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ORGANIC WATERMELON PRODUCTION BY SMART AGRITECHNIQUE USING ORGANIC FERTILIZERS, VERMITEA LEVELS AND AMF IN POOR NUTRIENTS SOIL

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Abstarct

Two field experiments were conducted at 5th March, 2019 of El-Amryia-Egypt to study positive effect of MOF "the mixture of 25% compost + 25% vermicompost +25% chicken + 25% cow manures" at 4 and 8 t/fed, vermitea (VTL) at 3 and 4 times as foliar spraying and AMF on yield and quality. Field experiments were arranged statistically in RCBD with three replicates. Results showed that, T13=MOF (8T/fed.) + VTL4 + AMF lead to significant increases in plant height 491.0 cm, total sugar% 10.6, reading sugar% 6.8, non- reducing sugar% 3.8, T.S.S.% 14.4, P% 0.36, K% 2.6, fruit weight 1.887 kg, total fruit weight 19.814 kg/plant and total yield 146.767 kg/fed as an average for both sites more than (T1) controlled. The lowest values were 134.9 cm, 3.2%, 2.0%, 1.2%, 3.8%, 0.12%, 0.42%, 0.529 kg, 1.324 kg/plant and 9.808 kg/fed, respectively at T1. No significant differences between VTL3 and VTL4 in No. of branches 10.1, flowers 10.2, fruits 6.6/plant, total chlorophyll 56.8 SPAD and N% 4.1 in fruit compared to T1 (2.9, 2.5, 1.3, 17.1 SPAD and 1.5%, respectively). Organic treatments lead to significant increases in N, P and K %, T.S.S. %, total sugar% in fruits and total fruit yield more than T1 and the best results were cleared at T13. Aim of this study, positive effect of MOF with AMF as "bio-organic fertilizers" and VTL4 as "biopesticides" compared to control in poor nutrients soil for successful Smart Agritechnique, safety production, cost lowest, eco-friendly and recycling organic wastes.

Key words: MOF, AMF, Vermitea, Watermelon

Introduction

Watermelon from family (*cucurbitaceae*); species "*Citrullus lanatus* L." has been an important vegetable crop worldwide; however its production is limited by poor nutrients soil. Egypt has the sixth range in world production. Watermelon Egyptian production is estimated by 1630000 tons valuing about 169.96 million US dollars. It is a major producer of the crop includes China, Turkey, United States, Iran and Republic of Korea (Dalorima *et al.,* 2018). Watermelon originated from Southern Africa occurring naturally in South Africa, Namibia, Botswana, Zimbabwe, Mozambique, Zambia and Malawi. Watermelon not only a nutritional valuable food, but also is considered a rich source of the phytochemically, which is as anti-cancer in particular prostate cancer in human. Watermelon juice has beneficial effects in the improvement of immunologic cardiovascular functions and a favorable regulation of whole-body metabolism and a good source of vitamins A and C, provides potassium and fiber. It contains high level of lycopene – an antioxidant which is may help the body fight cancer and prevent disease. As well as, it used to treat anemia/calculi formation and contains a lot of potassium lead to helpful in cleaning the toxic depositions in the kidney. The potassium and magnesium in the watermelon helps in reducing the high blood pressure to normal ones (Medeiros do *et al.*, 2017 and Mainga *et al.*, 2018). However, new reclaimed lands have many problems such as poor in organic matter, beneficial microbes and fertility, which may necessary to apply the special fertilization program and foliar application for plant growth promoters. It grows best on fertile sandy or sandy loam soils with good nutrition (Aniekwe and Nwokwu, 2015; Medeiros do *et al.*, 2017 and Mainga *et al.*, 2018). Nutrient requirement of watermelon is the ratio of (N: P 2 O 5: K 2 O) is 3.28: 1: 4.33 for the whole production period

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(Mainga *et al.*, 2018). It is now recognized that never chemical fertilizers alone able to increase crop productivity optimally. At the same time, the improvement towards to use organic sources in cleaning system agriculture and has revived farmer's interest.

