IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 14, Issue 4 Ser. I (April 2021), PP 01-05
www.iosrjournals.org

Investigation of the Effect of Organic Fertilizers Used in Walnut (*Juglans Regia* L.) Cultivation on Yield and Quality

*Ayşen Melda Çolak[1] and İbrahim Aydın Karaca [2]
[1] *Usak University, Faculty of Agriculture, Department of Horticulture, Usak, Turkey*
[2]*Graduate School Uşak University, Uşak, Turkey*

Abstract: *As it is known, walnut cultivation is widely carried out in almost every part of the world. In general, chemical fertilizers whose use is increasing in traditional walnut growing places; It has caused bad consequences such as the impoverishment of the soil as organic matter, the pollution of groundwater, and the deterioration of the chemical structure of the soil. According to 2018 FAO data, 3,662,507 tons of walnuts were produced from a total of 1,159,484 ha worldwide. In addition, according to 2018 FAO data, 188,159,954 tons of chemical fertilizers (N, P_2O_5, K_2O) were used in agricultural areas worldwide. In recent years, the use of organic or natural fertilizers has started to be preferred by producers due to low yield, healthier crops, and increased fertilizer costs. In this study, some worldwide studies on the use of natural or organic fertilizers related to walnuts are discussed.*

Keywords: *Juglans regia, fertilizer, organic, yield.*

Date of Submission: 20-03-2021 Date of Acceptance: 04-04-2021

I. Introduction

The history of fertilizer use is at least as old as the agricultural history. B.C. It is known that in the 1500s, they used animal feces as fertilizer and they made agriculture by leaving their land fallow (Taban and Şahin, 2020). In the writings of Pliny (AD 23-79), the first historically known record of walnut was BC. He stated that the Romans brought them from Iran to Europe in the 750-500s (Akça, 2001). It is thought that it then spread from Rome to all of Europe and from there it was taken to the American continent by the colonies. When walnuts are classified as pomologically, the Dicotyledoneae class is included in the Juglandales order, the Juglandaceae family, and the Juglans genus. The most widely grown walnut type in the world is Juglans regia. Considering its distribution as a natural population in the world, walnut has a distribution extending from the Central Asian Mountain Range to the Balkans (Şen, 2011). Walnut, which has a very wide distribution in the world, can be grown anywhere from 0-1500 m. Walnut has managed to find a place in many sectors such as cosmetics, food, pharmaceutical industry, furniture industry. For this reason, it has become the first preferred fruit type, especially in irrigated farming areas. Walnut is an essential nutrient for diets. It contains 14 g carbohydrate, 65 g fat, and 15 g protein based on the nutritional value of 100 g. (Anonymous, 2020). In recent years, consumers have started to look for products that grow more naturally due to the increasing health problems and the more and more pollution of groundwater. In order to produce enough food for the increasing world population, the producers initially fertilized their lands unconsciously in order to obtain more yield, causing their soils to become poorer, so the farmers who started new searches started to use various natural inputs to enrich their soils with organic matter. With this study, studies on natural or organic inputs and product cultivation in walnuts made in the world and in our country were investigated.

II. Materıals and methods

The research material consists of studies on the use of natural fertilizers in walnuts made around the world. For this research, many studies around the world have been examined and studies deemed appropriate have been included in this study. In these studies, the effects of using less costly natural or organic fertilizers and bacteria instead of compound fertilizers were observed.

III. Results and discussion

Studies on walnuts are stated below with their results.

The study titled "Investigation of the Effects of the Use of Compound Microbial Fertilizer in Walnut (cv. Chandler) on Yield and Quality Parameters" was conducted between 2018-2019 in the Demirci district of Manisa province, EM.A and EM.5 microbial fertilizers were used in 3 different periods in the variety named "Chandler" (before the male flowers bloom when the male flowers bloom and the fruits are the size of the hazelnut) it was applied by spraying the leaves at a dose of 2 cc/L per tree with the help of a pulverizer, the

highest results were obtained from EM.A application in terms of fruit width, weight and height in terms of the average of two years. In two applications, it was observed that the color of the fruits became darker but duller than the control group, in general, the amount of linoleic acid in the fruits was high in EM.5 application, followed by linoleic acid in the control group and oleic acid in the EM.A application, the highest yield EM. In 5 applications (2.52 kg/tree), the lowest yield was determined in the control group (0.78 kg/tree) (Bilgin et al., 2020).

