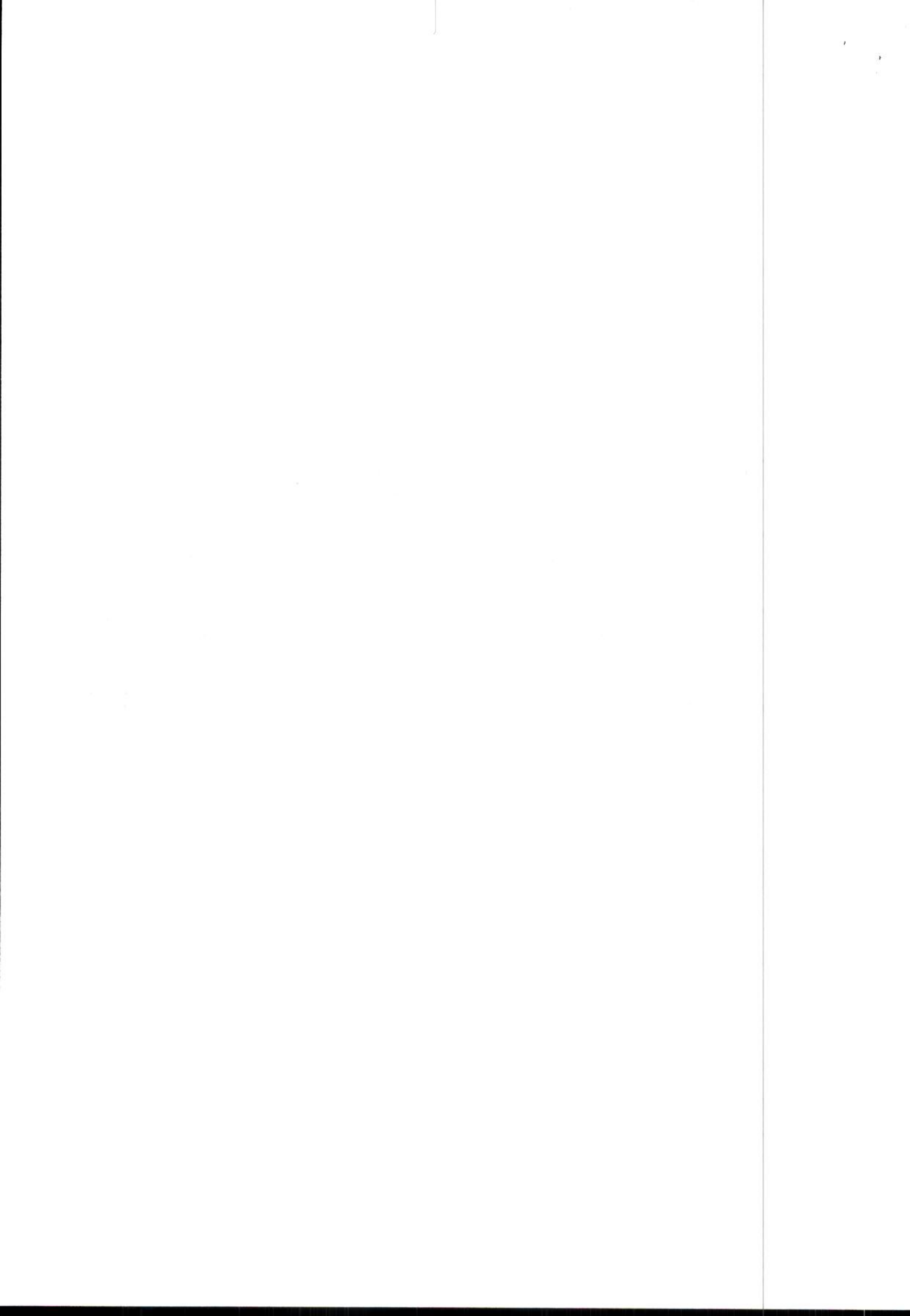


Effect of foliar application and mineral fertilizer on growth parameters and content auxins, GA and CK in cucumber leaves

by S N Sirajuddin

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To cite this article: S S Toman *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* **492** 012009

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Effect of foliar application and mineral fertilizer on growth parameters and content auxins, GA and CK in cucumber leaves

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Abstract. The experiment was conducted in an unheated plastic house at Al- Abassia /Al-Najaf Governorate during autumn seasons of 2016. The objective of this work to study the effect of foliar and soil applied fertilizers on growth and yield of cucumber (*Cucumis sativus* L. cv. Siyff). Results indicated that: The foliar spray with 10ml L⁻¹ of the liquid fertilizer was superior in all traits and studied gave the highest value in leaf area index (20.8) plant dry weight (40.9) g, IAA (185.85) mg kg⁻¹, GA3 (187.2) mg kg⁻¹, CK (178.1) mg kg⁻¹. The treatment (F1) of mineral fertilizer was superior significantly in leaf area index (23.5) and plant dry weight (42.8) g. The treatment (F3) was superior in IAA (196.39) mg.kg⁻¹ and GA3 (199.8) mg.kg⁻¹, CK (196.1) mg kg⁻¹. The results showed that the interaction treatment spraying foliar fertilizer at a concentration 10ml.L⁻¹ and 50% of mineral fertilizer was superior significantly in IAA (211.83) mg.kg⁻¹, GA3 (221.6) kg⁻¹, CK (214.9) mg. kg⁻¹.