The mixture of different organic fertilizers (MOF) like chicken manure, cow dump, compost and vermicompost lead to increase organic matter, macro (N, P, and K) and micro (S, Zn, Mn, Mg, Ca and Fe) nutrients for enhancement the soil beneficial microbes serving as biofertilizers and biopesticides. It is natural remedies for pest, diseases and weed control in the farm of eco-friendly. Earthworms of vermicompost convert the waste material into small particles by breaking in the gut and obtain the nutrients from the microbes that harbor upon them (Abou El Goud *et al.*, 2010; Ojo *et al.,* 2014 and Abou El Goud, 2020). This process increases the rate of degradation of the organic waste matter i.e. chicken, cow manure and plant composted, to modify the physicochemical properties of the matter and leads to formation of humus in which unstable waste matter is completely oxidized. Various physicochemical and biological characteristics of soil are enhanced by amendment with vermicompost and different organic sources, as well as it aggregates stability of soil, growth of plants, increases microbial activity and enzyme production. It also covers microbial pest control and control of weeds by allelopathic compounds and then will be invaluable to plant pathologists, plant biochemists, botanists, environmental chemists and farmers (Fig. 1). They contain differ beneficial microorganisms like nitrogen fixing bacteria" *Azotobacter* and *Azosperillium* and *Nitrobacter*", phosphate solubilizing bacteria "*B. megatherium*", potassium solubilizing bacteria "*B. circulance"*, *Trichoderma*, *Protozoa, Pseudomonas* sp. and *Actinomycetes*. Which they play a major role in anaerobic digestion in composting and vermicomposting processes, the behavior and dynamics of microbial communities is necessary for soil quality and vigor nutritional plant (Abou El Goud *et al.*, 2006; Franke-Whittle *et al.*, 2014, Singh and Singh, 2019 and Abou El Goud, 2020). They have positive effects of type and amount of input microbial soil lead to enhance the microbial communities, and inhibit the soil borne pathogens. In recent years; organic fertilizer has been heavily investigated (Gandhi and Sundari, 2012; Franke-Whittle *et al.*, 2014; Aniekwe and Nwokwu, 2015 and Ramnarin *et al.*, 2018). They are riched in hormons" auxins, cytokinines, indol 3 acetic acid, gibberellins" 30% , plant regulators 25%, vitamins 15%, macro and micro nutrients 7-10% and humus 40% , enzymes i.g. chitinases, lipases, cellulases, urases, phosphatases, protease and dehydrogenases; more than another (Aniekwe and Nwokwu, 2015; Khwanchaim and Kanokkorn, 2018; Mainga *et al.*, 2018 and Soraya *et al.*, 2020). As well as they used as bio-pesticides for a biological control by antagonistic ability "*Pseudomonas* sp., *Actinomycetes, Streptomyces* and *Trichoderma*" against soil bore pathogens to plant protect, promote plant growth and increase healthy production (Mainga *et al.*, 2018 and Soraya *et al.*, 2020). It is a soil, plant and environment friendly, it able to improve soil structure, reduce soil erosion, increase its physiochemical and microbial (Gao *et al.*, 2020). Mixed sources of different organic fertilizers were added as bio-organic fertilizers and biopesticides for a sustainable environmental protection (Khwanchaim and Kanokkorn, 2018; Abou El Goud, 2020 and Soraya *et al.*, 2020).

Vermitea is extract from vermicompost for efficiency production (Sundararasu and Jeyasankar, 2014) has positive effects in flowering, fruiting, soil quality; because of it has Integrated Plant Nutrition System (IPNS), which plays an important role for plant vegetation, rooting initiation system, promoting growth regulators rates of shoots and roots and improve plant production (Baniya and Vaidya, 2011 and Sundararasu and Jeyasankar, 2014; Aniekwe and Nwokwu, 2015; Abou El Goud, 2020 and Soraya *et al.*, 2020). Vermitea as liquid manure for excellent plant promoting, enhances enzymatic activity, hormons and plant growth regulators (Brown, 1995; Baniya and Vaidya, 2011 and Soraya *et al.*, 2020) and as a biological control for different diseases (Edwards *et al.*, 2006). Friendly-environment divided mature like the mixture of organic fertilizers with high porosity, aeration, water-holding capacity, drainage and microbial activity which are stabilized by interactions between red wiggler worm and microorganisms in chicken manure, cow dump and plant composted (Fig. 1). They contain most nutrients in plant available form such as nitrates, phosphates, soluble potassium and exchangeable calcium (Arancon *et al.*, 2008; Ramnarin *et al.*, 2018 and Ye *et al.,* 2019). Due to their different production of organic fertilizers might exhibit different physical, chemical and microbial features which might influence plant growth and yield in diverse ways (Arancon *et al.*, 2003; Kumar, 2005; Arancon *et al.*, 2008; Sinha *et al.*, 2009; Moradi *et al.,* 2014; Singh and Singh, 2019 and Soraya *et al.*, 2020). Chemical fertilizer causes environmental hazards; ground and surface water pollution by nitrate leaching (Ye *et al.*, 2019) to reduce the use of chemical fertilizer could be recycling of organic wastes. The mixture of organic fertilizers can be a valuable and inexpensive fertilizer; which have positive effects of organic waste on aggregate stability, water-holding capacity and soil structure and source of potential plant nutrition (Singh *et al.*, 2008; Sinha *et al.*, 2009; Rajiv *et al.*, 2009 ; Singhai *et al.*, 2011; Singh *et al.*, 2012; Moradi *et al.,* 2014; Singh and Hussain, 2015; Ramnarin *et al.*, 2018 Mahmud *et al.*, 2018 and Gao *et al.*, 2020).