In a study conducted in the Kashmir region of India, four selections were found in walnut (SKAU/002 (S1), SKAU/008 (S2), SKAU/024 (S3), and SKAU/040 (S4) in 6 different combinations of organic and inorganic fertilizers (T1): all inorganic NPK fertilizer; T2: 50% FYM fertilizer, 25% vermicompost, 25% poultry manure; T3: 75% NPK inorganic fertilizer, 25% through FYM; T4: 75% NPK through inorganic fertilizers + 25% through vermicompost; T5: 75% NPK through inorganic fertilizers + 25% through poultry manure; T6: 75% NPK through inorganic fertilizers + 25% through manure (1/3 FYM + 1/3 vermicompost + 1/3 poultry manure) the study has been done, looking at the results, the best result is from T4 application (tree height (16.12%), tree circumference (1.40%), tree canopy volume (37.85 m3), shoot elongation (0.81 m), fruit set (40.52%), fruit retention (58.21%), and yield (5.87 kg/tree). Compared to other select varieties, the maximum fruit set (38.96%) and fruit retention (57.53%) of the S1 variety were measured as higher results compared to other selections. The highest yield (5.86 kg/da) was obtained from the selection of, S2 compared to other varieties (Wani et al., 2016).

In a study of walnut yield and soil quality in Kashmir, India, four selections were walnut [(SKAU/002 (S1), SKAU/008 (S2), SKAU/024 (S3) and SKAU/040 (S4)] and six. fertilizer application in the first week of December (T1 (100% NPK recommended as per package of practices), T2 (FYM 50% + vermicompost 25% + poultry manure 25%), T3 (5% NPK inorganic fertilizers + 25% FYM), T4 (75% NPK inorganic fertilizers + 25% vermicompost), T5 (75% NPK inorganic fertilizers + 25% poultry manure) and T6 (75% NPK inorganic fertilizer, 25% (1/3 FYM + 1/3 vermicompost + 1/3 poultry manure))], the highest yield was obtained as a result of T4 application from S3 selection with 6.82 kg/tree, the highest nitrogen (338.59 kg/ha), phosphorus (20.80 kg/ha), calcium (1312.25 ppm), zinc (1.19 ppm), manganese (66.66 ppm), iron (55.95 ppm) and copper content (2.74 ppm) were found as a result of T5 application, the highest potassium (259.27 kg/ha) and magnesium (268.86 ppm) were obtained as a result of T2 application (Wani et al., 2017).

Dr. In a study conducted in a 10-year-old walnut garden at YS Parmar University of Horticulture and Forestry, 13 different fertilizers were applied, according to the results, 750 g nitrogen, 375 g phosphorus, 750 g potassium + 50 kg vermicompost fertilizer and It was observed that applications 562.5 g nitrogen, of 281.25 g phosphorus, 562.5 g potassium + 68.5 kg of vermicompost fertilizer were effective on the leaf nutrient status of trees (Bhattarai and Tomar, 2009).

In a study conducted in Otovalo canton of Imbabura province of Ecuador, 13 different applications (T1 = 25% Humus + 75% Husk of Rice, T2 = 25% Humus + 75% Pomina, T3 = 25% Humus + 75% Sand, T4 =% 25 Humus + 75% Wasteland Land, T5 = 50% Humus + 50% Husk of Rice, T6 = 50% Humus + 50% Pomina, T7 = 50% Humus + 50% Sand, T8 = 50% Humus + 50% Wasteland Land, T9 =75% Humus + 25% Husk of Rice, T10 = 75% Humus + 25% Pomina, T11 = 75% Humus + 25% Sand, T12 = 75% Humus + 25% Wasteland Land, T13 = Control) with a study on the germination time of walnut seeds, after the study, the highest germination and number of saplings were reached with 99.38% as a result of the application of 50% Humus + 50% Pomina (Cabascango, 2011).