19 Introduction

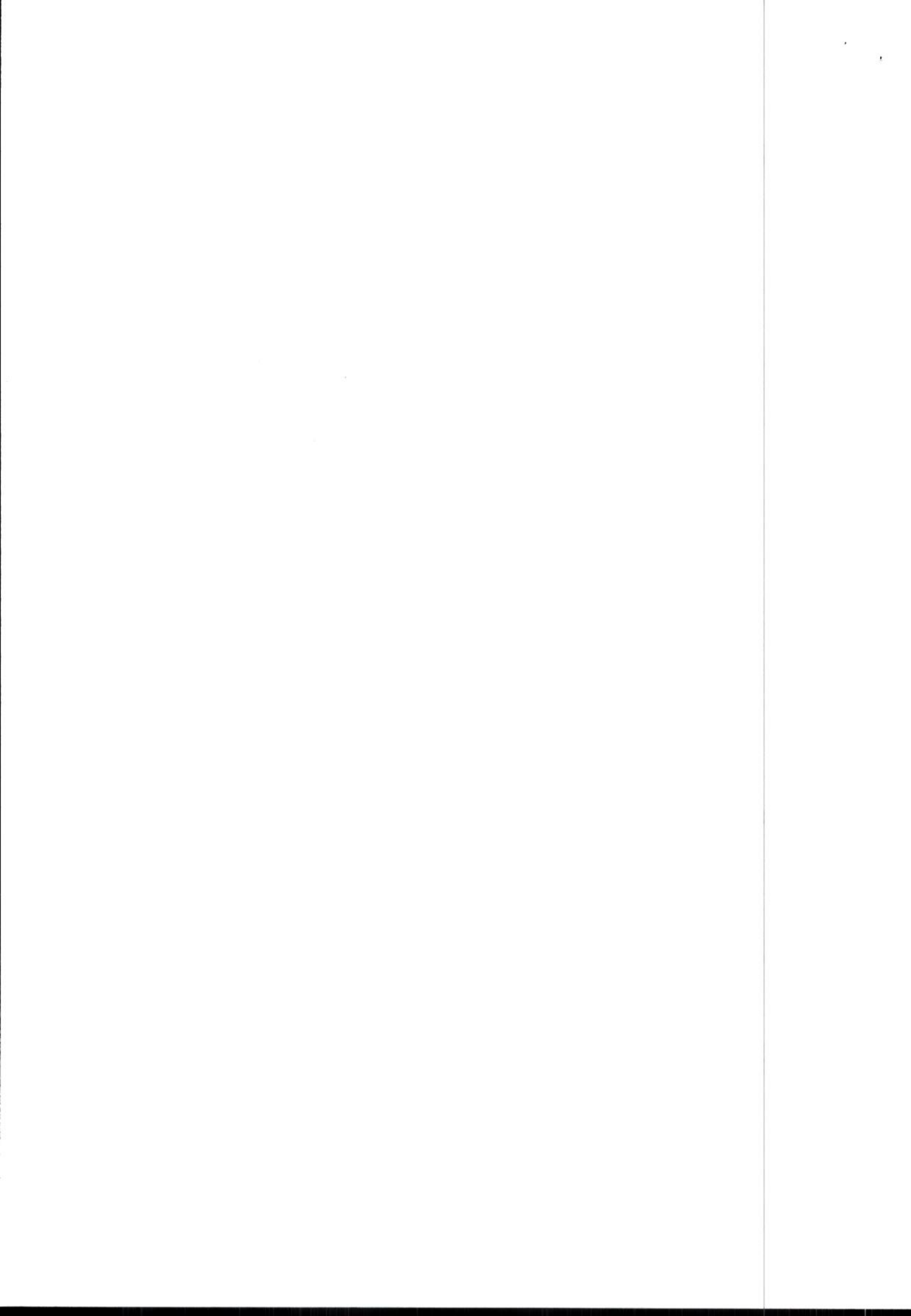
Cucumber (*Cucumis sativus* L.) belongs to the Cucurbitaceae family. It is widely cultivated in the Middle East. Currently, China, Iran, Turkey and the U.S have been producing 23.2 million tons that cover 66 % of global production. Moreover, cucumber is a critical summer vegetable and grown in Iraq in spring and autumn in open fields as well as a protected environment under the tunnel's plastic and glasshouses [1].

The cultural practice for producing cucumber under protected conditions depends on the heavy application of chemical fertilizers during life cycle to achieve the ideal growth and yield. These heavy fertilizers lead to soil degradation and environmental pollution in the long term [2]. Chemical fertilizers frequently decay soil fertility and the decreasing harvest efficiency because of supplement irregularity in the soil, which has been perceived as a standout amongst the most imperative factors that limit crop yield. However, Mineral fertilizers also play an essential role in increasing the production of crops [2], such as



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cucumber crop, as a result of problems associated with increased use and exacerbation of adverse effects. Therefore, recently the innovation to reduce application the fertilizer through balancing fertilization, which ensures high-quality food products [3].

Besides, foliar nutrition also is more critical to crops for achieved and micronutrients. According to few studies have been conducted on the effects of foliar application on the growth and yield of greenhouse cucumber, used the liquid nutrients is one of the methods to reduce the use of processed mineral fertilizers which have a good effect on the growth and development of the plant and can be considered as essential plant nutrients [4]. The foliar application increases the plant content, reduces the amount of fertilizer added to the soil, reduces the period of addition of fertilizer and absorbed by the plant [5]. Therefore, the research aims to determine the minimum amount of mineral fertilizer can be added to the plant and reduce the harmful effects of mineral fertilizers and improve the qualities of the plant and discover the levels of the hormone in cucumber leaves.

2. Materials and methods

2.1. Characterizations of the area: location and soil

The experiment was conducted in an unheated plastic house at Al- Abassia /Al-Najaf Governorate during autumn seasons of 2016. The size of plastic house 524 m² with covering contain soil which was prepared by plowing, smoothing, settling. A sample of soil was taken for chemical and physical analysis, as in Table (1).

Table 1. Some physical and chemical traits of the soil used in the experiment.