Mycorrhizal fungi able to improve plant growth under various environmental conditions and have beneficial effects to influence of AMF symbiosis on several plant physiology, such as mineral nutrients uptake, plant development, protection by chitinases, ligninase enzymes produced from AM hyphae within the root cells, decrease the soil pH by its production of much different organic acids within rhizosphere's mycorrhizae, enhance the soil aggregation quality by mycorrhizal hyphae (Abou El Goud, 2006; Abou El Goud, 2010; Ye *et al.*, 2019 and Gao *et al.*, 2020). It able to increase the surface area supply of nutrients to the plant and can be consider as bio control agents by reducing or suppression damage caused by soil-borne pathogens (Enujeke, 2013) and increase plant resistance to abiotic stress (Audi *et al.,* 2013; Mainga *et al.*, 2018 and Gao *et al.*, 2020). There are different beneficial microbes in organic fertilizers, compost and vermicompost relationship with mycorrhizal inoculation, but their joined use has not been widely studied. Organic fertilizers able to stimulate mycorrhizal colonization of roots and the dry weights of shoot and root were increased by inoculation with AMF and organic fertilizers. Combination between them lead to increase AM symbioses, protection and plant production enhanced (Abou El Goud *et al.*, 2010; Ortas, 2010; Ye *et al.*, 2019 Abou El Goud and Yousr, 2019). Improvement of new economically and environmentally friendly agriculture were aimed of this research to confirm the growth-promoting effects of mycorrhizal fungi, vermitea and the mixture of organic fertilizers "MOF" alone and combination between them on watermelon "*Citrullus lanatus*, L" growth, total yield and fruit quality. "MOF" is rich organic amendment by the interactions between earthworms from vermicompost and beneficial microorganisms by the breakdown of chicken, cow manures and plant composted "microbial communities".

Materials and Methods

Two open field experiments were carried out during the summer season, 5th March, 2019 in two different sites at a private farm (El Amryia, El-King Maryout- Egypt). Soil sample (0-30cm) was taken before sowing to determine the physicochemical properties, details: soil texture was sandy (90.74%), clay (4.95%), silt (4.31%); pH = 8.0, O.M. % = 1.86%, O.C. % = 1.08%, available of N = 19.53 mg/kg, P = 14.5 mg/kg and K = 475 mg/kg and E.C. (1:1 water extract) = 1.51 ds/m according to Jackson, 1973; Chapman and Pratt, 1978; Evenhuis,1978; Page *et al.*, 1982 and Klute 1986. Two field experiments were laid out in a split plot design in (RCBD) randomized complete blocks with three replicates. Every field experiment consists of 13 treatments. The present study was investigated the efficiency response of the mixture of organic fertilizers MOF (25% vermicompost + 25% plant composted + 25% chicken manure + 25% cow dump) at two levels (4 and 8t/fed.), vermitea "VTL" as a foliar spraying on leaves at (3 and 4 times) with AM inoculation on growth parameters, total yield and fruit quality in poor nutrients soil. Treatments were illustrated as follows; T1 = control (recommended doses of Ammonium Nitrate 33.5% = 500 kg/fed. + Super Phosphate 15.5% = 450 kg/fed. + Potassium Sulphate 48% = 350kg/fed.), T2 = MOF (4 t/fed.), T3 = MOF (4 t/

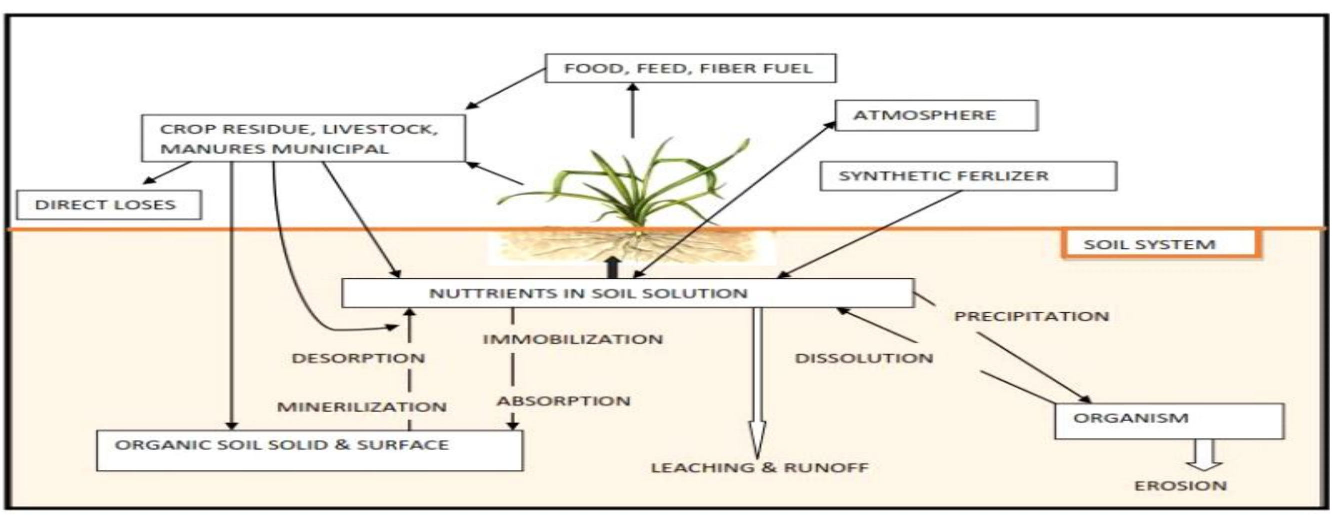

Fig. 1: Mineralization of organic matters in the soil.

