

The Effect of Foliar Spraying with Calcium Chloride and Fertilization with Fish Protein Hydrolysate on the Growth and Yield of Some Cucumber Hybrids Grown in Plastic Houses

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I. Abstract

The effect of foliar application of calcium chloride and fish protein hydrolysate at the 4-5 true leaf stage on cucumber hybrids Sayff, Shady, Darina, Super Faris and Ballistic was studied. The study involved eight factorial treatments. The factorial treatments were combinations of four levels of calcium chloride (3%, 2%, 1%, 0%) for Sayff and Shady hybrids and fish protein hydrolysate (0%, 2%, 4%, 6%) for Darina, Superfaris and Ballistic hybrids. The hybrid Shady is compared to variations based on plant height, stem diameter, fresh weight, dry weight, moisture percentage, average fruit weight, vitamin C content, and potassium ion absorption. Fruits contain 38.97% calcium relative to the Sayff variety. The Sayff variety surpassed the Shadi variety, achieving a 12.92% increase in early revenue inside the plastic home. The plants get calcium chloride as nourishment. The treatment with a 3% concentration demonstrated a significant enhancement in the fresh weight of the plant, exhibiting a 14.73% increase in calcium chloride content of the fruits, a notable reduction in the percentage of potassium ions infiltrating the fruits, and a substantial rise in overall productivity of the house by 19.98% relative to the control treatment. Plants treated with 6% fish protein hydrolysate exhibited considerable superiority in all assessed vegetative characteristics, root and flower development metrics, and overall yield. Darina surpasses other types in both fruiting and yield.

Keywords: *Cucumber hybrids, calcium chloride, fish protein hydrolysate, plastic houses .*

II. Introduction

Cucumis sativus L. is one of the most important summer vegetable crops in Iraq. It is grown in two seasons, spring and autumn, and may also be produced in a controlled setting. The fruits are usually eaten fresh or preserved by pickling. The fruit has 96% water content and 0.7 mg protein, 14 calories, 24 mg calcium, 20 IU vitamin A, 0.075 mg riboflavin (vitamin B2) and 0.3 mg niacin per 100 g (Matloub *et al.*, 1989). In 2007, the planted area in Iraq was around 5000 ha, with a production of 480,000 tons and a yield of 8.727 tons/ha (FAO, 2009). In order to increase the production of the plants in the country it is essential to use basic agricultural methods based on good scientific concepts such as chemical fertilization. Calcium is an important macro-nutrient for plants. It has several physiological functions in plants' growth and development because it helps in the manufacture of pectin molecules linking cell walls and forming the middle lamella. Calcium has an important role in controlling the spoiling during the storage. Higher calcium content in fruits shows more resistance to the microbial infections which cause deterioration after storage. It also enhances the hardness of the fruits by integrating into the composition of the cell wall and serving as a crucial component in the cohesion of pectin, so augmenting the rigidity of the cell wall (Bangerth *et al.*, 1972). Consequently, calcium insufficiency within the minimal threshold results in the cracking of fruits. The phenomenon arises from the characteristics of divalent calcium, which enhances the structural integrity of fruit cell walls by facilitating the formation of pectins that associate with calcium, so augmenting the fruits' resistance to internal pressure (Siddiqui and Bangerth, 2004). Liang *et al.* (2008) discovered that the application of calcium chloride at a concentration of 15 mmol/L on cucumber plants cultivated in greenhouses optimally enhanced plant development by elevating the rate of photosynthesis

and augmenting yield. This study was done due to the absence of prior research on the impact of calcium chloride spraying on the development of hybrid cucumber cultivars Saif and Shadi cultivated in plastic homes in desert conditions in Basrah Governorate.

In 2015, the cultivated area for this crop in Iraq was 82,160 dunums. The total output amounted to 156,334 tons, with a poor yield of 1.902 tons per dunum (Central Statistical Organization, 2016). Enhancing cucumber output may be achieved by expanding the cultivation area, selecting superior cultivars, and using traditional agricultural methods. Nonetheless, expanding the area is challenging owing to the adverse effects on the production of other crops. Consequently, the optimal method to enhance cucumber output is to pick high-yielding genotypes suited to the agricultural requirements of the specific region. (al-Rawahi *et al.*, 2011) The genotypes of parthenogenetic cucumber do not need pollination or fertilization for fruit development, and they exhibit much greater vigor compared to conventional cucumber cultivars. Moreover, they have a high price owing to the higher price of seedless fruits than seeded fruits (Thapliyal, 2017). Many rich countries have started to go to organic agriculture, attempting to reduce the use of chemical toxins as much as possible. It aims to grow plants that are free from toxins of pesticides and artificial fertilizers to provide clean and healthy harvests (Farhan, 2008). Fish flesh contains minerals such as calcium, phosphorus, salt and magnesium, trace elements iodine, iron, copper and vitamins B, A and D. Many people living near the water or on the coast are supplied largely with fish. Numerous studies indicate that fish waste, including bones, intestines, skin, scales, and fins, constitutes around fifty percent of the fish's weight and serves as an essential source of protein, enzymes, and oil (Bhaskar and Mahendrakar 2008). Waste encompasses all discarded materials and is regarded as a significant environmental pollutant. The sorts of garbage differ according on their source. For instance, slaughterhouse waste promotes the proliferation of flies and harmful bacteria by providing an optimal habitat for their survival and disease dissemination. Waste is rapidly consumed by microorganisms referred to as decomposers. Balkhandev (2020) asserts that it is essential to create methods that enhance crop yields and provide an optimal diet for plants to preserve soil biodiversity, mitigate pollution, and facilitate high-quality food production and sustainable harvests (Ronga *et al.*, 2015).

2- The study's objective

- 1- Study the effect of spraying calcium chloride on a cucumber hybrid.
 - 2- Study if irrigation with a hydrolyzed fish protein extract solution changes The growth and yield of three female cucumber hybrids.
 - 3- Production of an organic crop free of chemical pollutants.
 - 4-Introducing new hybrids to Iraq to find out the best of them
 - 5- Reduced fish waste and store odors.
- 3-Review sources
- 3-1Effect of Hybrids

Hybrids significantly enhance overall output owing to their high yield, early maturity, superior quality, and disease resistance. A rapid enhancement in production per unit area may be attained by the use of high-quality seeds, novel hybrids, and the implementation of contemporary technology (Tomar, 2017). Parthenocarpic cucumbers, which do not need pollination or fertilization for fruit development, have a production capacity that surpasses that of traditional cucumber cultivars. Moreover, it yields a substantial economic return, since seedless fruits possess greater value than their seeded counterparts (Thapliya, 2017). Cucumber genotypes exhibit significant cross-pollination potential and extensive genetic diversity in vegetative development and fruit traits. Being monoecious, it is suitable for hybrid seed production. Consequently, hybridization in breeding projects is regarded as one of the most efficacious methods to use genetic variety in cucumbers (Hemant and Tiwari 2018). Plant breeders must understand techniques for producing female seeds to economically develop hybrid cucumber applications in greenhouses. Seedless cucumber fruits intrigue customers globally, since field-grown cucumbers often have a rough texture. They are advantageous to the touch when situated in greenhouses (Kumari *et al.*, 2021). The introgression method is a technique in plant breeding that facilitates the rapid acquisition of favorable genetic structures, which can be evaluated under the conditions of the importing nation, allowing for the selection of varieties suited to specific environmental conditions by specialized research institutions (Hassan, 2005).