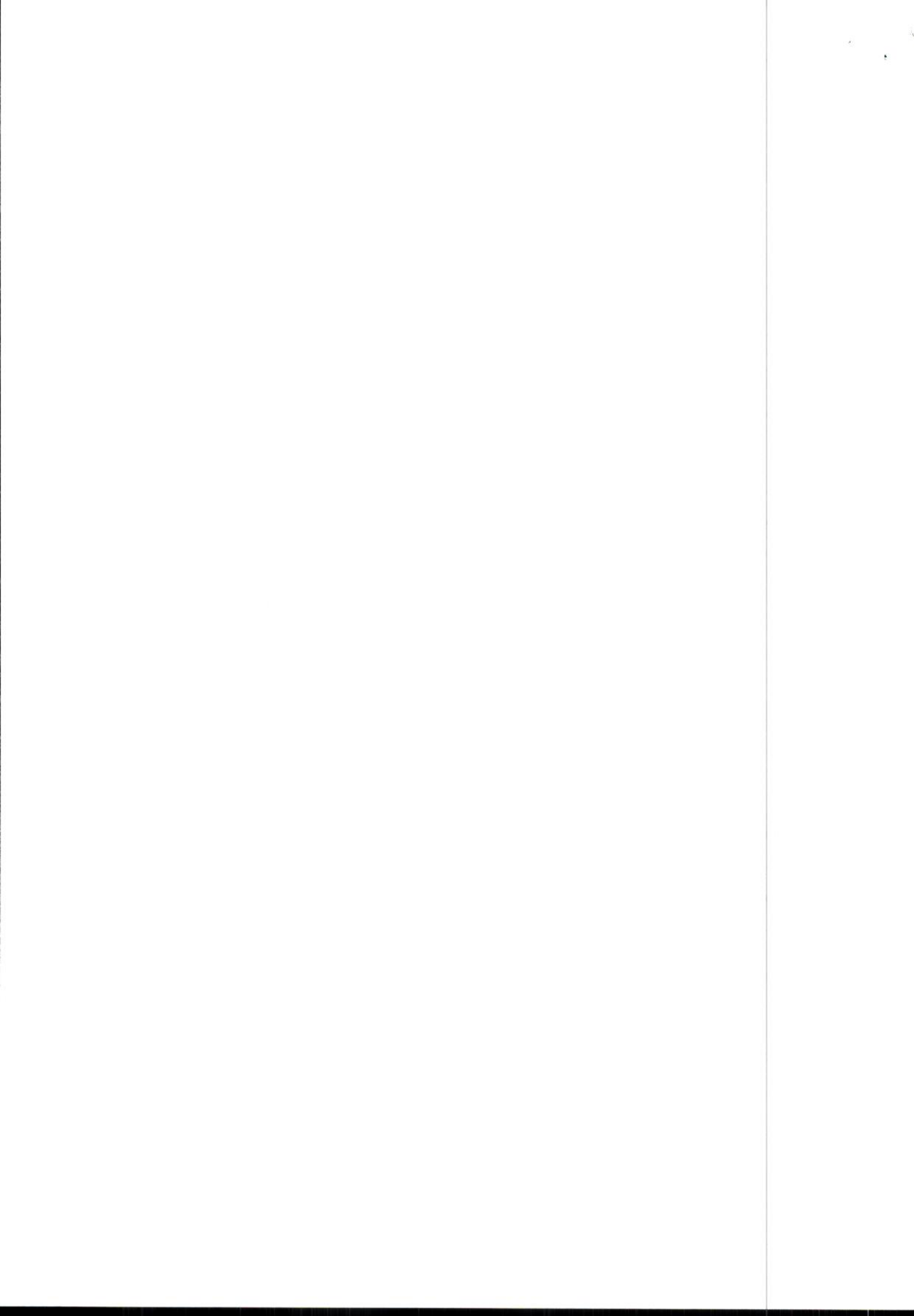
Type of analysis	Value	Measuring unit
Soil texture	Loamy sand	
Clay	50.6	%
Silt	19.1	%
Sand	30.3	%
(pH)	7.26	
Electrical conductivity (Ec)	2.28	ds.m ⁻¹
Sodium	5.5	ml L ⁻¹
Magnesium	7.97	ml L ⁻¹
Calcium	22.1	ml L ⁻¹
Total nitrogen	5.3	mg.kg ⁻¹
Phosphorus availability	39.2	mg.kg ⁻¹
Potassium availability	79.5	mg.kg ⁻¹

2.2. Experimental design and unit

The experimental design was randomized blocks in a 3 x 4 factorial design with three replications. The experiment area was divided into the row of the 1m width and the distance between the row and the other 50 cm. The distance between the sides of the house 50cm. Distributed the rows to plots and each plot have 12 experimental units by 10 plants per experimental unit 10 plants (five plants on each side) and the total number of experimental units total 36, ignoring 0.50 m at both ends.

2.3. Description treatment and fertilizer sources

The foliar application was three levels and assigned as (C1, C2). The foliar fertilizer was sprayed every 15 days from the appearance of 2-3 leaves on the plant until the end of the growing season. For Mineral fertilizer which are N, P, K with four levels and assigned as (F1, F0, F2, F3) are added without



mineral fertilizer 0 as control, 50% fertilizer recommendation, three-quarters of 75% fertilizer recommendation, and 100% fertilizer.

Nitrogen fertilizer was used as a source of nitrogen (46% N), a triple superphosphate fertilizer as a source of phosphorus (46% P₂O₅), a potassium sulphate fertilizer as a source of potassium (46% K₂O) and as recommended by [6]. The method of the addition was 15 cm from the stem of the cucumber.

2.4. Plant material

Cucumber seeds were germination and when the second leaf appearance, the seedlings were transferred to the experiment area and cultivated on both sides of the row. The distance between the seedlings (40) cm and the distance between experimental unit 40 cm.

2.5. Experimental design and statistical analysis

A factorial experiment was carried out in Randomized Complete Block Design (R.C.B.D) with 10 replicates in two factors. The first factor was foliar spraying of AL Jameah liquid fertilizer in three concentrations (0, 5- and 10-ml L⁻¹). The second factor was mineral fertilizers N, P and K with four levels symbolized control treatment without mineral fertilizer, 50%, 75% and 100% of recommended fertilizer.

Table 2. Chemical composition of prepared liquid Fertilizer in university.

Chemical	Percentage (%)
Nitrogen	5%
Phosphorus	5%
Potassium	7%
Magnesium	0.5%
Humite potassium	0.5%

2.6. Study parameters

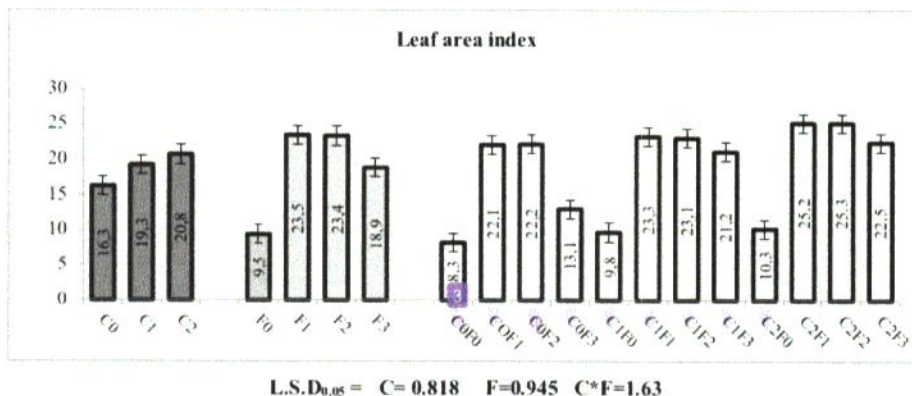
The dry weight of the vegetative growth (g plant⁻¹) and Leaf area index (cm²). Determination of leaf content from plant growth regulators (mg/kg dry weight). The Growth regulator measurements were done cytokine (CK), auxin (IAA), and gibberellin (GA3) was performed according to the method used by Nuray et al [7]. 1 g from fresh leaves taken and added 60 mL of the extraction (12 mL methanol and 5 Chloride and 47 mL of ammonium hydroxide), then added 25 mL of distilled water was added to the mixture. The acidity of the solution was adjusted to pH 2.5 using hydrochloric acid (1 standard) and sodium hydroxide (1 standard) and 15 mL ethyl acetate. GA3 and IAA was the measurement by Spectrophotometer at wavelength 254 and 280 respectively while CK was measured at wavelength 269 by using Spectrophotometer.