In a three-year study with pecans, vermicompost, and a combination of 3 different fertilizers (urea, potassium nitrate, Hydro complex (N 12.4%, P_2O_5 11.4%, K_2O 17.7%, S 8%, Fe 0.2%) , Mn, 0.02%, Zn 0.02%, B 0.015%)) 4 replications, 4 different applications, applied (F1 = 30 g/tree synthetic fertilizer, F2 = 60 g/tree synthetic fertilizer, 5 kg/tree vermicompost and control group) soil properties and plant growth were examined, no significant change in soil pH was observed, an increase in salinity was observed in the last two years of the study, trunk diameter was achieved by synthetic fertilization or organic improvement, the highest P in the soil and C levels were obtained as a result of vermicompost application (Giuffré et al., 2017).

In a study conducted in the Kashmir region of India, the bio-efficacy of rhizobacteria isolated from walnuts grown in the Himalayas against five fungal pathogens in the future was investigated. As a result of in vitro evaluation of rhizobacteria against 5 fungal pathogens, namely Dematophora necatrix, Alternaria solani, Pythium aphanidermatum, Fusarium oxysporum and Phytophthora capsici in terms of biocontrol activity, most of the bacteria were found to belong to the genus Bacillus, in study 23, 20, 19, 21 and 20 isolates. D. necatrix, A. solani, F. oxysporum, P of WI 90 (66%), WI 63 (55.6%), WI 62 (43.8%), WI 63 (45.5%) and WI 65 (49%), respectively. phanidermatum and P. capsici, and has been found to be antagonistic and has maximal inhibition. The 12 most effective isolates were morphochemically and molecularly characterized and based on the 16S rDNA sequence, Bacillus licheniformis (isolates WI90), Bacillus subtilis (isolates WI63 and WI65), Bacillus tequilensis (isolate WI62), Bacillus cereus (isolateus luteus WI1236), WI41 and WI80 isolates), Micrococcus yunnanensis (WI30 and WI60 isolates), and Micrococcus sp. (WI11 and WI91 isolates) (Sofi and Dar, 2018).

In a study named "Effect of Microbial Liquid Fertilizer on Rooting of Fig (Bursa Black), Reverse Mulberry, Red Mulberry, Walnut (Tiger-86) Wood Cuttings", wood cuttings were taken from Fig, Reverse Mulberry, Red Mulberry, Walnut trees in two different periods during the winter rest season. After the cuttings were kept in 0, 25, 50, and 100 ml/L solution of 10×10^4 (w/w) microbial organic liquid fertilizer overnight, they were planted in plastic black pots containing perlite, the most species in terms of rooting were fig, red mulberry and reverse. No rooting was observed in the walnut while it was in the mulberry while increasing doses of organic microbial liquid fertilizer used in the experiment had a negative effect on rooting, it was observed that the optimum dose of 50 ml /L had a positive effect on root length, root diameter, shoot length and shoot diameter in cuttings planted in autumn (Dalkılıç et al., 2019).

The mineral nutritional status of the walnut orchards in Uşak was investigated by soil and leaf analysis, in the study soil samples were investigated by the composition, pH, electrical conductivity (EC), lime ($CaCO_3$), organic matter, useful phosphorus, potassium, calcium, magnesium, iron, zinc, manganese. and copper; In the leaf samples, additional nitrogen and boron mineral analyzes were made for these elements, according to the results of the analysis, 39% of the soil of the gardens was loam, 57% was clay loam, salinity was among normal values. Approximately 61% of the soils have lime problems, neutral or slightly alkaline in terms of pH value, mostly middle class in terms of organic matter content, 69% of the gardens are phosphorus, 78% magnesium, 96% zinc, and 98%. was found to be poor in terms of potassium; According to the leaf analysis results, it has been observed that the walnut orchards are deficient in 29% phosphorus, 76% potassium, 80% magnesium, 78% iron and 94% zinc and copper (Yıldız and Uygur, 2016).

