fruits per plant for 2.58 g fruit weight under 4-times-a-week watering and 10.33 fruits per plant for 2.50 g fruit weight under 2-times-a-week watering.

3.2 Effect of Fertilizers on Variation in Agro-morphological Parameters

Table 2 shows the variation in tomato agro-morphological parameters under the influence of the various fertilizers applied. It can be seen that all the organic and mineral fertilizers applied significantly (p < 0.05) affected the tomato's agro-morphological parameters, except for the value of span, which was non-significant (p > 0.05). Explicitly, an overall average height of 31.36 cm with a branching of 13.55 branches of tomato plants were noted with the application of the different fertilizers. However, the highest heights, although statistically identical, were observed with poultry manure-PM (35.22 cm) and NPK (33.55 cm). Sawdust-SD had the lowest height (25.89 cm) compared with an intermediate height (30.78cm) for the blank-CO control. A similar variation in branching was noted with the greatest number of branches (15.55) for poultry manure-PM versus an intermediate number with NPK (13.78). Sawdust-SD (12.11) and blank-CO (18.78) were the lowest and statistically identical.Regarding yield parameters (number of fruits and fruit weight), fertilizers affected them significantly (p < 0.05) with an overall average of around 13 fruits per plant for a weight of 3.33 grams. Treatments with poultry manure-PM and NPK had a statistically identical number of fruits, with 15.78 fruits (poultry manure-PM) and 16.67 fruits (NPK) per tomato plant, for an overall average of around 13 fruits per tomato plant. Sawdust-SD had the lowest fruit count (8.44), while the blank-CO control showed an intermediate fruit count (11.00) per tomato plant. Similar fruit weight results were obtained with the highest NPK weight (5.11g) and the lowest sawdust-SD (1.78g) and blank control (2.44g), which were statistically identical. Fruit weight affected by poultry droppings was intermediate (4.00g).

Table 1. Effect of water regime on tomato growth parameters

	Water regimes applied				
Paramters	**Watering 7/Week**	**Watering 4/Week**	**Watering 2/week**	***Mean***	***P value***
Height (cm)	36.17^{a}	29.50^{b}	28.42^{b}	31.36	0.010
Branching	13.67^{a}	14.17^{a}	12.83^{a}	13.55	0.457
Span (cm)	13.58^{a}	12.25^{ab}	11.58^{b}	12.47	0.051
Nomber of fruits	17.50^{a}	11.08^{b}	10.33^{b}	12.97	0.013
Fruits weight (g)	4.92^{a}	2.58^{b}	2.50^{b}	3.33	0.009

Values followed by the same letter in line are not significantly different at the 5% threshold

Table 2. Effect of fertilizers on tomato growth parameters

	Fertilizers applied					
Parameters	**PM**	**SD**	**NPK**	**CO**	***Mean***	***P value***
Height (cm)	35.22^{a}	25.89^{b}	33.55^{a}	30.78^{ab}	31.36	0.022
Branching	15.55^{a}	12.11^{b}	13.78^{ab}	12.78^{b}	13.55	0.021
Span (cm)	13.67^{a}	11.44^{a}	13.00^{a}	11.78^{a}	12.47	0.072
Nomber of fruits	15.78^{a}	8.44^{b}	16.67^{a}	11.00^{ab}	12.97	0.022
Fruits weight (g)	4.00^{ab}	1.78^{b}	5.11^{a}	2.44^{b}	3.33	0.004

Values followed by the same letter in line are not significantly different at the 5% threshold
Key : PM = poultry manure ; SD = sawdust ; NPK12-22-22 = mineral fertilizer and CO = fertilizer-free control