3. The results

3.1. Leaf area index

Figure (1) shows that there are significant differences in the leaf area index of foliar application and C2 treatment was the highest leaf area index (20.8). While there is also significant difference for Mineral treatment and the highest leaf area index for fertilizer treatment for F1 and F2 for (23.5) (23.4), respectively. The interaction between treatment showed the highest leaf area index (25.2) (25.3) were achieved under C2F1 and C2F2





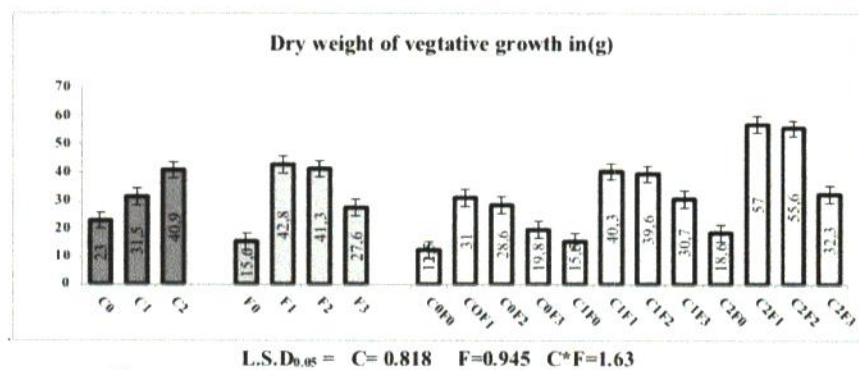
L.S.D_{0.05} = C= 0.818 F=0.945 C*F=1.63

Figure 1. Effect of foliar application and mineral element on leaf area index.

3.2. The dry weight of vegetative growth (g)

The results of Figure (2) show significant differences in dry weight of the total vegetative growth from the foliar application (liquid fertilizer of the university). The C2 treatment recorded the highest rate of 40.9 g compared to the C0 treatment which recorded the lowest average of 23.

The results of the same figure indicate the superiority of the treatment of F1, recording the highest rate of 42.8 g compared to the treatment of F0, which recorded 15.6 g. The results showed that C2F1 was superior to C2F1, with the highest rate of 57 g, compared to C0F0, which recorded the lowest rate of 12.5 g.

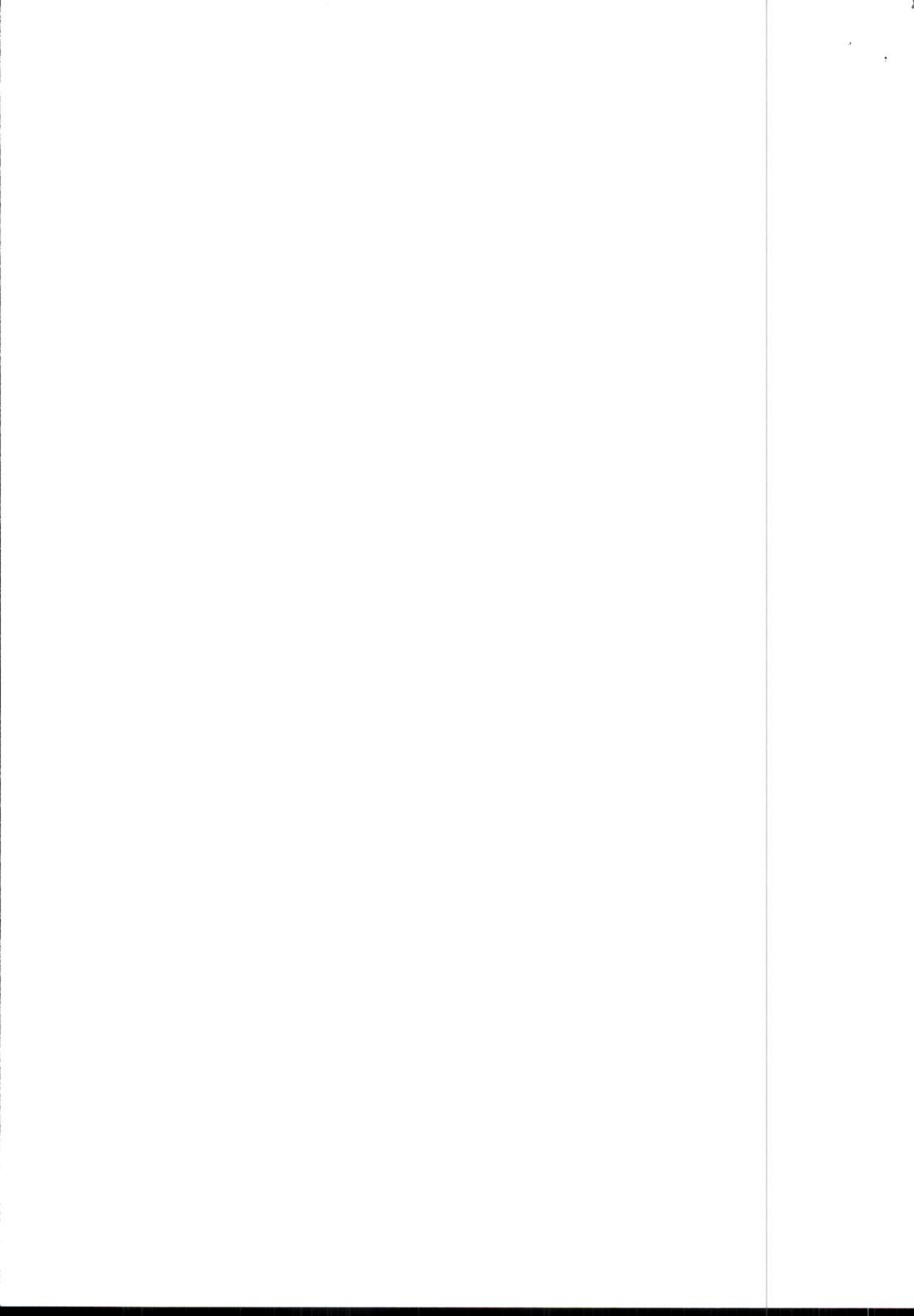


L.S.D_{0.05} = C= 0.818 F=0.945 C*F=1.63

Figure 2. Effect of foliar application and mineral element on Najafdry weight of vegetative growth.