3-1-1Effect of hybrids on vegetative growth

Abdullah *et al.* (2012) identified in a research of three cucumber hybrids cultivated in plastic homes (Hadeel, Toshka, and Shabah) that the Toshka hybrid exhibited a considerably greater plant height than the other hybrids. Al-Shammari and Saud (2013) observed that, while cultivating three cucumber hybrids (BF 372, AS1 0001, AS2 001) in unheated plastic homes, the AS1 hybrid exhibited a substantial superiority in plant height, reaching 3.44 meters, compared to hybrids AS2 and BF. In a study by Al-Bayati and Kamel (2014) assessing two cucumber hybrids, Dates and Sayff, cultivated in unheated plastic houses, the Dates hybrid exhibited a significantly greater leaf count than the Sayff hybrid, while no significant difference was observed in plant height between the two hybrids. Yousefi (2016) conducted a research to assess three cucumber hybrids: Saturn, 195, and 29. The findings indicated that the 195 hybrid exhibited substantial superiority in both plant height and stem diameter relative to the other hybrids. Hussein and Atallah (2017) demonstrated in their study of two cucumber hybrids, Grass and Karima, cultivated in an unheated greenhouse, that the Karima hybrid exhibited significant superiority in plant height, leaf count, and dry weight of the vegetative group relative to the Grass hybrid. Al-Mutawwari (2010) reported that in unheated greenhouse circumstances, the Shady cucumber hybrid outperformed the Sayff hybrid in plant height, stem diameter, and both fresh and dry weight. Ehiokilen and Samson (2010) conducted a research on two cucumber hybrids, Palmetto and Ashley, under covered culture circumstances. The Palmetto hybrid significantly outperformed the Ashley hybrid for plant height, leaf count, and leaf area. Abdullah *et al.* (2012) conducted a research to assess the performance of three cucumber hybrids: Hadeel, Toshka, and Shabah, over the winter season. During the 2003-2004 and 2004-2005 seasons, studies indicated that the hybrid Toshka exhibited markedly increased plant height in both years. The increase in height percentages was (21.1% and 37.95%) and (11.9% and 32.21%) relative to the hybrids Hadeel and Shabah. Al-Mohammadi and Al-Naif (2013) established that the cultivation of two cucumber hybrids, Sayff and Ryan, in unheated greenhouse conditions during the 2012 and 2013 seasons demonstrated that the hybrid Sayff exhibited significant superiority in leaf area and leaf count in the 2012 season compared to hybrid Ryan. Nonetheless, in the 2013 season, no notable difference was seen between the two hybrids. Neither hybrid had a substantial impact on the total dry weight of the vegetation in either season. A research by Sahoo (2014) evaluated five cucumber hybrids: Himangi Isatish, Hilton, Alamgir_ct_180, and Poona. Khira cultivated under controlled settings demonstrated that the Isatish hybrid had remarkable superiority in both plant height and total leaf count relative to other hybrids. A field experiment by Chikezie *et al.* (2016) assessed sixteen cucumber hybrids, including Straight, Table Green, Poinsett, Centriolo, Regal, Sumter, Ashley, Marketer, Calypso, W12757, MarketMore 76, Royal F1, Beit Alpha 8, Delilha, Zeine, and Palmetto. The results showed that the Ashley hybrid was superior in plant height and leaf number with the highest values. The Sumter hybrid, by contrast, has greater leaf area. In a 2016 study of five cucumber hybrids (Faris, Sayff, Silyon RZ, BARAA 138 and Dalia), Vian found that Silyon RZ produced the tallest plants compared to the other hybrids. Al-Ibrahimi (2017) studied four varieties of hybrid cucumber in a controlled setting. The varieties were Baraa 138, Silyon, Rami and Sayff. The findings indicated that the hybrids Baraa 138 and Silyon exhibit differences from other hybrids regarding plant height and stem diameter. The hybrid Sayff exhibited a much greater total leaf count; nevertheless, no significant differences in leaf area were observed amongst the hybrids. Hassan and Atallah (2017) examined the cultivation of two cucumber hybrids. Specifically, Grass and Karima, results indicated that the hybrid Karima exhibited considerably greater plant height, leaf count, and dry weight of the vegetative group compared to the hybrid Grass. Al-Bayati (2020) conducted a research on the cucumber hybrids Zain and Sultan cultivated in unheated plastic greenhouses. The hybrid Zain substantially outperformed the hybrid Sultan for plant height, leaf count, leaf area, and plant length. Mohammed *et al.* (2020) conducted a study to assess the impact of cultivating various cucumber hybrids under protected conditions, which included three locally developed hybrids at the College of Agriculture, University of Anbar (H2, H3, H4), compared to a hybrid sanctioned by the Iraqi Ministry of Agriculture (H1) during the autumn seasons of 2018-2019. The hybrid (3H) exhibited much greater leaf area and dry weight in both seasons, measuring 110.69 dm² and 88.84 g in the autumn, and 117.20 dm² and 96.41 g in the spring. Hassan's (2020) research on the development and germination of two cucumber hybrids (Beitha alpha, Biyar delta) demonstrated that the Beitha alpha hybrid exhibited considerably greater height and dry weight, surpassing the vegetative group by 12.27 cm and 6.55 g, respectively, in comparison to the Biyar delta hybrid. Albayati (2020) documented the development of two cucumber hybrids, Zain and Sultan, and determined that hybrid Zain surpassed hybrid Sultan in terms of plant height, leaf count, and leaf area. Albayati *et al.* (2023) performed a research to assess the impact of three cucumber hybrids (Ronnie, Modhesh, and Bahir), revealing that the novel hybrid Ronnie surpassed the other two in plant height.



3-1-2 Effect of hybrids on leaf chemical components

Rasool *et al.* (2009) performed a research in which two cucumber hybrids, "Storm" and "Sultan," were cultivated in a controlled setting. The results indicated that the hybrid "Storm" had a much higher proportion of chlorophyll in its leaves compared to the hybrid "Sultan". A research by Abdulrahman *et al.* (2013) on two cucumber hybrids, Maxeem and Summit, revealed that the Maxeem hybrid had a considerably higher total chlorophyll content in the leaves, exceeding that of Summit by 38.280%. Al-Shammari and Saud (2013) indicated that there was no significant variation in chlorophyll concentration among the leaves of three cucumber hybrids, AS1, AS2, and BF372. Sahoo (2014) conducted a study assessing five cucumber hybrids cultivated in a controlled environment: Isatish, Hilton, Alamgir-ct-180, Poona Khira, and Himangi. The findings indicated that the Isatish hybrid exhibited a significantly greater leaf potassium percentage compared to the Alamgir-ct-180, Poona Khira, and Himangi hybrids. Al-Jubouri *et al.* (2017) performed a research on three cucumber hybrids: H, P2, and P1, over the spring and fall seasons. The findings indicated that hybrid H had a markedly greater leaf chlorophyll percentage compared to the other hybrids. A study by Al-Ibrahimi (2017) assessed four cucumber hybrids—Baraa 138, Rami, Sayff, and Silyon—cultivated in Thi Qar Governorate. The findings indicated that the Rami and Silyon hybrids exhibited significantly higher leaf carbohydrate content than the Sayff and Baraa hybrids. Baraa and Rami hybrids had considerably greater leaf chlorophyll content than Sayff and Silyon hybrids.

3-1-3 Effect of hybrids on flowering growth parameters

A research by Al-Khadiri (2008) revealed that the cucumber cultivars Dine and Hybrid, cultivated in plastic homes, had considerably more fruit set than the Hatem cultivar. The Hatem cultivar demonstrated a marked advantage in bloom quantity relative to the other two varieties. A study by Khan (2013) assessed six cucumber hybrids: Nun-3134, Kian, Isatis, Infinity, Nun-3121, and Nun-3141. The findings indicated that hybrid Nun-3141 exhibited a significantly greater number of flowers per plant than hybrid Infinity, whereas hybrid Nun-3134 demonstrated a significantly higher fruit set percentage compared to the other hybrids. Sarhan and Salih (2014) discovered no significant difference in the quantity of flowers and the set % of cucumbers cultivated in a protected environment, namely Reem and Karol. A research by Sahoo (2014) assessed five cucumber hybrids: Isatish, Hilton, Alamgir-ct-180, Poona Khira, and Himangi. The findings indicated that the Isatish hybrid was significantly better as a proportion relative to other hybrids. Pragathi (2014) did a research to assess nine cucumber hybrids: Don, Encounter-962, Indam-Swadisht-43, Kareena, Maharaja, Multi-Star, Sedona, Silyon, and Vahini. The findings indicated that the Silyon hybrid exhibited a considerably greater number of blossoms per plant compared to the Don hybrid. The Kareena hybrid had a markedly higher set % in comparison to the Don hybrid. Yousefi's (2016) research, which examined three cucumber hybrids—Saturn, 195, and 29—revealed that the Saturn hybrid exhibited a significant increase in flower quantity relative to the other hybrids. Ibrahimi (2017) did a research on four hybrids of the same plant: Baraa 138, Rami, Sayff, and Silyon. The hybrids Baraa 138, Rami, and Sayff exhibited a considerably greater quantity of blooms than the hybrid Silyon. The hybrid Baraa 138 shown a significant advantage in fruit set % relative to the other hybrids Rami, Sayff, and Silyon.

3-1-4 The effect of hybrids on quantitative and qualitative yield indicators.