In a study conducted for walnut growers in Uşak, the general situation of walnut growers was examined by making a survey, the rate of orchards smaller than 10 decares was 52%, and that the farmers engaged in breeding between 10-25 decares were 27%. Garden facilities with a distance of 10 x 10 m and more are 61%, Chandler and 22% Kaman varieties are in the first two places in terms of variety, 80% of the producers who regularly water their gardens and 49% of these producers Most of the cultural and technical operations such as irrigation with drip irrigation, soil cultivation (85%), fertilization (82%), pruning (76%) are carried out by the producers, the producers who cannot buy products are around 70% and the biggest reason (85%) is cold It has been determined that there is damage and as a harvest criterion, 50% of the producers are based on the period when the green shell begins to crack (Yıldız and Çolak, 2018).

In a study conducted on the "Western" variety of pecans, anaerobically digested bio-solids were applied to pecan nut trees for three years, it was observed that fruit shoots increased by 16% and the yield per tree increased by 11.3% as an average of three years, a decrease in heavy metal concentrations (As, Cd, Cr, Hg, Ni and Pb) was observed and also Salmonella spp. and Escherichia coli were not found (Tarango-Rivero et al., 2011).

In a study on pecans, it was observed that one of the most important elements of walnut development is nutrition, and some of the direct-acting elements for the best development of the fruit are N, P, K, Zn, and B (Acevedo-Barrera et al., 2013).

Two different nitrogen-binding bacteria (*Pseudomonas chlororaphis and Bacillus megaterium*) and two different phosphate-dissolving bacteria (*Arthrobacter pascens and Burkholderia cepacia*) were inoculated into the soil to make rock phosphate useful in the soil, the highest phosphorus solubility was obtained from the mixture of *Pseudomonas chlororaphis* and *Arthrobacter pascens* bacteria, a strong correlation was found between total organic acid production and phosphorus solubility as well as the correlation between pH and soluble phosphorus, as a result of the co-inoculation of Pseudomonas *chlororaphis* and *Arthrobacter pascens* bacteria, the highest plant height, root and shoot dry weight were observed and the maximum amount of nitrogen and phosphorus uptake was achieved from the soil, also, the combined use of *Bacillus megaterium* and *Arthrobacter pascens* failed, with this study, it was concluded that the co-inoculation of *Pseudomonas chlororaphis* and *Arthrobacter pascens* bacteria would be a good alternative to fertilization (Yu et al., 2012).

In a study conducted in California, "Paradox", which is widely used as a walnut rootstock, is sensitive to *Agrobacterium tumefaciens*, and against this important problem, the use of methyl bromide and Telone-C35 (1,3-dichloropropene and chloropicrin) is common and It has been stated that these applications significantly changed the microbial activity in the soil over time. It was assumed that the increase in microbial activity and diversity in the fumigated soil will cause competition against *A. tumefaciens* and reduce its density, three soil types (vermicompost and two different fermented microbial fertilizers) were commercially procured and the study was initiated, the study continued for 4 weeks, two commercial microbial fermentation mixtures had no effect, it was found that worm fertilizer decreased the *A. tumefaciens* population, and the reason for this was biotic (Strauss et al., 2015).

In a study, a trial was established on walnut plants using 3 synthetic and 3 natural and microbial inputs, N = 0; 16; 80; 160 and 320 g; P_2O_5 = 0; 7; 35; 70 and 140 g; K_2O 0; 7,5; 37,5; 75 and 150 g; composting 0; 250; 1250; 2500 and 5000 g; vermicompost 0; 100; 500; 1000 and 2000 g; mycorrhiza 0; 3.81; 19.05; 38.00 and 76.20 g it was applied as a result of the study, 226 kg / ha nitrogen, 121 kg / ha P_2O_5, 94 kg / ha K_2O, 3111 kg /

ha composting, 1905 kg / ha vermicompost for the production of 1.94 t / ha, 149 fruit / kg and 59% edible walnut and 33.02 g/cm mycorrhiza were used it was also observed that the required doses for production are 30% nitrogen and organic amendments, 50% phosphorus and potassium and mycorrhiza contributed 95% to fruit quality; It was also determined that fertilizer costs constitute 40.8% of the total expenses (Flores-Cordova et al., 2018).