3.3. Auxin (IAA)

The results of Figure (3) showed significant differences in the content of IAA from spraying with foliar fertilizer (The university liquid fertilizer). The C2 treatment recorded the highest rate of 185.44 mg kg⁻¹



compared to the treatment of C0, which recorded the lowest average of 144.22 mg kg⁻¹. The results showed that at the F3 treatment, which had the highest rate of 196.39 mg / l, was higher than F0, which was 124.85 mg kg⁻¹. The results of the same form indicated the superiority of the treatment of interference C2F3, which recorded the highest rate of 211.83 mg kg⁻¹ compared with the comparison treatment C0F0, which recorded 111.43 mg kg⁻¹.

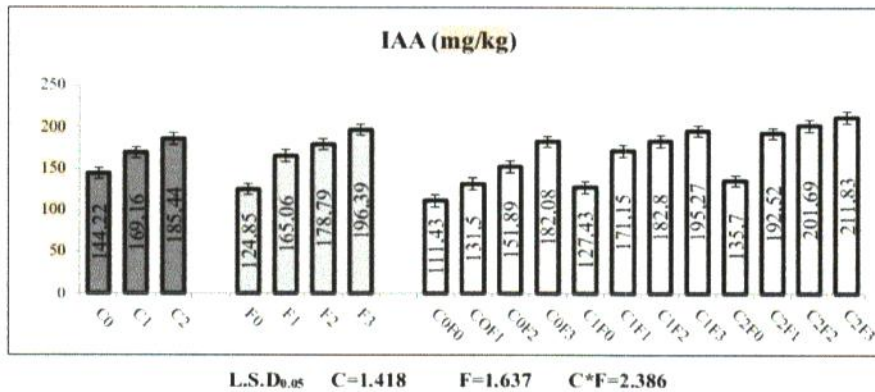


Figure 3. Effect of foliar application and mineral element on auxin content.

3.4. Gibberlic acid (GA3)

The results of Figure (4) showed significant differences in the content of GA3 from spraying with foliar fertilizer (The university liquid fertilizer). The C2 treatment recorded the highest rate of 187.2 mg kg⁻¹ compared to the treatment of C0 which recorded the lowest average of 149.2 mg kg⁻¹. The results showed that at the F3 treatment, which had the highest rate of 199.8 mg kg⁻¹ was higher than F0, which was 128.2 mg kg⁻¹. The results of the same form indicated the superiority of the treatment of interference C2F3, which recorded the highest rate of 221.6 mg kg⁻¹ compared with the comparison treatment C0F0, which recorded 112.6 mg kg⁻¹.

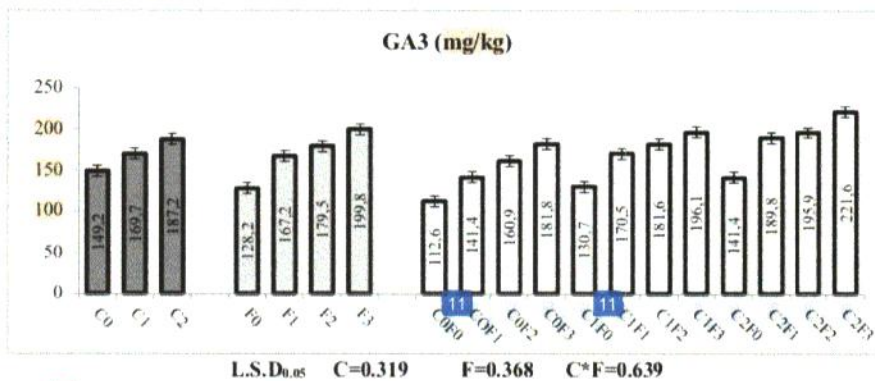
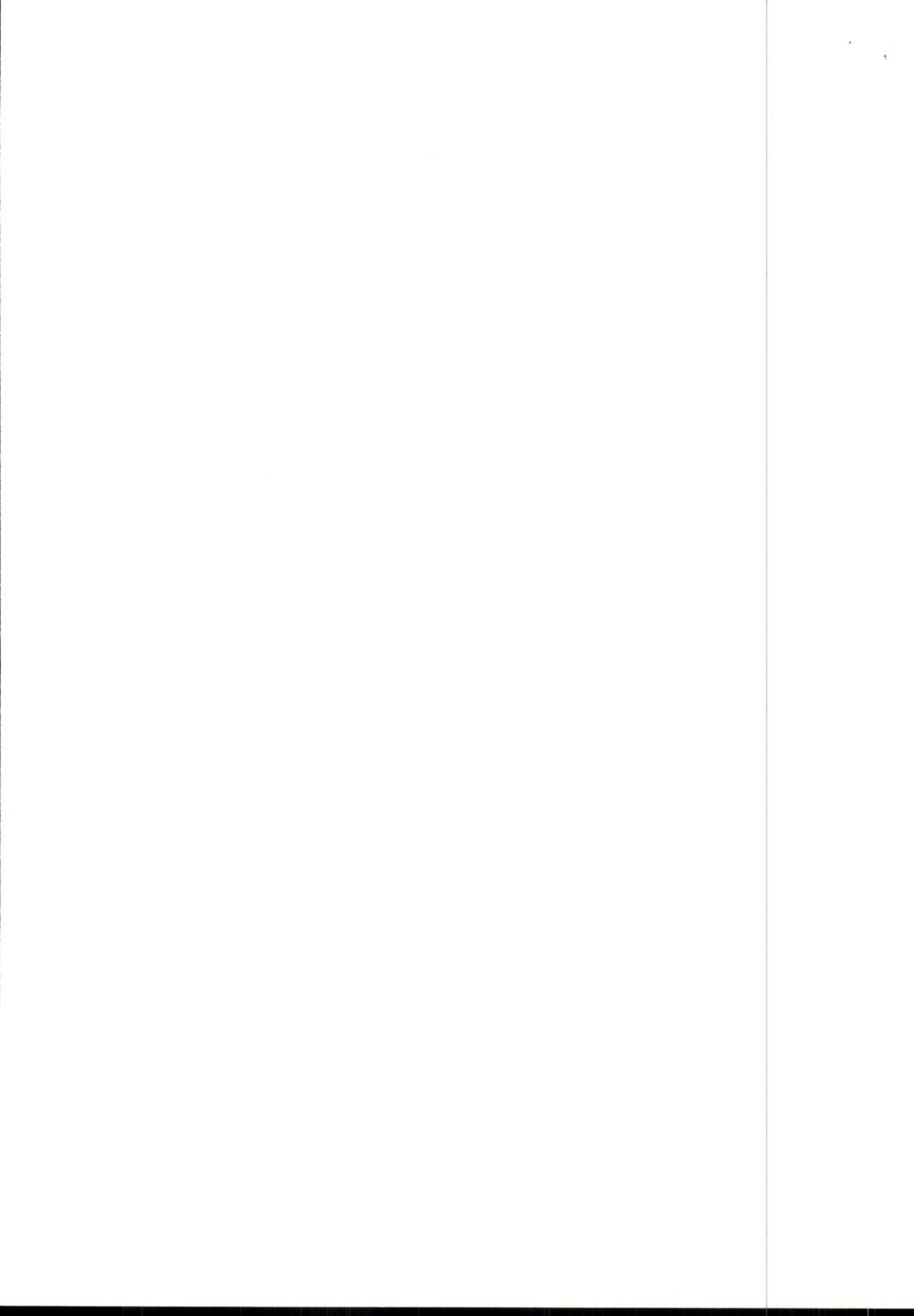


Figure 4. Effect of foliar application and mineral element on Gibberlic acid content.