In a research conducted by Al-Sahaf *et al.* (2011), three cucumber hybrids—Ghazir, Najm, and Babylon—were assessed over the spring and fall seasons. The findings indicated that the hybrid Ghazir exhibited remarkable superiority in fruit quantity, average fruit weight, yield per plant, early yield, and overall yield relative to other hybrids. An experiment done by Abdullah *et al.* (2012) observed the cultivation of three cucumber hybrids, namely Hadeel, Toshka, and Shabah, in plastic housing. The findings indicated that the hybrid Toshka had a marked superiority in yield per plant, early yield, and overall output, demonstrating a substantial difference from the other hybrids, which showed no variations. A study conducted by Al-Habar *et al.* (2013) assessed the performance of seven female cucumber hybrid cultivars: Summit, 276 Ameer, Grass, Baraa, Karol, Shadi, and Laheeb, during the spring and autumn seasons. The results showed that the hybrid cultivar Grass was significantly better to all other cultivars in fruit weight, quantity of fruits per plant, early production and total yield in both seasons. Al-Mohammadi and Al-Naif (2013) studied two cucumber hybrids (Ryan and Sayff) grown under protected conditions throughout the seasons of 2012-2013. The researchers found no significant effect of the hybrids on the number of fruits and output per plant. Pragathi (2014) conducted a study to evaluate the performance of nine cucumber hybrids viz., Don, Encounter-962, Indam-Swadisht-43, Kareena, Maharaja, Multi-Star, Sedona, Silyon and Vahini. The results suggested that the Multi-Star hybrid was much better than the Sedona hybrid in per plant output and total yield. Don hybrid showed significant advantage in fruit length and diameter as compared to other hybrids and fruit weight as compared to Multi-Star hybrid. Sahoo (2014) analyzed five cucumber hybrids i.e. Isatish, Hilton, Alamgir-ct-180, Poona Khira and Himangi. Isatish hybrid was

superior to other hybrids for fruit length, average fruit weight, number of fruits per plant, yield per plant and overall yield. Mahmoud and Al-Rawi (2015) studied four cucumber types namely, Sayff, Reem, Silyon and Datis, and found that Datis had a higher yield of fruits than Sayff and Reem. The Silyon variety was superior to other varieties in fruit weight, length and total yield, while the Sayff variety was superior in total soluble solids. Supermarketer hybrid gave much greater fruit weight and number of fruits per plant than the other two hybrids, Poinsett and Marketer (Ikenganyia *et al.*, 2015). Yousefi (2016) observed that the three cucumber types, Saturn, 195, and 29, have little influence on yield parameters including fruit length, diameter, and weight. The research by Vina (2016) examined five cucumber varieties: BARAA 138, Dalia, Faris, Sayff, and Silyon RZ, revealing that the hybrid Silyon RZ had a markedly higher yield per plant and overall yield compared to the hybrid Dalia. In comparison to the hybrid Dalia, the hybrid Faris exhibited a superior quantity and yield of fruits. The hybrid Dalia has a much larger fruit diameter than the hybrid Faris. In their examination of four cucumber hybrids—Pointsett-76, Marketer, Supermarketer, and Ashley—Adinde *et al.* (2016) found that Pointsett-76 significantly outperformed the others in terms of fruit quantity, fruit weight, fresh fruit weight, and overall yield (ton/ha). In 2017, three cucumber hybrids—H, P2, and P1—were examined throughout the spring and fall seasons. The hybrid H outperforms the other hybrids in terms of yield per plant, initial yield and aggregate yield. Kumar *et al.* (2017) performed a research to assess sixteen cucumber hybrids: Kafka, Dinamik, Fantasy, RS 03602833, Kian, KUK 9, Oscar, Valleystar, KUK 6, 52-23, Multistar, Y-225, JSCU 01, CBA 910569500, Ronino, and Pruva. The hybrid JSCU 01 surpassed the hybrid KUK 9 in both fruit length and weight relative to all hybrids. The hybrid KUK 9 has a much larger fruit diameter than the hybrid CBA 910569500. The hybrid Multistar yields much more fruits per plant than the hybrid JSCU 01. The hybrid Valleystar had a much superior yield per plant in comparison to the hybrids Kafka, Dinamik, Fantasy, JSCU 01, CBA 910569500, Ronino, and Pruva. The hybrid Oscar exhibited much higher overall yields compared to the hybrids Kafka, Dinamik, Fantasy, KUK 6, Y-225, JSCU 01, CBA 910569500, Ronino, and Pruva. Hussein and Atallah (2017) discovered that the Grass cucumber hybrid exhibited substantial superiority over the Karima hybrid in terms of fruit length, weight, fruit quantity per plant, and overall yield per plant. Chinatu *et al.* (2017), in their investigation of seven cucumber hybrids—Belt Alpha, Point Set, Market More, Regal, Unbeit, Zeina, and Ashley—planted during the 2015-2016 seasons, determined that the Regal hybrid exhibited a statistically significant superiority in fruit weight relative to all hybrids, as well as in the number of fruits and total yield (ton/ha) compared to the Belt Alpha and Ashley hybrids. The findings indicated that the Belt alpha hybrid had a much greater fruit length than the Point set, Zeina, and Ashley hybrids. In his research on four cucumber hybrids—Baraa 138, Rami, Sayff, and Silyon—Al-Ibrahimi (2017) determined that the hybrids Rami and Baraa 138 exhibited a considerably greater quantity of fruits. The hybrid Baraa 138 shown a significant advantage in yield per plant.

3-2-Organic matter

The effective control of fertilizer application to ensure robust production while safeguarding the environment has been a significant challenge in recent years. Augmenting output to satisfy global food demand is highly dependent on synthetic fertilizers, resulting in human health issues as well as land, water, and air contamination. Consequently, organic agriculture arose as a remedy to mitigate these issues and safeguard human and animal health (Adnan and Anjum, 2021). The incorporation of fish dung markedly elevated positive ions, with ammonium levels rising 16-fold and potassium levels increasing 35-fold; however, the enhancement attributed to chemical fertilizers was just 28%.

Magnesium levels increased thrice, whereas calcium levels rose 1.5-fold. The augmentation of nutrient availability resulted in enhanced crop yields. Moreover, fish waste fertilizer bolsters sustainable agriculture and the viability of fish farms by converting 30-70% of their waste into organic fertilizer, so offering both productive and environmental advantages to the agricultural sector (Ahuja *et al.*). Fish waste serves as an exceptional fertilizer, rich in essential elements for crop development, including nitrogen, phosphorous, and potassium. Moreover, calcium is present in this waste and may be used to amend calcium-deficient soils. Jaies *et al.* (2024). The disposal of fish waste presents ecological challenges as well as disposal complications. Therefore, it is essential to identify sustainable methods for using this trash. Numerous studies have shown that fish waste is rich in bioactive substances, which may be extracted and purified, including bioactive peptides, oligosaccharides, fatty acids, enzymes, water-soluble minerals, and biopolymers. Geethanjali *et al.* (2020) identify fish waste as including numerous components, including flesh, shells, skin, viscera, bones, and fluids. This waste comprises a diverse array of fish species or fishing components of little or negligible commercial value, including tiny or injured commercial species, as well as those that do not migrate in sufficient numbers for sale (Caruso, 2016). Approximately two-thirds of fish are wasted as garbage, leading to considerable environmental and economic consequences (Wu and Song, 2021). Fish waste, owing to its nutritional makeup, may enhance compost or provide nutrients to plants (Løes *et al.*). Fish waste has historically been used as fertilizer owing to its nutritional density, particularly in nitrogen and phosphorus, and its fast breakdown. Approximately 75% of the



entire weight of fish results in solid waste, including intestines, head, skin, bones, fins, and carcasses post-processing. This trash is abundant in nitrogen, potassium, phosphorus, and trace minerals. Ghaly *et al.* (2013) and Radziemska *et al.* (2018) investigated the impact of fish waste-derived fertilizers on vegetable growth and outcomes. A pot experiment was conducted to examine the impact of various fertilizers on the growth of snow lettuce (*Lactuca sativa* L.) and to analyze its whole chemical makeup and microelements.

3-2 -1Effect of organic matter on vegetative growth indicators

Staley *et al.* (2013) observed that organic fertilizers produced from the decomposition of fish waste serve as a natural stimulant that promotes vegetative and root development in horticultural plants, providing an effective alternative to artificial fertilizers. Numerous studies have demonstrated that decomposed fish manure can yield effects comparable to chemical fertilizer NPK in enhancing the dry and fresh weight of plants such as *Amaranthus hybridus*, *Solanum macrocarpon*, *Celosia argentea*, and *Vigna unguiculata*. The findings indicated a considerable rise in carotenoid levels with the addition of fish organic fertilizer. Lema and Degebassa (2013) performed an experiment using fish waste fertilizers, inorganic fertilizers, and non-decomposed fertilizers to assess their effects on the development and productivity of tomato plants. The results showed that fish waste fertilizers considerably affected the height of the plants compared to other fertilizers. Rajasree and Aranganathan (2016) reported that the application of 5% and 10% liquid fish organic fertilizer significantly increased the plant height of tomato plants (*Solanum lycopersicum*) after 30 days of cultivation with heights of 50.8 and 54.29 cm, respectively. The results were much higher than normal treatment and set fertilizer with height 38.6 cm and 33.5 cm respectively. Fertilizer application of 15% fish fertilizer gave an average of around 50 leaves per plant, while the recommended fertilizer treatments delivered just 33 leaves per plant. Priyanka *et al.* (2019) reported that foliar application of fish amino acids from degraded fish waste improved vegetative growth of mung bean (*Vigna radiata*). The height of plants using this fertilizer at 1% gave 34.8 cm whereas the control treatment produced plants of 28.0 cm. Mustafa *et al.*, (2022) observed that sweet pepper plants height significantly increased by the use of fish extract at 10 and 20 ml concentration. The height of sweet pepper plants were 35.33 cm at 10 ml concentration and 27.33 cm at 20 ml concentration while 17.16 cm at 0 ml concentration. Karo and Marpaung (2020) revealed that the use of fish fertilizers at the rate of 1000 kg/ha on leek plants increased the height of the plants. Sutriana *et al.* (2023) did an experiment to determine the influence of river fish waste with different concentrations of 0, 5, 22, 45, 67.5, and 90 ml on the development of leek plants. The concentrations of 90 and 67.5 ml of fish waste resulted in a significant enhancement in plant height, leaf count, tuber formation age, wet tuber weight, and dry tuber weight. Pakeerathan *et al.* (2023) discovered that the use of fish emulsion with other organic fertilizers enhanced the vegetative and root development of marigold (*Amaranthus viridis* L.). The application of fish emulsion in conjunction with Vermicompost extract yielded the most significant average growth characteristics, with a leaf area of 17.3 cm, a plant height of 27.13 cm, and a root length of 19.95 cm. Moreover, there was a notable increase in the plant's fresh and dry weight, with the fresh weight attaining 4.92 g and the dry weight reaching 1.63 g, while the leaf count was 11.25 leaves per plant. Ramesh *et al.* (2020) observed that the application of fish amino acids at several quantities (4%, 3%, 2%, 1%, 0.5 ml) on cucumber plants was conducted. L -1 At a concentration of 2%, the chlorophyll content dramatically increased, reaching values of 26.5 and 26.10 compared to the other concentrations.