fed.) + VTL3, T4 = MOF (4 t/fed.) + VTL4, T5 = MOF (4 t/fed.) + AMF, T6 = MOF (4 t/fed.) + AMF + VTL3, T7 = MOF (4 t/fed.) + AMF + VTL4, T8 = MOF (8 t/ fed.), T9 = MOF (8 t/fed.) + VTL 3, T10 = MOF (8 t/ fed.) + VTL4, T11 = MOF (8 t/fed.) + AMF, T12 = MOF (8 t/fed.) + AMF + VTL3, T13 = MOF (8T/fed.) + AMF + VTL4. The seeds of Watermelon "*Citrullus lanatus*, L." of species "cv. Sakatta- F1" was sown at 5th March, 2019; in two different sites. Total plot area (experimental unit) was (0.8 m width & 3.4 m length = 2.7 m2) and total number of plants /plot were 5 plants and the distance between two hills = 66 cm. Weeds controlled by hand-howling once every week after germination directly to increase the plant resistance against the insects in order to cover watermelon under white net; after 40 days from sowing; for a good protection. Vermitea (VT) was produced by mixed of vermicompost (250g), coffee (100g), yeast, rabbit urine (200 ml), salicylic acid (5 g), humic acid (100g) and molasses soaked in 2 liters of tap water for three days and sieved through net and diluted by concentration (1:10) to obtain the vermitea (Sundararasu and Jeyasankar, 2014). It was applied as spraying on leaves (200 ml/ plant) three and four times per 10 days were beginning after 45 days from sowing. MOF was obtained from the mixture of 25% vermicompost, 25% plant composted, 25% chicken manure and 25% cow dump (w:w), were composting process of them for 25 days and then vermicomposting process for two months to produce MOF. Sample of "MOF" was taken before adding on the soil to determine (total organic matter% = 30.3, organic carbon% = 17.3, C/N ratio = 3.4:1, pH (1:10) = 7.6, E.C.(1:10, water extract) = 4.3 dS/m, total amount of macro elements; N = 3.24% ,P = 2.42% and K = 6.4%) according to Chapman and Pratt, 1978; Evenhuis,1978; Jackson, 1973; Page *et al.*, 1982 and Klute 1986. It was added at 8th February, 2019. AM specie was obtained from the Agricultural Research Center (CARC) Eldoky, Giza, Egypt. It was mixed with the seeds of watermelon for three hours before sowing. Two seeds were dropped per hill and then irrigated with drip irrigation after sowing directly. From each plot was taken two randomized plants to estimate plant height (cm), No. of branches/plant, No. of flowers/plant, No. of fruits/plant, fruit weight (g) and total fruit weight (kg/plant). At a green stage, total chlorophyll in leaves (SPAD); Signal Passed At Danger; which is a light weight hand held to measure the total chlorophyll content in leaves without causing damage to plant according to Roods and Blood-Worth, 1964. The first cutting was after 75 days from sowing (the early harvest), the total No. of cuttings were three cuttings and 20 days were individual time between them to calculate the total fruit yield (kg/fed). Samples of watermelon were washed by distilled water and oven dried at 75°C to fix dry weights after (72h.) and measure fruit contents of N, P and K after dryness samples. Dried samples of fruits were finely ground, then wet digested by using concentrate of H_2SO_4 / H_2O_2 according to Lowther, 1980 to estimate the percentage of potassium (flam photometer); phosphorus (vanaomoly-bdophosphoric method) according to Jackson, 1973. Total nitrogen was estimated by Nessler's method (Chapman and Pratt, 1978). Fresh juice from watermelon samples were taken to determine T.S.S. % (total soluble solids) by hand refractometer according to Chen and Mellenthin (1981). As well as, total sugars were extracted from fresh fruit weight (5g) and determined by phenol sulfuric and Nelson Arsenate- Molybadate Colorimetric methods for measuring the total and reducing sugars, respectively according to Malik and Singh (1980). Non-reducing sugars were calculated by the equivalent (total sugars - reducing sugars = non-reducing sugars). All data were statistically analyzed using the SAS program (Statistical Analysis System SAS, 2001) and means values of treatments were compared with controlled once by using Duncan's Multiple Range test at 5% level of probability.

Results and Discussion

Vegetation, yield and its component parameters

This work to study the vegetative and total fruit yield parameters of watermelon "*Citrullus lanatus* L." to investigate the efficiency impact for application the high rate (8 t/fed) of MOF, AM fungi as a biofertilizer and VTL4 "vermitea as a foliar spraying on leaves compared to the control once (R100% of NPK chemical fertilizers). Positive effects of them were recorded on vegetative, yield and quality parameters as mean values of results in Table 1, 2 and 3. Table 1 shows that, significantly different between all treatments, however T13 = MOF (8 t/fed.) + AMF + VTL 4 lead to significant increase in plant height (489.7 and 492.33 cm) more than controlled once (134.57 and 135.07 cm) of two sites, respectively. (Table 1) cleared that, there are non-significantly differences between T13 and T12 in No. of branches/plant, No. of flowers/plant, No. of fruits/plant and total chlorophyll in leaves SPAD. They were significant increased (10.1, 10.2, 6.6 and 56.8 SPAD, respectively) compared to T1, which they were resulted (2.9, 2.5, 1.3 and 17.1 SPAD, as an average of both sites, respectively). T13 and T12 lead to increase in plant height, No. of branches, flowers and fruits/plant and total chlorophyll in leaves by the percentage increasing of (263.7, 320, 320, 438.5 and