3.5. Cytokinin

The results of Figure (4) showed significant differences in the content of CK from spraying with foliar fertilizer (The university liquid fertilizer). The C2 treatment recorded the highest rate of 178.1 mg kg⁻¹ compared to the treatment of C0 which recorded the lowest average of 148.7 mg kg⁻¹. The results showed that at the F3 treatment, which had the highest rate of 196.1 mg kg⁻¹ was higher than F0, which was 133.8 mg kg⁻¹. The results of the same form indicated the superiority of the treatment of interference C2F3, which recorded the highest rate of 214.9 mg kg⁻¹ compared with the comparison treatment C0F0, which recorded 121.5 mg kg⁻¹.

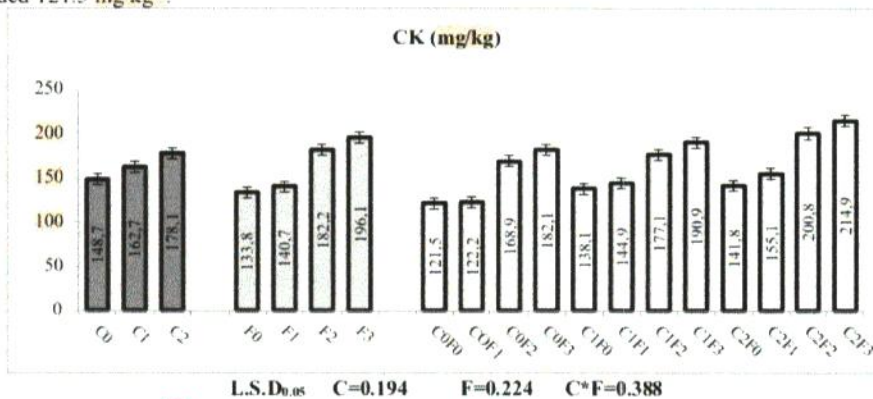


Figure 5. Effect of foliar application and mineral element on Cytokinin content.

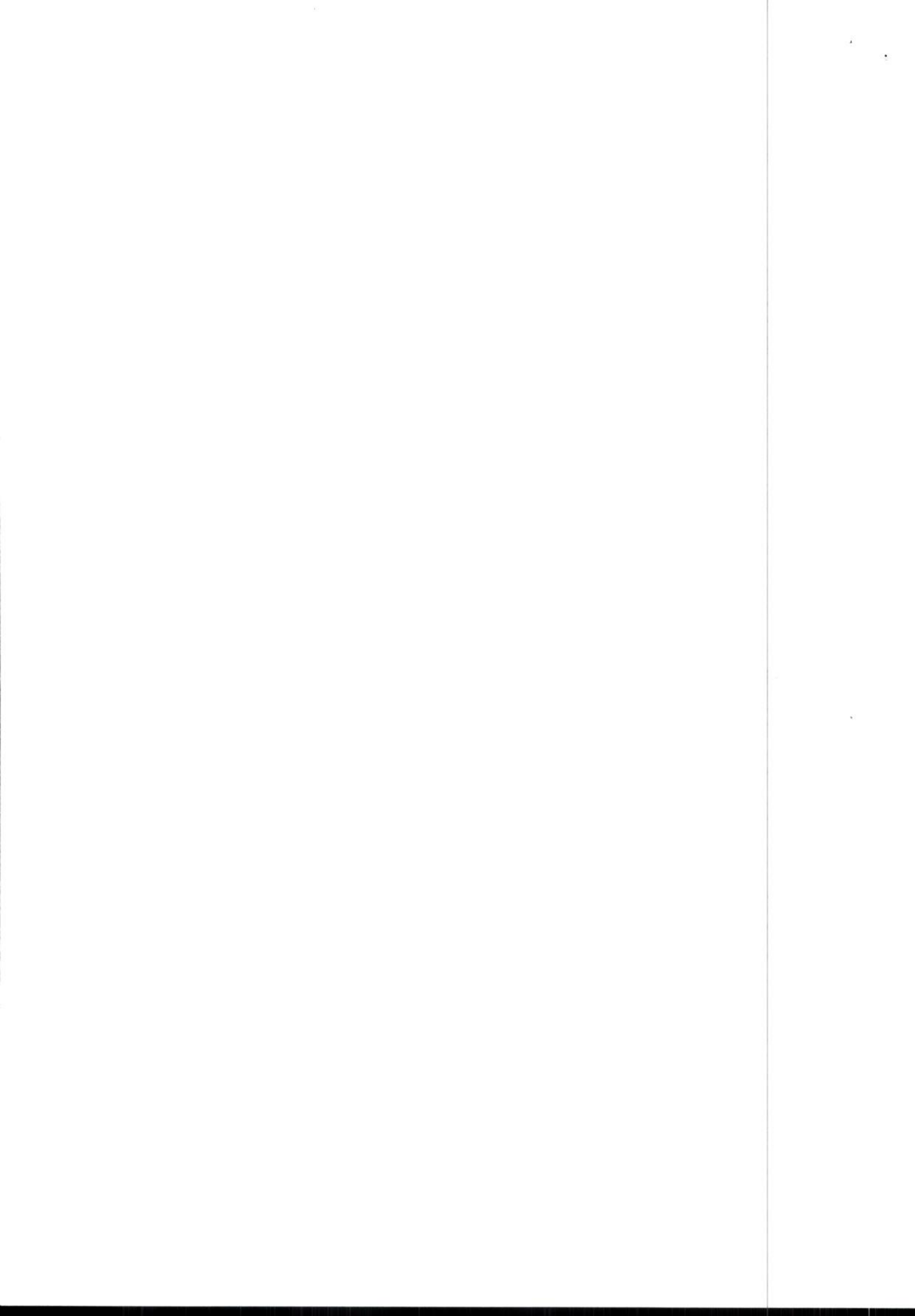
4. Discussion

It is clear from the results that the foliar application by nutritious fertilizer (The university liquid fertilizer) has led to a significant increase in vegetative qualities, and may be attributed to the role of foliar fertilizer and its components of ready to plant Table (2) through spraying to the leaves, which is the centre of many vital events.