In walnut nurseries, anaerobic soil disinfection was applied to control *A. tumefaciens* and other soil and seed-borne phytopathogens, considering that it could be an alternative option compared to fumigation, and after this application, its potential with worm manure was examined. In this study, 20 metric tons/ha of soil was covered with rice bran, which was covered with TIF for 6 weeks after watering for 24 hours, before this process *A. tumefaciens* and *Pythiumultimum* were buried under the ground in sterile net bags, and under anaerobic conditions within a week. Paradox walnut rootstock seeds were immersed in *A. tumefaciens* inoculum before planting and planted in such a way that anaerobic soil disinfection efficiency and the effects of vermicompost application after anaerobic soil disinfection on the disease incidence were reached. The amount of A. tumefaciens was found to be significantly less than the fields without vermicompost compared to the control plots containing walnut seeds and vermicompost (Sarah et al., 2014).

"Organic Walnut Production and Turkey Importance of" our work in the country has in terms of organic coconut productivity in the world is a very important cultural practice to take part in top place and that by combining with new farming methods, traditional methods are stated (Özkan, 2015).

According to the studies conducted, it has been observed that the use of natural fertilizers has become widespread in recent years. It has been observed that mostly worm castings are used in studies. In studies, it has been observed that the use of worm fertilizer has shown the expected effect in all studies in real terms, and it has been found that it increases the vitality in the soil, suppresses some harmful microorganisms and prevents their damage, and significantly increases the nutrients and yield in the soil. In addition, it has been observed that microbial fertilizers can be sufficient for plant nutrition.

IV. Conclusion and recommendations

The important factors that determine the yield and quality in walnut cultivation are the right variety selection, regular irrigation, and adequate plant nutrition. Although our country has an important place in the world in terms of the number of walnut trees, it could not reach the expected result in terms of yield due to reasons such as wrong variety selection, inadequate and correct nutrition of plants.

In the world walnut production with 2.521.504 tons of production according to yield in 2019. FAO data on China has located in the first row respectively the United States 592.390 tonnes, Islamic Republic of Iran 321.074 tonnes, Turkey 225.000 tons, Mexico shared their rest position with 171.368 tonnes (FAO, 2019).

Looking at the above studies in terms of yield and quality, it has been determined that microbial and organic fertilizers are really effective in plant nutrition, and in some studies, they have more effect when given with compound fertilizers. In some studies, it has been determined that worm manure inhibits the activity of a microorganism such as *Agrobacterium tumefaciens*, which causes one of the most important diseases in fruit growing.

References

[1]. Acevedo-Barrera, A.A., Soto-Parra, J., Yañez-Muñoz, R.M., 2013. "Impacto de la fertilizacion nutricional en la calidad de la nuez pecanera," *Juyyaania*, s. 1, ss. 1.

[2]. Akça, Y., 2001. "Ceviz Yetiştiriciliği,"*Arı Ofset Matbaası.*

[3]. Anonymous 2020. "https://en.wikipedia.org/wiki/Walnut,"

[4]. Bhattarai, B.P., Tomar, C.S., 2009. "Effect of Integrated Nutrient Management on Leaf Nutrient Status of Walnut (*Juglans regia* L.)," *Nepal Journal of Science and Technology*, c. 10, s. 2009, ss. 63-67.

[5]. Bilgin, N.A., Mısırlı, A., Şen, F., 2020. "Cevizde (cv. Chandler) Kompoze Mikrobiyal Gübre Kullanımının Verim ve Kalite Parametreleri Üzerine Etkilerinin Araştırılması," *Ziraat Mühendiliği*, s. 370, ss. 84-93.

[6]. Cabascango, M.V.C., 2011. "Evaluación de cuatro tipos de sustratos y tres niveles de humus en la obtención de plántulas de nogal (*juglans neotrópica*) en la zona de Otavalo, Provincia de Imbabura," *Tez Çalışması*.

[7]. Dalkılıç, Z., Yersel, B., Ünal, M., Özer S., Yavaş, S., 2019. "İncir (Bursa Siyahı), Ters Dut, Kırmızı Dut, Ceviz (Kaplan-86) Odun Çeliklerinin Köklenmesi Üzerine Mikrobiyel Sıvı Gübrenin Etkisi,"*IJAAES International Journal of Anatolia Agricultural Engineering*,c. 2019 s. Özel Sayı 1, ss. 60-66.