247.1%; respectively) more than T1. Data in table 1 cleared that, there are significant differences from T13 to T1 in vegetative parameters. Results in tables 2 and 3 shown that, fruit quality parameters were positive affected by applying different treatments of bio-organic fertilization in both sites compared to T1. Applying the high rate of the mixture of organic fertilizer MOF (8 t/fed), inoculated with AMF and vermitea as a foliar spraying at 4 times (T13) lead to the best results of T.S.S, total sugar, reducing sugar, non-reducing sugar %, P and K % in fruits, which they were (14.4, 10.6, 6.8, 3.8%, 0.36 and 2.6 % as an average of both sites, respectively) more than controlled (T1). But the results were shown at T1 (3.8, 3.2, 2.0, 1.2%, 0.12 and 0.43% as an average of both sites, respectively). Table 2 and 3 the results were achieved that, T13 lead to significant increases in (T.S.S%, total sugar%, reducing sugar%, non-reducing sugar %, P and K% in fruits) by the percentage increasing of (291.9, 231.3, 240, 216.7, 100 and 163%, respectively) more than controlled (T1). However, T1 had the lowest values for all vegetative and fruit quality parameters of both sites. Which this reflected on fruit weight (kg), total fruit weight (kg/plant) and total yield (kg/fed) were (1.887, 19.814 and 146.767 as an average of both sites, respectively) at T13 compared to (0.529, 1.324, 9.808; respectively) at T1 in table 3. Due to that, chicken, cow manures, vermicompost and plant composted have the high concentration of macro and micro nutrients, vitamins, hormones, plant regulators, antibiotics, humus and organic acids to decrease the soil pH in (Fig. 1), which lead to dissolve the minerals in soil, their chelating and transport them to root hairs for a good nutritional plant, health growth and safety fruits produce (Abou El Goud and Yousry, 2019 and Abou El Goud, 2020). Improvement the physical, chemical and microbial communities of soil, providing energy of organic carbon for microbes activity for increasing the availability of nutrients uptakes, which they lead to positive reflect on powerful growth, yield and quality parameters (Taha *et al.*, 2011; Massri and Labban 2015; Dalorima *et al.*, 2018; Panchaban *et al.*, 2019 and Abou El Goud, 2020). Stimulation of watermelon growth by using 100% mixture of organic fertilizers may be attributed to the combination effect of plant composted, vermicompost, chicken and cow manures; which they contained huge amounts of humic acids, folvice acid, vitamins, amino acids, macro and micro nutrients, hormones, plant regulators, antibiotics, humus and organic acids. They able to enhance the growth, yield and quality of crops and improve the soil fertility were agreement with (Rajiv *et al.,* 2009; Huerta *et al.,* 2010; Dalorima *et al.,* 2017; Dalorima *et al.*, 2018; Abou El Goud and Yousry, 2019 and Abou El Goud, 2020). They who reported that the soil physicochemical properties enhanced by the addition of any different kinds of organic fertilizers by increasing water holding capacity, cations exchange, moderate soil pH, moisture content, total carbon, nitrogen, phosphorous and potassium ultimately resulted in plant biomass accumulation. As well as mycorrhizal fungi with symbiosis colonize with watermelon roots caused not only stimulate the production of growth regulators, hormones "auxins, cytokinins and gibberellins", vitamins and phenols but also dissolve P and it absorption and enhance the beneficial microbial population "microbial communities" to inhibit the soil borne pathogens (Webber *et al.*, 2006 and Soraya *et al.*, 2020). They are obvious from table 3 that T13 was produced the highest significant values of fruit weight (kg); total fruit weight (kg/plant) and total fruit yield (kg/ fed), which they were (1.9, 13.3 and 97802.5 kg/fed; as an average of both sites; respectively). The percentage increasing was (90, 1230 and 9780 %) more than the lowest values at T1. Similar results were shown according with (Ma *et al.*, 2015; Zhao *et al.,* 2017; Khwanchaim and Kanokkorn, 2018 and Abou El Goud, 2020). Table 1, 2 and 3; cleared that T13 were applied to improve the vegetative parameters, yield and fruit components of watermelon under poor nutrients soil as compared with the recommended doses of chemical NPK fertilizers T1. Total nitrogen, total carbon and available phosphorus were increased when the organic matter was increased by application the highest rate (8t/fed) of MOF, inoculum with AMF and foliar spraying on leaves by vermitea at 4 times. There were because of the plants had to establish a well-developed root system to tap nutrients by AM colonization and soil fertility, this argument is in concordance with this investigated. Vermicompost proved to be the best organic fertility and organic-pesticides by vermitea as spraying applied in regards to increase total yield and fruit quality of watermelon plant and successful of intervals. In the same trend fined by (Elliott and Des Jardin, 1999; Kumar *et al.,* 2005; Abou El Goud, 2006; Sinha *et al.*, 2010;; Shuyan *et al.*, 2017; Zhao *et al.*, 2018; Dalorima *et al.*, 2018 and Abou El Goud, 2020). This is due to increase the rate of mineralization and degree of humidity cation by the action of biological agents. Different sources of organic fertilizers have good properties to conserve moist and nutrients in the soil, turn could help to improve the vegetative growth and increase watermelon yield and its quality in fig. 1. The enhancement of vegetative plant induce other physicological parameters of watermelon, the number of leaves, branches, flowers and fruits were also higher in fields treated. This was influenced as a result of vermicompost produces, which lead to increase the activity of microorganism, positive effects on plant growth and subsequently the enhancement of yield and safety products (Singh and Hussain, 2015; Mainga *et al.*, 2018 and Gao *et al.*, 2020). Poultry manure also improves the vine length of watermelon; to investigate the physicochemical parameters and the microbial communities involved in composting and vermicomposting processes of the mixture of anaerobic, aerobic digestive, green waste and biodegradation of *Red wiggler* intestine. These results are similar to other studies (Rajiv *et al.,* 2009; Sinha *et al.*, 2009; Huerta *et al.*, 2010; Ojo *et al.*, 2014; Jigme *et al.*, 2015; Ogodo *et al.*, 2015; Zhao *et al.,* 2017 and Abou El Goud and Yousry, 2019) on various crops. The organic nitrogen could has been slow to release N during the short watermelon growth period, the highest rate of cattle manure was possibly caused by the temporary fixation of nitrogen as a result of microbial activity. Supplied N from organic sources for increasing rates of N supply, is required to enhance watermelon growth parameters to increase high amounts of dry matter accumulation in the fruits. However, the inability of the manures to increase fruit weight may be attributed to the fact that; manures able to fixe in the soil in the short-run due to high C/N ratio associated with high levels of application (Edwards, *et al.*, 2006). They revealed that shoot length, dry matter, number of leaves, weights of roots and shoots, fruit number and fruit weight were influenced significantly by vermicompost and NPK fertilizer treatment in the growth media. The highest level of vermicompost (20 t ha -1) were increased dry weight of root, No. of fruit/plant and mean fruit weight. They reported that; growth and yield performance of plant were better by adding vermicompost amended soil than another grown in the inorganic fertilizer (Webber *et al.*, 2006; Huerta *et al.*, 2010; Zhao *et al.,* 2018; Du *et al.*, 2019; Abou El Goud and Yousry, 2019; Htwe *et al.*, 2019 and Abou El Goud, 2020). Organic manures able to activate many species of living organisms which release phytohormones and may stimulate the plant growth and nutrients (Fig. 1). Organic food contains more antioxidants and less unhealthy fatty acids "organic wheat, tomatoes, potatoes, cabbage, onions, lettuce, cucumber, squash, watermelon, eggplant and molokhia" had 20 and 47% more nutrients, vitamins than non-organic foods. Cow dung was superior as regards No. of fruits on each vine, number of vine and vine length and poultry manure application on watermelon growth is promoting vine length and increasing (Enujeke, 2013, Audi *et al.* 2013; Aniekwe and Nwokwu, 2015; Zhao *et al.,* 2018 and Htwe *et al.*, 2019). The usage of organic fertilizers lead to enhance soil productivity, improve soil micro-organisms, soil organic carbon and nitrogen content, improve soil physicochemical structure, nutrient status of soil, microbial communities and enhance crop yield (Aniekwe and Nwokwu, 2015; Zhao *et al.,* 2018 and Abou El Goud, 2020). Because of