In addition, potassium hydrate has a physiological effect similar to that of cytokinin, which affects plant growth [8]. Also, potassium hydrate has a significant effect on the dry leaf and leaf area index of plants. These results are consistent with [9–11].

The increase in growth was due to the availability of essential nutrients such as N, P and K in soil and close to the root zone. These elements transfer to the vegetative range and their utilization in critical biological and phytosanitary processes that improvement the growth of different parts of the plant [12,13]. The increase in N and K content in the plant improved the vegetative growth characteristics (the leaf area and the dry weight of vegetative growth). This is in line with the findings of Colpan et al [14] and Al-Taey et al [2].

The results indicate that the addition of mineral fertilizers and foliar nutrition has been significantly increased the plant growth regulators (IAA, GA3, and cytokine CK). The reason for this is that the University's fertilizer is rich in nutrients, especially phosphorus and nitrogen (Table 2). These elements enter the protein synthesis Enzymes, nucleic acids, DNA, and RNA, which stimulate the formation of cytokines, as well as containing hemic acid in the potassium hydroxide, which prevents IAA from breaking down IAA-oxidase. IAA increases GA3 in the plant [15].

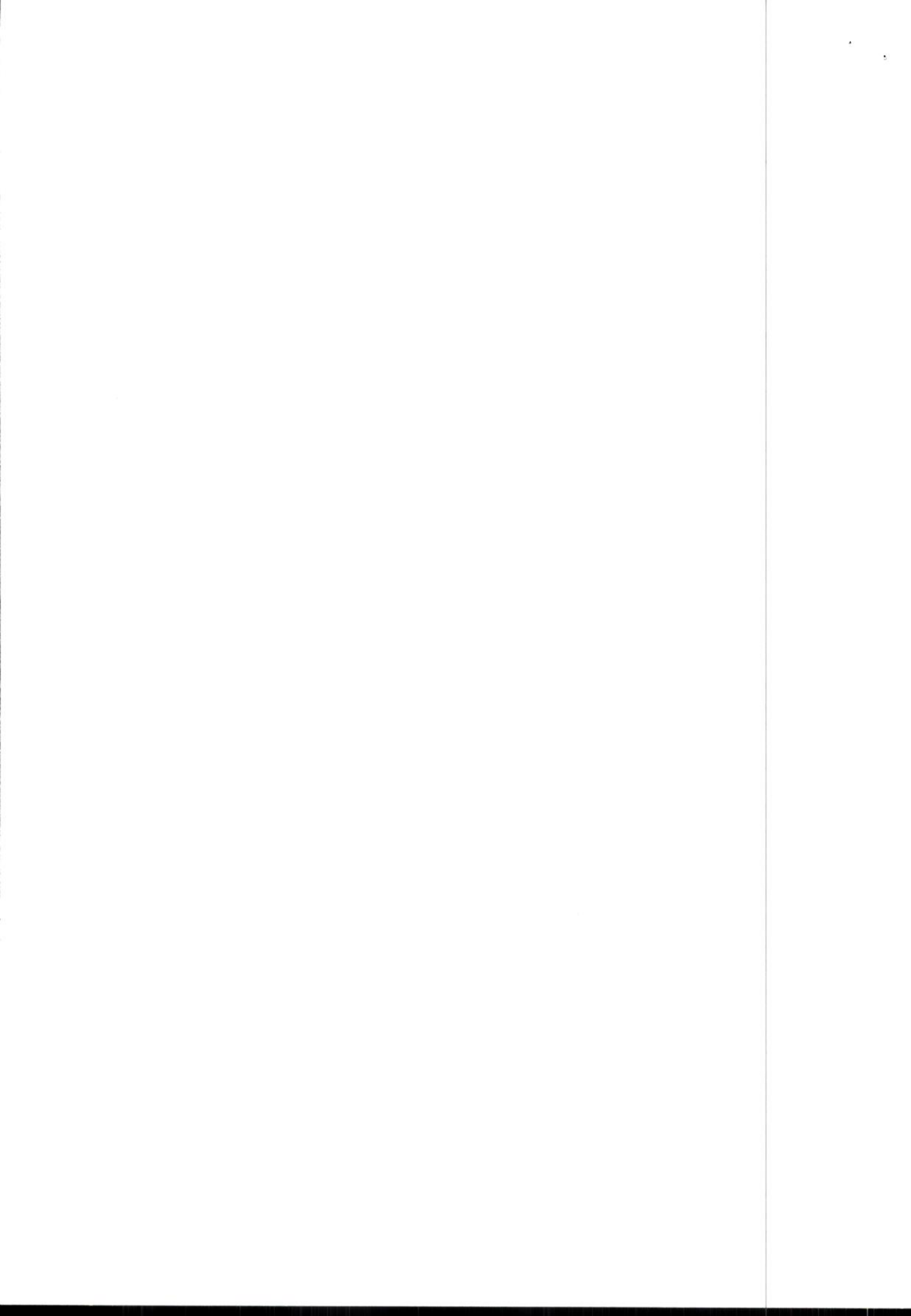


5. Conclusion

The conclusion showed that the interaction treatment spraying foliar fertilizer at a concentration 10ml.L⁻¹ and 50% of mineral fertilizer was superior significantly in IAA (211.83) mg.kg⁻¹, GA3 (221.6) kg⁻¹, CK (214.9) mg. kg⁻¹.