3 -2-2Effect of organic matter on the chemical components of leaves

Mazur and Radziemska (2014) conducted an experiment cultivating radish (*Raphanus sativus*) in Sinadin, using an organic fertilizer composed of various elements, with fish waste comprising 80% of its formulation. The findings indicated that the mean leaf nutrient concentrations of phosphorus (P), potassium (K), calcium (Ca), and sodium (Na) were markedly elevated in all treatments using organic fertilizer in comparison to those employing mineral fertilizer. Shamsavani *et al.* (2017) shown that the incorporation of fish waste significantly enhanced the quality of cowpea (*Vigna unguiculata*) seeds cultivated in greenhouses, when compared to artificial fertilizers. This enhancement resulted in a substantial elevation in protein and phosphorus concentrations in the seeds. A study conducted by Radziemska and colleagues (2019) assessed the efficacy of fertilizers derived from fish waste decomposition in agriculture, revealing that the application of this fertilizer to agricultural soil resulted in a substantial enhancement of macronutrients in the leaves of snow lettuce (*Lactuca sativa* L.). Nitrogen levels rose by 78.6%, phosphorus by 61.8%, and potassium by 56.3%. Moreover, the concentration of micronutrients was similarly elevated. Hussein and Ahmed (2020) noted that the application of varying concentrations of fish oil at 3, 2, and 1 ml/L on potato plants resulted in a significant difference in nitrogen percentage in the leaves at the 2 ml/L level, achieving values of 2.91% and 2.87% across the two seasons, respectively, in comparison to other treatments. Unggang *et al.* (2023) noted that the terrestrial application of fish meal fertilizers enhanced the nitrogen content in spinach leaves. Alawi and Drifl (2016) reported that the application of the organic nutrient Slaptoniol 2 at a concentration of 2 ml/L on cucumber plants cultivated in a plastic



house, administered three times—initially 12 days post-transplantation, followed by two subsequent applications at 21-day intervals—resulted in a significant enhancement of the total chlorophyll content in the leaves. However, the spraying did not affect the nitrogen and phosphorus levels in the leaves much but caused a significant decrease in the potassium content as compared to the control treatment.

3-2-3 Effect of organic matter on markers of floral growth

Hamza *et al.* (2010) Demonstrated that the application of four different concentrations of organic fertilizer (4.0, 5.0, 6.0 and 7.0 ml/L) to the cucumber plants in a greenhouse in central Iraq significantly increased the number of flowers and the percentage of fruit set at the concentration of 6.0 ml/L. Shafeek *et al.* (2016) used two strategies to incorporate humic acid into Pracodo hybrid cucumber plants cultivated in a plastic greenhouse: foliar spraying and soil application, at four levels each (0, 3, 6, and 9 L/acre). The findings indicated that a concentration of 9 L/acre for both approaches resulted in a substantial increase in bloom quantity throughout both seasons. A study by Buang *et al.* (2018) demonstrated that the application of fish waste extract to cucumber plants at various concentrations (50, 40, 20, 10 ml), alongside a control treatment, resulted in a significant enhancement in the number of flowers, number of fruits, and fruit weight at the 20 ml concentration compared to the other concentrations. Abusaief and Bulsod (2021) observed in their research that the application of fertilizers containing fish extract to flax plants resulted in enhanced grain and oil yield, as well as increased fiber content.

3 -2-4 Effect of organic matter on quantitative and qualitative yield

In a research by Castro *et al.* (2006), the application of liquid fish extract to the soil enhanced the fruit quantity and overall output of cherry tomato plants. Sanwal *et al.* (2006) found that the use of the aqueous extract derived from anaerobic organic fertilizer waste resulted in enhanced crop yield and elevated nutritional antioxidant levels in broccoli plants. In an experiment by Fahlivi (2015), the application of liquid fertilizer derived from fish guts to onion and garlic plants resulted in enhanced production and increased plant height. A study by Llera *et al.* (2015) examined the effects of various fertilizers, including marine wood fertilizers, fish waste, mackerel fish fertilizer, and pine bark fertilizer, on the growth and yield of tomato plants, revealing that fish waste fertilizer produced a significantly superior crop compared to the other fertilizers. Organic fertilizers are crucial for improving the quality of fresh vegetable crops post-harvest (Nurhidayati and Murwani, 2017). Elkharafen *et al.* (2018) observed that the incorporation of fish waste into peach bushes resulted in an enhancement in their quantitative production. Kaab (2019) discovered that irrigating basil plants with fish farm water resulted in a substantial enhancement in both the fresh and dry weight of the vegetative and root systems, the leaf count, and the stem height, in comparison to irrigation with river water. A research by Abdelghany (2024) shown that applying 1.5 ml/L of fish fertilizer to pomegranate trees resulted in an increase in fruit quantity, grain weight, peel weight, juice volume, and dissolved solids compared to 0.5 ml/L.

3-3 Storability

3-3-1 Percentage of weight loss %

Fruits diminish their water content by transpiration and respiration, regardless of whether they remain connected to the plant or have been harvested. While the fruits remain connected to the mother plant, this deficit may be mitigated by the absorption of water from the plant. Post-harvest, water loss emerges as a critical issue, since even little weight reduction results in fruit wrinkling and withering, leading to substantial losses (Al-Ani, 1985). Weight loss transpires either from water evaporation from the fruit's surface, from the use of the fruit's nutritional reserves via respiration, or from a combination of both factors. Jasim *et al.* (1991) conducted a study on "California Wonder" green sweet pepper fruits, which were subjected to varying concentrations of calcium chloride (0, 1000, 3000, 5000 ppm) and stored at 5 and 10 °C for 20 days, with quality assessments performed every five days. Regardless of the dosage of calcium chloride utilized, the scientists found that the weight loss was lower in fruits kept at 5 °C compared to fruits stored at 10 °C. Ashtari (2004) harvested the fruits of "Shahmiveh" pear variety in the early morning in July and August in an experiment. The fruits were divided into two groups, one treated with 100% calcium chloride and the other with 2% calcium chloride and 100 ppm chlorin. When the fruits were kept at 2 °C the weight loss in both groups was reduced by 30-40% in comparison with the non-calcium treated fruits which showed the highest weight loss. Grey *et al.* (2007) reported substantial differences in weight loss rates across five tomato cultivars: Hatouf F1, Rio F1, Douna F1, Primato F1 and Super Mamande. Primato F1 exhibited the lowest weight loss rate, with no significant difference observed when compared to Super Mamande; however, notable differences were evident when compared to the other cultivars. The research also revealed that Primato F1 had the lowest spoilage rate, which considerably

differed from all other cultivars. Taain *et al.* (2007) demonstrated that the weight loss in okra fruits of the Khneissri cultivar escalated with time during storage, reaching a maximum of 13.76% after 12 days at $10\pm 1^{\circ}\text{C}$.