Table 1: Effect of MOF, VTL levels and AMF on vegetative and yield parameters of Watermelon "*Citrullus lanatus* L." of specie "cv. Sakatta- F1" at two different sites, 2019

T	Plant height (cm)		No. of branches / plant		No. of flowers /plant		No. of fruits /plant		Total chlorophyll in leaves (SPAD)	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
T1	134.57 m	135.07 m	2.67 j	3.0 j	2.33 h	2.67 f	1.33 j	1.33 j	16.8 j	17.27 L
T2	151.9 L	152.73 L	3.67 hi	4.0 h	2.67 hg	3.0 ef	1.67 ji	2.0 ji	18.43 ji	18.33 L
T3	171.3 k	172.9 k	3.33 ji	3.0 i	3.33 fg	3.00 ef	2.33 hi	2.33 hi	20.87 ji	20.8 k
T4	190.43 j	190.53 j	3.67 hi	3.67 hi	4.0 ef	3.67 e	2.67 gh	2.33 hi	23.57 hi	24.0 j
T5	212.0 i	213.17 i	4.57 gh	4.33 gh	4.67 de	5.0 d	3.33 fg	3.0 gh	17.6 ji	26.37 i
T6	235.33 h	233.17 h	5.07 fg	5.0 fg	5.33 cd	5.0 d	3.33 fg	3.67 fg	28.5 hg	28.17 h
T7	261.17 g	261.57 g	5.6 ef	5.67 ef	5.67 c	6.0 c	3.67 f	3.57 fg	31.43 g	31.43 g
T8	288.77 f	289.4 f	6.13 e	6.33 de	6.0 c	6.67 c	4.0 ef	4.33 ef	35.73 ef	35.23 f
T9	320.3 e	320.4 e	7.33 d	7.0 cd	7.33 b	6.67 c	4.67 de	4.67 de	39.27 de	39.93 e
T10	357.0 d	356.3 d	7.67 d	7.33 c	7.3 b	7.67 b	5.0 cd	5.33 cd	43.20 cd	44.57 d
T11	398.67 c	389.03 c	8.63 c	8.33 b	8.0 b	8.33 b	5.67 bc	5.67 bc	48.57 bc	48.87 c
T12	438.67 b	443.17 b	9.67 b	10.0 a	10.0 a	9.67 a	6.0 ab	6.3 b	53.97 ab	54.77 b
T13	489.67 a	492.33 a	10.67 a	10.0 a	10 67 a	10.33 a	6.67 a	7.3 a	59.47 a	59.1 a