[8]. FAO, 2019.http://www.fao.org/faostat/en/#rankings/countries_by_commodity

[9]. Flores-Cordova, M.A., Soto-Parra, J.M., Javier-Piña., F., Sánchez-Chávez, E., 2018. "Contribution of nutrients, organic amendments and mycorrhizae on the yield components in pecan walnut (Carya ilinoinensis),"*Cultivos Tropicales*, c. 39, s. 1, ss. 35-42.

[10]. Giuffré, L., Ciarlo, E., Giardina, E.B., Bonafina, C., 2017. "Fertilization Strategies In Pecan And Effects On Soil Properties And Plant Growth," *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, c. 10, s. 4, ss. 21-25.

[11]. Özkan, Y., 2005. "Organik Ceviz Yetiştiriciliği ve Türkiye Açısından Önemi,"*Bahçe Ceviz*, c. 34, s. 1, ss. 177–185.

[12]. Sarah, L.S., Bowne, G., Kluepfel, D.A., 2014. "Effect of anaerobic soil disinfestation and vermicompost on soilborne pythopathogenic agents under tree-crop nursery conditions,"*Annual meeting of the American Phytopathological Society*.

[13]. Sofi, S., Dar, Gh.H., 2018. "In vitro Bioefficacy Of Rhizobacteria, Isolated From Walnut (*Juglans regia* L.) Rhizosphere In North-Western Himalayas, Against Five Fungal Phytopathogens," *Applied Biological Research*, c. 20, s. 3, ss. 234-243.

[14]. Strauss, S.L., Stover, J.K., Kluepfel, D.A., 2015. "Impact of biological amendments on *Agrobacterium tumefaciens* survival in soil," *Applied Soil Ecology*, s. 87, ss. 39-48.
[15]. Şen, S.M, 2011. "Ceviz Yetiştiriciliği, Besin Değeri, Folkloru," *4. Baskı ÜÇM Yayınları*, ss. 220.
[16]. Taban, S., Şahin, Ö., 2020. "Gübre Kullanımının Öyküsü," *Ankara Ü. Açık Ders Notları.*
[17]. Tarango-Rivero, S.H., Teresa, M., Herrera A., Orrantia-Borunda, E., 2011. "Crecimiento, rendimiento, metales pesados y microorganismos en suelo y frutos de nogal pecanero fertilizados con biosólidos,"*Rev. Mex. Cienc. Agríc*, s. 2, ss. 6.
[18]. Wani, I.A., Bhat, M Y., Dar, M.A., Mehraj, S., Bisati, I.A., Wani, S.A., Khanday, M., 2016. "Response of Different Walnut (*Juglans regia* L.) Selection to Combined Application of Inorganic Fertilizers and Organic Manures," *American Journal of Experimental Agriculture*, c. 12, s. 6, ss. 1-10.
[19]. Wani, I.A., Mehraj, S., Ali, M.T., Hassan, A., Wani, S.A., Hussain, S., Bisati, I.A., 2017. "Effect of Inorganic and Organic Fertilisers on Yield and Soil Nutrient Status of Walnut Orchard," *International Journal of Plant & Soil Science*, c. 16, s. 2, ss. 1-13.
[20]. Yıldız, E., Çolak, A.M., 2018. "Uşak İli Ceviz Yetiştiriciliğinin Teknik Yapısı," *Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, c. 22, s. 1, ss. 166-171.
[21]. Yıldız, E., Uygur, V., 2016. "Uşak İli Ceviz Bahçelerinin Mineral Beslenme Durumları," *Süleyman Demirel Üniversitesi Ziraat Fakültesi Dergisi*, c. 11,s. 2, ss. 70-78.
[22]. Yu, X., Liu, X., Zhu, T., Liu, G., Mao, C., 2012. "Co-inoculation with phosphate-solubilzing and nitrogen-fixing bacteria on solubilization of rock phosphate and their effect on growth promotion and nutrient uptake by walnut," *European Journal of Soil Biology*, s. 50, ss. 112-117.

Ayşen Melda Çolak, et. al. "Investigation of the Effect of Organic Fertilizers Used in Walnut (Juglans Regia L.) Cultivation on Yield and Quality." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)*, 14(4), 2021, pp. 01-05.