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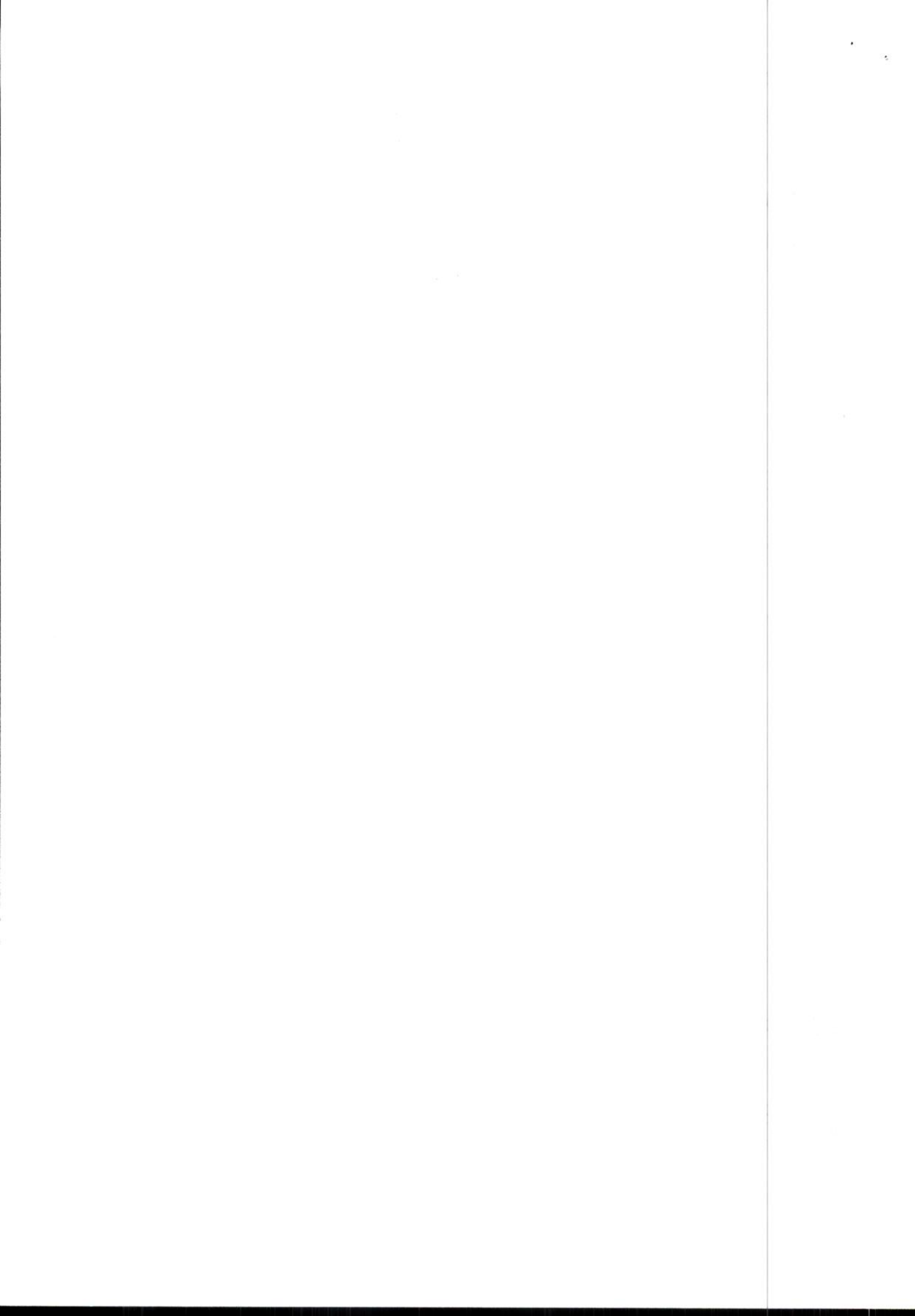
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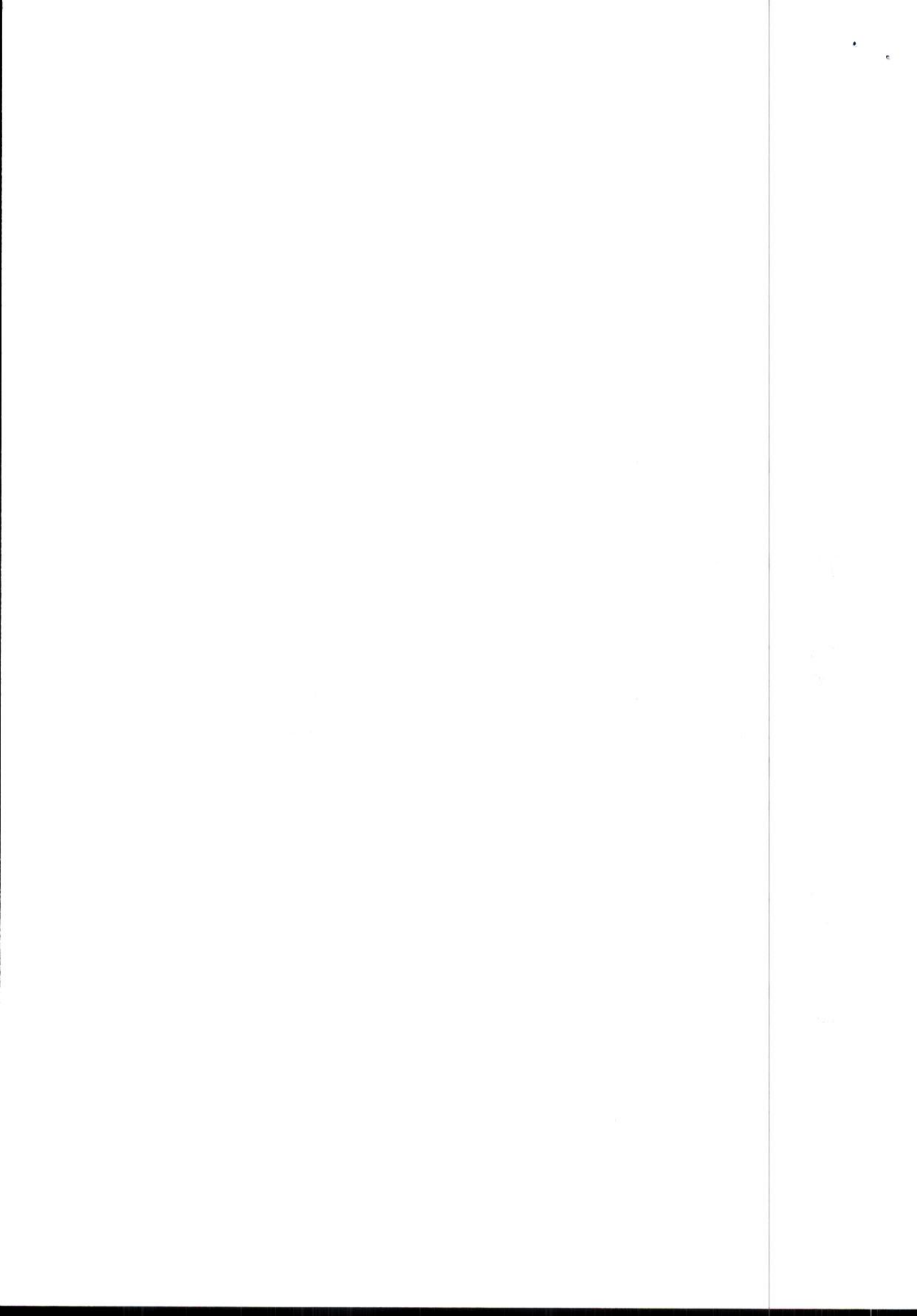
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