T1= control (recommended doses of ammonium nitrate 33.5% = 500 kg/fed. + super phosphate 15.5% = 450 kg/fed. + potassium sulphate 48% = 350kg/fed.), T2 = MOF (4 t/fed.), T3 = MOF (4 t/fed.) + VTL3, T4 = MOF (4 t/fed.) + VTL4, T5 = MOF (4 t/fed.) + AMF, T6 = MOF (4 t/fed.) + AMF + VTL3, T7 = MOF (4 t/fed.) + AMF + VTL4, T8 = MOF (8 t/fed.), T9 = MOF (8 t/fed.) + VTL 3, T10 = MOF (8 t/fed.) + VTL4, T11 = MOF (8 t/fed.) + AMF, T12 = MOF (8 t/fed.) + AMF + VTL3, T13 = MOF (8T/fed.) + AMF +VTL4.

Table 2: Effect of MOF, VTL levels and AMF on fruit quality of Watermelon "*Citrullus lanatus* L." of specie "cv. Sakatta- F1" at two different sites, 2019

T	T.S.S. %		Total Sugar %		Reducing Sugar %		Non-Reducing Sugar %		N % in fruits	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
T1	3.57 m	3.97 L	3.23 L	3.27 L	2.03 m	2.0 m	1.20 h	1.27 g	1.48 k	1.47 L
T2	4.60 L	4.5 k	3.7 k	3.8 k	2.23 L	2.27 L	1.47 gh	1.53 f	1.77 j	1.73 k
T3	5.03 k	5.43 j	4.07 j	4.06 j	2.53 k	2.53 k	1.53 hg	1.51 f	1.87 j	1.9 j
T4	5.6 j	5.57 j	4.67 i	4.70 i	2.93 j	2.89 j	1.73 gf	1.8 e	2.17 i	2.13 i
T5	6.37 i	6.40 i	4.93 hi	5.0 h	3.13 i	3.17 i	1.8 gf	1.83 de	2.32 h	2.33 h
T6	7.1 h	7.33 h	5.0 h	5.60 hg	3.5 h	3.53 h	1.5 gh	2.07 cd	2.57 g	2.56 g
T7	7.80 g	7.90 g	5.70 g	5.83 g	3.70 g	3.73 g	1.97 ef	2.1 c	2.72 f	2.73 f
T8	8.73 f	8.97 f	6.23 f	6.53 f	4.33 f	4.30 f	1.9 f	2.23 c	2.93 e	2.97 e
T9	9.83 e	10.13 e	6.8 e	6.83 e	4.50 e	4.6 e	2.30 de	2.23 c	3.13 d	3.17 d
T10	10.83 d	10.63 d	7.67 d	7.53 d	5.23 d	5.24 d	2.43 cd	2.3 c	3.33 c	3.32 c
T11	12.23 c	12.13 c	8.33 c	8.5 c	5.68 c	5.67 c	2.67 c	2.83 b	3.69 b	3.67 b
T12	13.37 b	13.10 b	9.5 b	9.4 b	6.43 b	6.40 b	3.07 b	3.0 b	4.03 a	4.07 a
T13	14.38	14.39 a	10.6 a	6.8 a	6.7 a	3.8 a	3.7a	10.6 a	4.11 a	4.1 a

T1 = control (recommended doses of ammonium nitrate 33.5% = 500 kg/fed. + super phosphate 15.5% = 450 kg/fed. + potassium sulphate 48% = 350kg/fed.), T2 = MOF (4 t/fed.), T3 = MOF (4 t/fed.) + VTL3, T4 = MOF (4 t/fed.) + VTL4, T5 = MOF (4 t/fed.) + AMF, T6 = MOF (4 t/fed.) + AMF + VTL3, T7 = MOF (4 t/fed.) + AMF + VTL4, T8 = MOF (8 t/fed.), T9 = MOF (8 t/fed.) + VTL 3, T10 = MOF (8 t/fed.) + VTL4, T11 = MOF (8 t/fed.) + AMF, T12 = MOF (8 t/fed.) + AMF + VTL3, T13 = MOF (8T/fed.) + AMF + VTL4.