3.3 Simultaneous Effect of Water Regime and Fertilisers on Variation in Agro-morphological Parameters

Table 3 shows the simultaneous effect of the water regime and the fertilisers applied on the variation in the agro-morphological parameters of the tomato plant. It can be seen that tomato agro-morphological parameters were affected differently by the combined effect of the water regime and fertilisers. More explicitly, no significant difference ($p > 0.05$) was observed between the growth parameters (height, branching and span) of tomato plants with fertilisers (organic and mineral) under watering applied 7 times a week. On the other hand, the yield parameters (number of fruits and fruit weight) showed statistically significant values under the hydric regime of watering 7 times a week with the different fertilisers applied. With an overall average of 17.50 fruits per tomato plant, the NPK treatment stimulated the highest number of fruits (28.33 fruits per plant) compared with the organic fertilisers, poultry droppings-PM (19.00 fruits), sawdust-SD (10.00 fruits) and the white control-CO (12.67 fruits), which were statistically identical under this watering regime (watering 7 times a week). For fruit weight, the water regime associated with the different treatments was also significant ($p < 0.05$) with an overall average fruit weight of 4.92 grams. The highest fruit weight was noted with NPK (8.67 g) and the lowest weights were observed with sawdust-SD (2g) and the blank control-CO (3.33g), while poultry droppings gave an intermediate fruit weight value (5.67g) under water sprinkling 7 times a week. With watering 4 times a week, fertilisers had no statistical impact ($p > 0.05$) on the agro-morphological parameters of the tomato plant, except for plant height, which showed significant values ($p < 0.05$) with an overall average of 29.50 cm. However, it should be noted that the greatest heights were observed with poultry droppings-PM (34.33cm) and the blank control-Te (34.00cm). Sawdust-SD (23.33 cm) and NPK (26.33 cm) gave statistically identical and the lowest heights. As for the watering regime of 2 water sprinklings per week, all the fertilising treatments significantly ($p < 0.05$) affected all the agro-morphological parameters of the tomato plant. It can be seen that poultry droppings-PM had a much more expressive effect with the highest values whatever the tomato parameter assessed. This treatment was followed by NPK, sawdust-SD and the blank control-CO in descending order.

4. DISCUSSION

4.1 Water Regime and Variation in Tomato Agro-morphological Parameters

The results of watering regimes applied to tomatoes showed that regular daily watering (7 times/week) had a highly significant effect on growth and yield parameters, compared with watering 4 times/week and 2 times/week in descending order. In other words, watering frequency had a significant impact on tomato growth and yield parameters. This could be explained by the fact that daily watering increased the soil's water potential and resulted in a good useful soil reserve for the roots (Rasmata 2009), leading to harmonious growth and development of plant parameters. This result corroborates the work of Hireche (Hireche 2006) on grapevines, who showed that plant height increased steadily with water regimes. Similarly, the work of Guinambaye 2010 and Falalou 2000 showed that regular watering of plants increased growth parameters in lentil and cowpea.

In contrast, the low values of growth and yield parameters obtained with irregular watering (watering 2 times/week and 4 times/week) would be due to water stress. In fact, irregular watering induced reductions in water potential and stomatal conductance, causing disturbances in photosynthetic metabolism or water stress, which creates physiological disorders in tomato plants.

This would explain the reduction in normal plant growth and even flower drop (Passioura 2004, Dam et al. 2020). NRA 2006 has shown that a water deficit reduces organ size, fruiting and the number of kernels, resulting in lower yields. Similar results were obtained by Chebouti and Abdelguerfi 2000, Chebouti et al, 2001 and Libbey 2003 in plants subjected to water deficit during the vegetative and flowering phases.

4.2 Fertilizers and Variation in Tomato Agro-Morphological Parameters

The results obtained showed that, although the application of both organic and mineral fertilizers significantly affected tomato agro-morphological parameters, the highest parameter values were obtained with poultry manure (PM), NPK and sawdust (SD) in ascending order. This is because the mineralization of organic matter in poultry manure (PM) by microorganisms provided the tomato plant with nutrients required for growth, compared with other fertilizers. Indeed, Mulaji 2011 and Ojetayo et al. 2011 showed that the rate of organic matter decomposition and crop growth was closely linked to the synchronization between nutrient release and plant uptake. The higher values of growth and yield parameters obtained with poultry manure (PM) would be due to the continuous mineralization and release of nutrients and their availability to the plant during its life cycle. Poultry droppings are easily decomposed (Enujeke 2013) enabling the absorbent complex to easily fix and release nutrients. In addition, Dean et al. 2000 showed that short- and medium-term application of poultry droppings increased total nitrogen and available phosphorus levels in the soil, thereby stimulating tomato growth and development. Alongside poultry droppings, NPK mineral fertilizers induced high values for tomato agro-morphological parameters. This result can be explained by the fact that mineral fertilizers are synthetic substances produced by the chemical industry that are directly made available to the plant for nutrition until they are broken down (ANPEA 2012). They have a direct effect on plant growth and development. Numerous studies, including those by Bhardwaj et al. 2000 on tomato, Olaniyi et al. 2010 on okra, Ojetayo et al. 2011 on cabbage and Musas 2010 on onion and spinach, have shown good recovery and growth of plants on soil fertilized with NPK 15-15-15. Agro-morphological parameter values recorded for sawdust were lower or intermediate than for poultry dung-based organic fertilizer. These relatively low parameter values could be explained by the slow decomposition and mineralization of organic matter from sawdust. In fact, sawdust is very difficult for micro-organisms to digest, which, according to Cobo et al. 2001, delays root access to soil nutrients. The sawdust could not decompose normally to release the mineral elements required for plant growth.