3-3-2 Percentage of damage (%)

Fruits exhibit resilience to damage during storage, however post-harvest damage remains one of the most critical challenges they encounter. Mechanical damage, physiological damage, and microbial infections from fungus, bacteria, and yeasts that afflict fruits post-harvest, as well as during storage and distribution, are the most severe forms of damage. Temperature plays a vital role in assessing damage, since refrigerated storage at low temperatures considerably mitigates harm, according to research. Al-Ani (1985), Dementeva (1988), and Vegonski. A research conducted by Panwer (1982) shown that temperature and storage period significantly influenced the rate of deterioration in fruits. The extent of damage increases with higher temperatures and prolonged storage duration. Fruits experience deterioration both before to and subsequent to storage. Spoilage resulting from mechanical, physiological, and microbial damage is regarded as the most significant issue for fruits post-harvest. as per Al-Ani (1985). Tain *et al.* (2007) demonstrated that the spoilage rate of Super Marimmond tomato fruits held at $5\pm 2^{\circ}\text{C}$ for 21 days escalated to 12.2%.The research identified fungal infections as the predominant cause of loss, with several fungus detected, including *Aspergillus niger* and *Penicillium italicum*.

3-3-3 Total soluble solids (T.S.S)

Fruits decrease in water content while remaining on the plant or after harvest. The loss is readily compensated when the fruits remain attached to the mother plant. Post-harvest, water loss is a significant issue as it leads to the wilting and wrinkling of fruits, substantially diminishing their market value. Fruits that reach this level of deterioration may result in significant losses for farmers and merchants; hence, preserving the water content post-harvest is essential for maintaining the quality and marketability of the fruits. According to Al Ani (1985), the water content of fruit is regarded as a crucial component in maintaining quality throughout storage. When fruits dry, the turgor pressure of their cells decreases and withering happens. Weight loss occurs owing to water loss via evaporation from the outer surface of the fruit or due to the utilization of food reserves in respiration or both (Shirokvo, 1988). Total soluble solids showed a rise with storage period and reached a maximum of 21.24 % after 5 weeks. The research by Taain *et al.*, (2015) on storage capacity of jujube fruits of Taffahi variety at a temperature of $0\pm 1^{\circ}\text{C}$ in refrigerated incubator for a period of 5 weeks showed that

Table (1) Some chemical and physical parameters of the field soil and irrigation water of 2008/2009 season.

Indicator	Value
(E.C) Dsm^{-1}	4.06
(PH)	7.50
Total N mg l^{-1}	1.85
Total P mg l^{-1}	33.48
Total K mg l^{-1}	17.39
Na mg l^{-1}	169.60
Total Ca mg l^{-1}	1120
Organic Matter%	0.29
% Soil separations	
Sand	80.732
Silt	14.752
Clay	4.516
Soil texture	Sandy mix
Irrigation water	
(E.C) Dsm^{-1}	3.40

(PH)

7.00

4-Results and Discussion

The effect of variety was very significant as shown in Table (2) . The plants of Shadi variety were superior to those of the other variety in all vegetative growth indicators except the total number of leaves/plant in which there were no significant differences between the two varieties. In contrast, Shadi variety plants performed best with 4.29%, 13.48%, 24.39%, 6.31% and 11.36% increases in plant height, stem diameter, fresh weight, dry weight and moisture % accordingly as compared to Saif. This may be associated with the genetic characteristics of the variety and its response to environmental factors.

The same results showed substantial effects of spray treatments on all the vegetative growth parameters studied except total leaf number and dry weight of plants. The application of calcium chloride at 3% concentration significantly increased the fresh weight of the plant by 14.73% compared to the control treatment (distilled water only). This can be attributed to the ability to apply the correct concentration of calcium to activate numerous enzymes, thus promoting meristematic cell division and regulating various phases of plant growth and development as it acts as a secondary messenger in the plant's hormonal response (Poovaiah, 1993; Hopkins, 1999). Fresh weight gain of the plant was positively seen however calcium chloride spray at 1% concentration caused significant decrease in plant height and stem diameter than other spray treatments. Calcium chloride at 2% concentration was much more effective in reducing moisture than the other spray treatments. The table shows that the interaction of the two studied factors had a significant effect on all the studied indicators of vegetative development other than the total number of leaves per plant. Untreated Shadi cultivar exhibited the tallest plant height (212.8 cm) while the shortest plant height (170.7 cm) was obtained in the Saif cultivar treated with 1% calcium chloride. The stem diameter of the Saif cultivar plants treated with 2% calcium chloride solution is much greater with a mean diameter of 8.26 mm however the plants treated with 3% calcium chloride solution have a lesser stem diameter of 6.43 mm. The Shadi cultivar plants treated with 3% calcium chloride concentration recorded considerably higher fresh and dry weights with maximum weights of 66.66 grams and 262.1 grams, respectively. On the other hand, the lowest fresh weight (160.5) was recorded from the Saif variety plants sprayed with 2% concentration of calcium chloride and the lowest dry weight (55.43) was recorded at 3% concentration. The plants of Saif variety treated with 3% calcium chloride solution recorded highest moisture percentage (76.78%) however, lowest moisture percentage (65.04%) was seen in plants treated with 2% solution.

Table (2) Effect of spraying with calcium chloride on several vegetative development indicators of the two hybrid cucumber types ((Saif and Shadi)) cultivated in the plastic house

Variety	Calcium chloride concentrations %	Plant height (cm)	stem diameter (mm)	Total number of leaves/plant	Fresh weight of plant (g)	Dry weight of plant (g)	Humidity % percentage
Saif	0	187.5	7.40	35.53	197.6	55.50	69.09
	1	170.7	7.03	37.67	225.9	56.17	75.13
	2	181.4	8.26	36.53	160.5	57.11	65.04
	3	185.7	6.43	35.27	239.2	55.43	76.78
Shadi	0	212.8	8.10	37.13	257.40	63.99	75.13
	1	180.3	7.40	35.00	243.60	61.69	74.67
	2	210.1	7.30	37.40	238.60	62.08	73.98
	3	204.4	8.16	36.60	262.10	66.66	74.56
The least difference significance	significant at the 0.05 level for the interaction	29.87	0.07	No	43.58	6.28	6.01
Average effect Saif		181.3	7.28	36.25	201.3	56.05	71.51
Variety Shady		201.9	7.74	36.53	250.4	63.61	74.58
The least significant difference at a significance level of 0.05 for the variety		14.93	0.03	No	21.79	3.14	3.00
Average effect 0		200.1	7.75	36.33	218.5	59.74	72.11
Clod concentrations 1		175.5	7.21	36.33	234.8	58.93	74.90
Calcium 2		195.8	7.78	36.97	199.5	59.60	69.51
3		195.1	7.30	35.93	250.7	61.05	75.67
Least significant difference at 0.05 significance level for concentrations		21.12	0.05	No	30.81	No	4.01

Table (3) shows that the variety has substantial influence only on average weight of a single fruit and early production. The mean fruit weight revealed that Shadi variety had a significant advantage over the Saif variety by 15.25%. On the other hand, the early output of the Saif variety was much higher than the Shadi variety by 16.04%. The difference between the two kinds may be due to the genetic make-up of the variety and its general responsiveness to environmental stimuli. The results showed that only two features were considerably affected by spraying treatment, namely early and final product. Applications of calcium chloride at 1 and 2% resulted in less early production than the control treatment and application of 3%. However, 3% application increased the total production significantly compared to the control treatment and the 1% and 2% concentrations with increase rates of 20.0%, 33.89%, and 30.32%, respectively. The increase in yield may be explained by the activity of several enzymes after using a proper dose of calcium chloride, which causes an increase in the rate of cell division and photosynthesis. This is consistent with the results of Lieng *et al.* (2008).

It can be seen from the table that the interaction of the two study parameters had a substantial effect on all the studied yield characteristics. The best result was obtained in the untreated Shadi cultivar with a maximum number of 28.40 fruits and the maximum average fruit weight of 146.3 g. On the other hand, the lowest number of fruit (21.60) was recorded from Shadi cultivar treated with 1% calcium chloride. The lowest average fruit weight (112.4 g) was recorded from Saif cultivar treated with 1% calcium chloride. The maximum early production and total yield were found in the plants of the cultivar Saif, treated with 3% calcium chloride solution, which were 0.613 and 4.057 tons per plastic home, respectively. Conversely, the Shadi cultivar plants treated with a 1% calcium chloride solution yielded the lowest early yield of 0.350 tons per greenhouse, while the Saif variety plants receiving a 2% calcium chloride concentration exhibited the lowest total yield of 2.358 tons per greenhouse.

Table (3) The effect of spraying with calcium chloride on some quantitative yield characteristics of the two hybrid cucumber varieties ((Saif and Shadi)) grown in the plastic house.