Table 3: Effect of MOF, VTL levels and AMF on fruit quality and total yield (kg/fed) of Watermelon "*Citrullus lanatus* L." of specie "cv. Sakatta- F1" at two different sites, 2019

T	P % in fruits		K % in fruits		Fruit weight (kg)		Total fruit weight (kg/plant)		Total fruit yield (kg/fed)	
	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2	Site 1	Site 2
T1	0.12 m	0.12 L	0.43 L	0.42 i	0.532 j	0.536 k	1.308 j	1.340 k	9.689 L	9.926 L
T2	0.13 L	0.13 k	0.74 k	0.73 h	0.660 j	0.667 kj	1.848 j	1.868 jk	13.689 k	13.837 k
T3	0.15 k	0.14 k	0.87 j	0.83 h	0.710 ji	0.727 kji	2.272 ji	2.326 ijk	16.829 j	17.229 j
T4	0.16 j	0.16 j	1.07 i	0.70 h	0.810 hi	0.812 ji	3.080 hi	3.078 ji	22.815 i	22.800 i
T5	0.18 i	0.18 i	1.12 i	1.14 g	0.906 gh	0.896 hi	4.349 gh	4.301 hi	32.215 h	31.859 h
T6	0.20 h	0.20 h	1.26 h	1.26 fg	1.000 g	0.990 gh	5.200 g	5.148 gh	38.519 g	38.133 g
T7	0.22 g	0.21 g	1.49 g	1.40 ef	1.080 fg	1.087 fg	6.246 fg	6.305 fg	46.400 f	46.704 f
T8	0.23 f	0.24 f	1.54 f	1.52 de	1.117 f	1.120 f	7.037 f	7.056 f	52.126 f	52.267 f
T9	0.26 e	0.27 e	1.71 e	1.73 cd	1.246 e	1.260 e	8.722 e	8.820 e	64.607 e	65.333 e
T10	0.28 d	0.29 d	1.93 d	1.92 bc	1.397 d	1.400 d	10.478 d	10.500 d	77.615 d	77.778 d
T11	0.30 c	0.31 c	2.08 c	2.09 b	1.470c	1.503 c	12.054 c	12.325 c	89.289 c	91.296 c
T12	0.33 b	0.34 b	2.39 b	2.4 a	1.690 b	1.720 b	16.562 b	16.856 b	122.639 b	124.859 b
T13	0.36 a	0.37 a	2.63 a	2.64 a	1.884 a	1.890 a	19.782 a	19.845 a	146.533 a	147.000 a

T1= control (recommended doses of ammonium nitrate 33.5% = 500 kg/fed. + super phosphate 15.5% = 450 kg/fed. + potassium sulphate 48% = 350kg/fed.), T2 = MOF (4 t/fed.), T3 = MOF (4 t/fed.) + VTL3, T4 = MOF (4 t/fed.) + VTL4, T5 = MOF (4 t/fed.) + AMF, T6 = MOF (4 t/fed.) + AMF + VTL3, T7 = MOF (4 t/fed.) + AMF + VTL4, T8 = MOF (8 t/fed.), T9 = MOF (8 t/fed.) + VTL 3, T10 = MOF (8 t/fed.) + VTL4, T11 = MOF (8 t/fed.) + AMF, T12 = MOF (8 t/fed.) + AMF + VTL3, T13 = MOF (8T/fed.) + AMF + VTL4.

MOF combination with AMF and vermitea were contained enzymes "protease, amylase, unease and phosphatase", beneficial microbes for plant development, able to stimulate the growth and increase the safety productivity. Found nitrogen fixing bacteria "*Azotobacter; Rhizobium* and *Azospirrillum*"; phosphate solubilizing bacteria "*B. megatherium*" and potassium solubilizing bacteria "*B. circulans"* are found in vermitea. They are beneficial microbes, which lead to fix the atmospheric nitrogen and dissolve phosphorus and potassium in soil, for a good nutritional feeding in plant (Abou El Goud, 2006 and 2010; Joshi *et al.*, 2015; Dalorima *et al.*, 2018 and Ye *et al.*, 2019). It contains nitrogen, essential enzymes, and growth promoting hormones, infuses resistance in plants and is applied as a foliar spray. Results revealed that vermitea spray able to enhance the growth parameters (plant height, No. of branches and total chlorophyll in leaves); yield parameters (number of flowers and fruits/plant), fruit quality (T.S.S%, total sugar%, reducing sugar%, non-reducing sugar %, P and K % in fruits) and total yield (kg/fed).

Conclusion

With the global trend towards for safety food production of organic waste material processed by the naturally occurring should be used to produce mixed organic fertilizers, which they supplied nutrients and soil stimulants for plant growth, increase the yield and improve soil quality. Mixed organic fertilizers provide the best answer for ecological agriculture, which is named "Smart-Agriculture". Thus, farmers can use the mixture of different kinds of organic fertilizers "MOF", biofertilizer (AMF) and vermitea "VT" to replace of the huge amounts of chemical fertilizers and pesticides to reduce the cost, increase farming input and prevent an environmental pollution.

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