4.3 Water-Fertilizer Regimes and Variation in Tomato Agro-Morphological Parameters

The combined effect of water and fertilizer regimes showed that all agro-morphological parameters were significantly affected by the irregular watering condition, more specifically, watering twice a week. In addition, poultry manure (PM) recorded the highest values for all parameters, compared with NPK fertilizer, sawdust and the control, in descending order, under the irregular watering condition of 2 times/week. This result could be explained by the fact that watering 2 times a week created normal and optimal conditions for the decomposition of organic matter into nutrients by decomposers to improve soil structure (Beauchamp 2003, Daujat et al. 2015) and ensure plant nutrition (CIRAD 2002). Indeed, the living beings or microorganisms (fungi, bacteria and insects) present in the soil need moisture to live and decompose organic matter efficiently. However, the optimum humidity for decomposition and mineralization of organic matter must be suitable for good microbial activity. Filemon 2008 and Charnay 2005 have written that the water content of organic waste to be decomposed and mineralized, which conditions the activity of microorganisms, is generally 50-60%. According to these authors, if the water content falls below 30%, decomposition of the material is inhibited, and if it exceeds 70%, water begins to fill the gaps in the organic waste, preventing oxygen exchange and creating anaerobic conditions unfavorable to decomposition. This anaerobic and asphyxiated condition due to excess water and soil saturation inhibits or halts the activity of decomposers, and mineral compound are immobilized and incorporated into microbial cells. Indeed, in anoxic conditions, microorganisms use the organic matter transformed into nutrients in their biomass for their survival (Bodoharisoa 2007). This immobilization of nutrients temporarily depletes the soil solution of nutrients, limiting the plant's mineral nutrition (Comifer 2012). This variably translates into insignificant organic fertilizer values with daily watering (7times/week and 4times/week).

Table 3. Simultaneous effect of water regime and fertilizers on the variation of agro morphological parameters

	Watering 7/Week						Watering 4/Week						Watering 2/Week					
Parameter	**PM**	**SD**	**NPK**	**CO**	***Mean***	***P value***	**PM**	**SD**	**NPK**	**CO**	***Mean***	***P value***	**PM**	**SD**	**NPK**	**CO**	**Mean**	***P value***
Height (cm)	37.33^{a}	28.67^{a}	42.67^{a}	36.00^{a}	36.17	0.087	34.33^{a}	23.33^{b}	26.33^{b}	34.00^{a}	29.50	0.031	34.00^{a}	25.67^{bc}	31.67^{ab}	22.33^{c}	28.42	0.010
Branching	15.67^{a}	11.00^{a}	14.67^{a}	13.33^{a}	13.67	0.150	16.00^{a}	13.67^{a}	11.67^{a}	15.33^{a}	14.17	0.147	15.00^{a}	11.67^{b}	15.00^{a}	$9,67^{b}$	12.83	0.001
Span (cm)	13.00^{a}	12.67^{a}	13.67^{a}	15.00^{a}	13.58	0.333	14.33^{a}	11.00^{a}	12.33^{a}	11.33^{a}	12.25	0.095	13.67^{a}	10.67^{ab}	13.00^{a}	9.00^{b}	11.58	0.016
Nomber of fruits	19.00^{b}	10.00^{b}	28.33^{a}	12.67^{b}	17.50	0.004	13.00^{a}	10.67^{a}	8.00^{a}	12.67^{a}	11.08	0.323	15.33^{a}	4.67^{b}	13.67^{ab}	7.67^{ab}	10.33	0.031
Fruits weight (g)	5.67^{ab}	2.00^{b}	8.67^{a}	3.33^{b}	4.92	0.007	2.67^{a}	2.33^{a}	3.00^{a}	2.33^{a}	2.58	0.891	3.67^{a}	1.00^{b}	3.67^{a}	1.67^{ab}	2.50	0.010

Values followed by the same letter in line are not significantly different at the 5% threshold
Key : PM = poultry manure ; SD = sawdust ; NPK12-22-22 = mineral fertilizer and CO = fertilizer-free contro

5. CONCLUSION

The aim of the study carried out at Yomian-Kouadiokro in the Diabo sub-prefecture of central Côte d'Ivoire was to determine the combined effect of the water regime and the use of organic fertilizers in improving tomato productivity in central Côte d'Ivoire. At the end of the study, it was found that the agromorphological parameters of the improved PADMA tomato were much better under watered conditions (2 times/week) than under watered conditions (7 times/week and 4 times/week), irrespective of the treatments applied (organic amendments or fertilizers). However, it should be pointed out that the work showed that poultry droppings proved to be the best organic fertilizer compared with sawdust and NPK fertilizer in the ecosystem studied.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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