Variety	Calcium chloride % concentrations	Number of fruits/plant	Average weight of one fruit (g)	Early productivity (ton/greenhouse)	Total productivity (tons/greenhouse)
Saif	0	26.66	124.3	0.558	2.565
	1	28.00	112.4	0.461	2.644
	2	24.54	113.3	0.479	2.358
	3	22.14	114.3	0.613	4.057
Shadi	0	28.40	146.3	0.465	3.064
	1	21.60	127.2	0.350	2.402
	2	25.60	145.0	0.471	2.827
	3	25.86	116.7	0.536	2.714
The least significant difference at the 0.05 significance level for the interaction		5.25	32.6	0.102	0.517



Average effect Saif	25.43	116.1	0.528	2.906
Shady Variety	25.36	133.8	0.455	2.748
The least significant difference at a significance level of 0.05 for the variety	No	16.3	0.051	No
Average effect 0	27.54	135.3	0.510	2.815
Clويد concentrations 1	24.80	119.8	0.405	2.523
Calcium 2	25.06	129.1	0.475	2.592
3	24.00	115.5	0.575	3.378
Least significant difference at 0.05 significance level for concentrations	No	No	0.072	0.366

The variety has a substantial effect on the harvest quality, except for the total soluble solids content in the fruits as shown in Table (4). The Saif fruits had much higher vitamin C, potassium ion penetration and calcium content than the Shadi fruits. This disparity might be attributable to inherited factors. The calcium chloride spray treatments considerably affected two characteristics: the proportion of potassium ions entering the fruits and the calcium content of the fruits. The quantity of potassium ions entering the fruits was greatly reduced in the spray treatment compared with the control treatment and the reduction was more pronounced with increasing concentration of calcium chloride spray. This suggests that the spray treatments helped in preserving the fruit cell membranes and hence increased the life span of the fruits by maintaining the integrity of the cell membranes for a longer period. Bakr and Gawish (1993) found that spraying calcium chloride considerably increased calcium levels in fruits compared to the control treatment, and the impact increased with increasing the concentration of the spray. The same table indicates that the interaction of the two study components significantly affected all examined qualitative qualities, shown by the percentage of total soluble solids. The Shadi variety of fruits treated with 2% calcium chloride had the maximum vitamin C content at 11.52 mg/100 g of fresh weight, while the untreated Saif variety showed the lowest concentration at 8.53 mg/100 g of fresh weight. The Saif variety fruits treated with a 3% calcium chloride solution had the lowest potassium ion penetration at 24.79%, while the untreated Saif variety fruits showed the maximum penetration at 39.77%. The Shadi variety fruits, treated with a 3% calcium chloride solution, had the maximum calcium concentration at 63.10 mg/g, while the untreated Saif variety fruits displayed the lowest concentration at 12.21 mg/g.





Table (4) The effect of spraying with calcium chloride on some qualitative characteristics of the two hybrid cucumber varieties ((Saif and Shadi)) grown in the plastic house .

verity	Calcium chloride concentration %	Amount of Vitamin C (mg/100g fresh weight (percentage of total dissolved solids	Percentage of potassium ions penetrating the fruits	Calcium content of fruits (mg/g)
Saif	0	8.53	4.33	39.77	12.21
	1	8.75	4.00	33.30	20.69
	2	8.75	4.67	31.45	30.81
	3	10.99	5.00	24.79	40.99
Shadi	0	10.24	4.67	39.01	14.30
	1	10.77	4.67	35.64	24.69
	2	11.52	4.83	33.45	43.38
	3	11.20	4.83	34.13	63.10
The least difference significance for the interaction	significant at the level of 0.05 interaction	2.54	No	4.42	2.59
Average saif impact		9.25	4.50	32.33	26.17
Shady variety		10.93	4.75	35.56	36.37
The least significant difference at a significance level of 0.05 for the variety		1.27	No	2.21	1.29
Average effect 0		9.39	4.50	39.39	13.25
Clold concentrations 1		9.76	4.33	34.47	22.69
Calcium 2		10.13	4.75	32.45	37.09
3		11.09	4.92	29.46	52.05
Least significant difference at 0.05 significance level for concentrations		No	No	3.12	1.83



5-Conclusions

This research concludes that applying a 3% calcium chloride solution to cucumber plants at the 4-5 true leaf stage enhances vegetative development and both the quantitative and qualitative yield of cucumbers cultivated in plastic homes.

6-References

- Abdelghany, A. M. M. (2024). Biostimulants and their impact on growth and fruit quality of pomegranate trees via foliar spray. *Agric. & Env. Sci. (Damanhour University)*, 23, 170-191.
- Abdel-Mageed, Y. T., Tantawey, I. A. A., & Stouhy, M. Mai. (2024). Effect of mulching and different rates of compost on growth and production of three cucumber hybrids. *Minia Journal of Agricultural Research*, 44, 97-120.
- Abdul Rahman, Harith Burhanuddin, Ghassan Jaid Zidane and Qutaiba Yasser Ayed (2013). Effect of spraying with nutrient solutions on the quantitative and qualitative yield of two cucumber hybrids, Diyala Journal of Agricultural Sciences, 122:(2)5:132-132.
- Abdullah, Abdullah Abdul Aziz, Makki Hussein Ali Al-Momen and Basem Yassin Marzouq. (2012). Evaluation of some cucumber hybrids grown in plastic houses in southern Iraq. Thi Qar University Scientific Journal. 7(3): 1-9.
- Abusaief, H.M.A., Alhaddad, A., & Bulsod, N.B.O. (2021). Study on bio-fish extract and cultivation dates to improve production of flax (*Linum usitatissimum*) in Omar-Mukhtar area, Libya. *Journal Name*, 22, 536-548.
- Adinde, J.O.; U.J. Anieke.; O.J., Uche; .A.C.Aniakor;L.C.Isani and A.A.Nwagboso (2016). Assessment of performance of four cucumber (*Cucumis sativus* L.) cultivars in iwollo, southeastern Nigeria. Int.J. Curr.Res. Bio. sci. plant Biol.3(10):136-143.
- Adnan, M., & Anjum M. Z. (2021). Back to Past; Organic Agriculture. Acta Sci. Agri. 5(2), 01-02.
- Ahuja, I., Dauksas, E., Remme, J. F., Richardsen, R., & Løes, A. K. (2020). Fish and fish waste-based fertilizers in organic farming-With status in Norway: A review. Waste Management, 115, 95-112.
- Al-Ani, Abdul-Ilah Mukhlef (1985). Physiology of horticultural crops after harvest. Ministry of Higher Education and Scientific Research, Iraq
- Alawi, Mohammed Mustafa and Khaled Abdul Hussein Drifel (2016) The role of biofertilizer and spraying with some nutrients in the growth and yield of cucumber grown under protected environment conditions, Al-Furat Journal of Agricultural Sciences, 138-8.
- Al-Bayati, H. J. M. (2020). Effect of organic and inorganic fertilizers on growth and yield of hybrid cucumber *Cucumis sativus* L. grown under unheated plastic house. *1st Scientific International Virtual Agricultural Conference*, 10, 1755-1315.
- Al-Bayati, H. J. M., Al-Harbawy, K. A. M., Allela, W. B. A., Al-Sabawy, M. M. S., Ibraheem, F. F. R., Al-Taey, D. K. A., & Mahmood, S. S. (2023). Response growth and yield of three cucumber hybrids (*Cucumis sativus* L.) to nano fertilizer N20P20K20 under protected house. *Earth and Environmental Science*, 10, 1755-1315.
- Al-Bayati, Hassan Jawad Moharram and Tara Janan Kamel (2014). Improving the growth and yield of two varieties of female cucumber (*Cucumis sativas* L.) by covering the soil and adding organic fertilizers under unheated plastic house conditions. Journal of Agricultural Sciences. 7 (4): 22-9.
- Al-Habar, Mohammed Talal Abdul Salam and Hussein Jawad Muharram Al-Bayati and Walid Badr Al-Din Al-Layla (2013). Evaluation of some hybrid female cucumber F1 (*Cucumis sativus* L.) cultivars grown under unheated plastic house conditions in Mosul city. Iraqi Journal of Agriculture, Rafidain 41(3): 65-72.

- Al-Ibrahimi, Ahmed Mahdi Saleh (2017) The effect of the breeding method on the growth, yield and storage capacity of some cucumber hybrids (*Cucumis sativus* L.) grown in plastic houses. Master's thesis. College of Agriculture. University of Basra.
- Al-Jubouri, Kazem Dili Hassan, Hadi Mahdi Abboud and Faleh Hassan Saeed (2017). Effect of biofertilizers and genetic compositions on the growth and production of cucumber (*Cucumis sativus* L.). Anbar Journal of Agricultural Sciences, 15 Special Issue (308-317).
- Al-Khudairi, Khaled bin Eidan Surur (2008). Effects of fertilization with triple superphosphate fertilizer on growth, yield and quality characteristics of some cucumber varieties under water stress conditions. Master's thesis, King Abdulaziz University, Kingdom of Saudi Arabia.
- Al-Mohammadi, Saad Abdul Wahid Mahmoud and Liqaa Hikmat Nafie Al-Naif (2013). Response of two cucumber hybrids to different types of fertilizers and magnetic irrigation under protected cultivation conditions. Karbala University Scientific Journal, 11(4): 77-88.
- Al-Mutawwari, Aqila Juma Hajim (2010). Effect of calcium on the growth and yield of two hybrid cucumber varieties grown in plastic greenhouses and its effect and storage temperature on storability. Master's thesis, Department of Horticulture and Landscape Engineering, College of Agriculture, University of Basra, Iraq .
- Al-Rawi, Khashe' Mahmoud and Abdul Aziz Mohammed Khalaf Allah (1980). Design and Analysis of Agricultural Experiments, Dar Al-Kutub Printing and Publishing Foundation - University of Mosul - Iraq.
- Al-Sahaf; Fadhel Hussein and Mohammed Zidan Al-Muharib and Firas Mahmoud Jawad (2011). Response of cucumber varieties to chemical and organic fertilizers. Iraqi Journal of Agricultural Sciences. 42(4): 52-62.
- Al-Shammari, Aziz Mahdi Abdul and Omar Ghazi Yahya Saud (2013). Effect of spraying with some organic nutrients and breeding method on the growth and yield of three cucumber hybrids (*Cucumis sativus* L.) under protected cultivation conditions. Diyala Journal of Agricultural Sciences, 5:283-294;(2).
- Al-Shammari, Aziz Mahdi Abdul and Omar Ghazi Yahya Saud (2013). The effect of spraying with some organic nutrients and the breeding method on the growth and yield of three cucumber hybrids under protected cultivation conditions. Diyala Journal of Agricultural Sciences 5 (2): 283-294
- Aranganathan, L., & Rajasree SR, R. (2016). Bioconversion of marine trash fish (MTF) to organic liquid fertilizer for effective solid waste management and its efficacy on Tomato growth. Management of Environmental Quality: An International Journal, 27(1), 93-103
- Ashtari, A. K.(2004). Effect of postharvest pre-cooling processes and cyclical heat treatment on the physico-chemical properties of "Red Haven peaches"and "Shahmiveh pear" during cold storage. J. Food. Safety, 5:24-34
- Baker,A.A. and R.A.Gawish (1993).Technological aspects of keeping and picking qualities of cucumbers as influenced by fertilizers. journal of and Foods for-Human nutrition 44(1):17-28. Plant.
- Bangerth, F.; D.R. Dilly and P.H. Dewey (1972). Effect of post harvest calcium treatments on internal break down and respiration of apple fruits. J. Amer
- Buang Ellyzatul, A., Yusoff, N., Mat, N., & Khandaker, M. M. (2018). Effects of fish waste extract on the growth, yield and quality of **Cucumis sativus** L. *Agrobiotech*, 9, 250-259.
- Caruso G (2016) Fishery wastes and by-products: A resource to be valorised. J Fish Sci 10(1):0-0
- Castro, R. S., Azevedo, C. M. S. B., & Bezerra-Neto, F. (2006). Increasing cherry tomato yield using fish effluent as irrigation water in Northeast Brazil. *Journal Name*, 110, 44-50.
- Chikezie O. E.;E.O. Peter; U.A. Christian and P.C. Uche (2016).Evaluation of sixteen Cucumber (*Cucumis sativus* L.) genotypes in derived savannah environment using path coefficient analysis. Not Sci Biol., 8(1):85-92.

- Chinatu, L.N., O. Henry, and C.B.Okoronkwo, (2017). Assessment of yield and yield components of cucumber (*Cucumis sativus* L.) in southeastern Nigeria. International Journal of Agriculture and Earth Science ,3(1):2481-2489.
- Dementeva, M.E. and M.E. Vegonski (1988). Disases of fruits, vegetables and potatoes during storage. Moscow. 231pp.
- Ehiokhilen K. E. and U.R. Samson (2010). Growth and yield of cucumber (*Cucumis sativus* L.) as influenced by farm yard manure and inorganic fertilizer. J. Plant Breeding and Crop Sci., 2(4): 1-6
- El-Kharafen, A. S., El-Alakmy, H. A., Ahmed, R. B., Sourour, M. M., & El-Deeb, M. D. (2018). The use of some organic and bio-fertilizers for Earligrande peach trees fertilization under North Sinai conditions. *SINAI Journal of Applied Sciences*, 7, 2314-6079.
- Fahlivi, M. R. (2015). Physicochemical characteristics of liquid fertilizer from fish viscera.
- Food and Agriculture Organization of the United Nations (FAO) (2009) . Faostat. Http://Fostat .Fao.Org/Site/567/Desktopdefault.aspx?Pageid=567#Ancor
- Geethanjali, S., Subash, A., Govindan, K., Pandiyan, M., & Paramasivam, V. (2020). An overview of fish visceral waste pollution and its eco-friendly management practices. *International Journal of Chemical Studies*, 5, 19-26.
- Ghaly, A. E., Ramakrishnan, V. V., Brooks, M. S., Budge, S. M., & Dave, D. (2013). Fish Processing Wastes as a Potential Source of Proteins. Amino Acids and Oils: A Critical Review, Journal of Microbial Biochemistry and Technology 5(4): 107-129
- Hamza, Musa Mohammed, Hassan Alwan Salman and Omar Hamid Obaid (2010). Effect of number of spraying times and level of Humusoil fertilizer on growth and yield of cucumber (*Cucumis sativus* L.) grown in greenhouse. Al-Furat Journal of Agricultural Sciences (12) 24-28.
- Hassan and Man Saleh (2020) The effect of soils previously planted with leguminous crops on the plant and growth of two cucumber varieties. Al-Rafidain Scientific Journal (29(2):11-19
- Hassan, Ahmed Abdel Moneim (2017). Plant Breeding Series. General Principles of Plant Breeding. Arab House for Publishing and Distribution. Faculty of Agriculture. Cairo University. 85 pp .
- Hemant K. S. and A. Tiwari. (2018): Exploitation of heterosis for yield and contributing traits in cucumber (*Cucumis sativus* L.) J of Pharm and Phyto 7 (3): 395-397.
- Hopkins, W.G. (1999). Introduction to plant physiology . John Willy and Inc.2 nd edition.
- Hussein, Hiba Ali and Hakim Shamran Atallah (2017) The effect of spraying with foliar fertilizer Qol Spray on the growth and yield of two cucumber hybrids grown in unheated plastic houses, Al-Furat Journal of Agricultural Sciences (1) 39-48.
- Hussein, W. A., & Ahmed, N. E. (2020). Growth and yield of potato in relation to application of Alphylax and fish oil as organic fertilizers. *EurAsian Journal of BioSciences*, 14, 374-378.
- Ikenganyia, E. E, U. M. Ndubuaku, C. C. Onyeonagu and I. N. Dimelu (2015) . Performance of three varieties of Cucumber (*Cucumis sativus*) in composted rice husks plus poultry manure media and the effects on soil nutrient status. International Journal of Plant & Soil Science. 5(3): 167-174
- Illera-Vives, M., Seoane Labandeira, S., Brito, L.M., López-Fabal, A., & López-Mosquera, M.E. (2015). Evaluation of compost from seaweed and fish waste as a fertilizer for horticultural use. *Scientia Horticulturae*, 186, 101-107.
- Jaies, I., Qayoom, I., Saba, F., & Khan, S. (2024). Fish wastes as source of fertilizers and manures.
- Jari, Awatif Nima Jari, Hamid Abdul Karim Abdul Wahid and Diaa Ahmed Tain (2007). Study of the storage capacity of five varieties of tomato *Lycopersicon esculentum* Mill grown in Basra Governorate. Basra Journal of Agricultural Sciences 20 (1): 101-108



- Jasim A.M.; K.F. Jabor and A.H.Jasim (1991). Effect of calcium chloride and storage temperature on post harvest quality of bell pepper (*Capsicum annum L.*). *Basrah J. Agric. Sci.*, 4 (1,2).
- Kaab Omeir, M., Jafari, A., Shirmardi, M., & Roosta, H. (2019). Effects of irrigation with fish farm effluent on nutrient content of basil and purslane. *The National Academy of Sciences*
- Karo', B. B., & Marpaung, A. E. (2020). Effectivity of Potassium and Fish Fertilizer on Leek Growth (*Allium fistulosum L.*). *Journal of Tropical Horticulture*, 3, 23-28.
- Khan , I.,(2013). Response of Crop Geometry on the Performance of Parthenocarpic Varieties of Cucumber (*Cucumis sativus L.*) as Influenced by Humic Acid and Micro Nutrients Application under Polyhouse Condition . *Int.J.Curr.Microbiol.App.Sci*, 6(3): 1763-176
- Kumar , S ; V Chaudhar , ; S. Saravaiya and D, Raj (2017). Potentiality of greenhouse cucumber cultivars for economic and nutritional realization . *International Journal of Farm Sciences*, 7(1): 1-7.
- Kumari,A., Kumar,R., Bhardwaj, A., & Tripathi,v. (2021) .Mean performance of gynococious cucumber hybrids in sub-tropical climate of eastern ladia . *Journal of current opinion in crop science* ,2(1) , 95-101
- Lema, A., & Degebassa, A. (2013). Comparison of chemical fertilizer, fish offal's fertilizer and manure applied to tomato and onion. *African Journal of Agricultural Research*, 8, 274-278.
- Liang , W.J. : M.L. Wang and X.O. San(2008) .Effect of calcium on growth and yield of cucumber in Solor-Green House. *China Vegetables*, 1:18-19.
- Loes AK, Katsoulas N. Caceres R, de Cara M, Cirvilleri G, Kir A, Knebel L, Malinska K. Oudshoorn F, Raskin B (2018) Current use of peat, plastic and fertiliser inputs in organic horticultural andarable crops across Europe. European Commission, Brussels, Belgium,2018
- Mahmoud, Hazem Abdel Aziz and Marwan Ahmed Kafi Al-Rawi (2015). Effect of cultivar and planting dates on yield and components of cucumber (*Cucumis sativus L.*) plant in unheated plastic houses. *Tikrit University Journal of Agricultural Sciences* 15: (2)82-91
- Matloob, Adnan Nasser and Izz Al-Din Sultan Mohammed and Karim Saleh Abdul (1989). *Vegetable Production. Part One and Two - Revised Edition - Higher Education Press - Mosul - Iraq: 680-337 pp.*A.O.A.C. (1970). *Official methods of analysis. 11th Ed . Washington of the official analytical chemists, Washington D.C. USA .*
- Mazur, Z., & Radziemska, M. (2014). Influence of compost from fish by- products on nutrient supply in radish. *Ecological Chemistry and Engineering. A*, 21(2), 231-240,
- Mohammed, Ibrahim Anwar and Moaz Mohi Mohammed Sharif Al-Abdali and Essam Khadir Hamza Al-Hadith (2020). The effect of water stress on the growth and production of some cucumber hybrids for protected cultivation in Iraq. *College of Agriculture, University of Anbar* 18(1): 75-84
- Mustafa, H. H., Hamad, A. S., Hameed, R. T., & Mohamed, S. H. (2022). Comparing the effect of using two concentrates of liquid organic fertilizers on growth and flowering pepper plant. *Agricultural Statistics Science*, 18, 1217-1224.
- Nurhidayati, M. M; and Murwani, I. (2017). Combined effect of vermicompost and earthworm *pontoscolex corethrurus* inoculation on the yield and quality of broccoli (*Brassica oleraceae L.*) using organic growing media. *Journal of Basic and Applied Research International*, 22(4), 148- 156
- Pakeerathan, K., Dayananda, A. N. P. E., & Viharnaa, R. (2023). Formulation and efficacy testing of vermi-tea based liquid organic fertilizers on green-amaranth (*Amaranthus viridis L.*) for home gardens.
- Panwar, J.S. (1982). Post harvest physiology and storage behavior of ber fruits (*Zizyphus mauritiana Lam*) in relation storage temperature and various treatments. *M. Sc. Thesis*
- Poovaiah, B.W. (1993). Biochemical and molecular aspects of calcium. *Action . Acta Hortic.*,326:139-147.





- Pragathi, K. (2014). Evaluation of cucumber (*Cucumis sativus* L.) hybrids for production potential and qualitative traits under net house conditions. M.S.C.,Thesis, Deparment Pr.YSR.Horticulture university Andhar Pradesh,India.
- Priyanka, B., Ramesh, T., Rathika, S., & Balasubramaniam, P. (2019). Foliar application of fish amino acid and egg amino acid to improve the physiological parameters of rice. *Int. J. Curr. Microbiol. App. Sci*, 8(2), 3005
- Radziemska, M., Vaverková, M. D., Adamcová, D., Brtnický, M., & Mazur, Z. (2019). Valorization of fish waste compost as a fertilizer for agricultural use. *Waste and Biomass Valorization*, 10, 2537-2545.
- Ramesh, T., Rathika, S., Murugan, A., Soniya, R. R., Mohanta, K. K., & Prabharani, B. (2020). Foliar spray of fish amino acid as liquid organic manure on the growth and yield of *Amaranthus*. **Chemical Science Review and Letters**, 34, 511-515.
- Rasool,A.,; M.T.Gigiou ; and H Behzad. (2009). The Effect of sheep manure vermicompost on quantitative and qualitative properties of cucumber (*Cucumis sativus* L.) grown in the greenhouse. *Afr.J. Bioethanol*. 8(19): 4953-4957.
- Sahoo, U. (2014). Protected cultivation of cucumber for assured lively hood .M.S.C-Orissa univ. of Agri.and Tech., Bhubaneswar .
- Sanwal SK, Laxminarayana K, Yadav DS, Rai N and Yadav RK. (2006). Growth, yield, and dietary antioxidants of broccoli as affected by fertilizer type. *Journal Veg Science* 12:13- 26
- Sarhan , T. Z. ;F.I and Salih, (2014). Effect of low temperature and seaweed extracts on flowering and yield of two Cucumber cultivars (*Cucumis sativus* L.). *International Journal of Agricultural and Food Research*, 3 (1): 41-54.
- Shafeek, M.R; Y.I.Helmy and N.M.Omar (2016). Effect of spraying or ground drench from humic acid on groth total output and fruits nutritional values of cucumber (*Cucumis Sativus* L.) grown under plastic house conditions. *International Journal of pham Tech Research* 9(12): 52-57
- Shahsavani, S., Abaspour, A., Parsaeeyan, M., & Yonesi, Z. (2017). Effect of fish waste, chemical fertilizer and biofertilizer on yield and yield components of bean (*Vigna sinensis*) and some soil properties. *Iranian Journal Pulses Research*, 8(1), 45-59
- Shirokov, E.P. (1988). Technology of storage and processing of fruits and vegetables. Moscow, PP 319. [In Russian] 1
- Siddiqui, S. and F. Bangerth, (2004). Studies on cell wall mediated changes during storage of calcium ifiltrated apples, *ISHS Acta. Hort.*, 326 .
- Soc.,Hort.Sci.,97:679-682. Cresser ,M.S. and J.W. parsons (1979) . sulphric perchloric acid digestion of plant material for the determination of nitrogen,phosphorus, potassium, calcium and magnesium- *analytica chemical Acta* . 109:431-436
- Staley, L., Mortley, D. G., Bonsi, C. K., Bovell-Benjamin, A., & Gichuhi, P. (2013). Hydrolyzed Organic Fish Fertilizer and Poultry Litter Influence Total Phenolics and Antioxidants Content but Not Yield of Amaranth, Celosia, Gboma, and Long Bean. *HortScience*, 48(6), 768-772.
- Sutriana, S., Sabli, T. E., Vaulina, S., & Ulya, U. M. (2023). Optimizing the Growth and Production of Shallots (*Allium ascalonicum* L) by applying Liquid Organic Fertilizer from Kampar River Fish Waste on Ultisol Soil. **Jurnal Agronomi Tanaman Tropika**, 5, 377-387.
- Taain, D.A., Jerry,.A.N.and Naama, A.K., (2007) Effect of some organic acids on storability of tomtto fruit cv.super Maramond *Journal of karbala university*, vol.5(143-148
- Taain, Dhia Ahmed; M.A.Ibrahim; N.R.H.Shala (2015). Effect of spraying gibberllic acid and calcium chloride on storage ability of jujube fruits. *International Symposium of Agricultureal and Mechanical Engineering*. Bucharest. Romania
- Tain, Diao Ahmed Hamid Abdul Karim Abdul Wahid and Awatif Nima Jari (2007). Study of the storage capacity of five tomato varieties *Lycopersicon esculentum* L. grown in Basra Governorate. *Basra Journal of Agricultural Sciences*, 20 (1) 101-108.





- Thapliyal, V. (2017). Heterosis and combining ability for yield and yield attributing traits of Parthenocarpic cucumber (*Cucumis sativus* L.) under poly-net house conditions (Doctoral dissertation, Punjab agricultural university Ludhiana).
- Tomar B.S:G.S.Jat and Jogendra singh (2017) Advances in hybrids seed production vegetables crops .university of Horticulture and forestry Nauni -173.230 Solan Himachal Pradesh .
- Unggang, J. A. F., Bakar, M. N., & Khair, A. B. A. (2023). The potential of several wild invasive fish species as fish-based organic fertilizers on the growth of two common vegetables in Malaysia. *Sains Malaysiana*, 52, 71-81.
- Vian, A.,D.(2016). Response of some cucumber hybrid cultivars (*Cucumis sativus* L.) grown in plastic house. Joranal poly technic. 6(1):1- 7
- Wu Y, Song K (2021) Anaerobic co-digestion of waste activated sludge and fish waste: Methane production performance and mechanism analysis. J Clean Prod 279:123678
- Yousefi, A. (2016). Evaluating the effectiveness of different levels of humic acid the on yield of different greenhouse cucumber cultivars.Adv.7(6):114-1.

