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# EFFECT OF SHADING AND NANO NPK FERTILIZERS ON THE GROWTH OF *RUSCUS ACCULATUS* PLANT

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## ABSTRACT

**This experiment was conducted in the plastic greenhouse belong to the nursery of Duhok University for the period from 1st Aug. 2021 to 30th May 2022. Aimed to study the effect of shade (0, 50 %) and three concentration (0, 3, 6) g $L^{-1}$ of Nano NPK fertilizers added twice monthly on the growth of *Ruscus acculatus* plant. The results showed that 50% of shade increased significantly the Number of branches, leaves area, number of rhizomes growth index, root dry weight, total chlorophyll compared with 0 % shade. Increased Nano NPK fertilizers to 6 g $L^{-1}$ increased significantly the plant height, number of leaves, leaves area, growth index, Vegetative dry weight compared with the other concentration. The highest Number of branches (22.00) and growth index (84303) was for (50% shading + 3 g $l^{-1}$) Nano (NPK), number of leaves (1083.3 and 1035.7) and (16515 and 16371) and Vegetative dry weight (52.01 and 47.95) for the (two shades respectively + 6 $gl^{-1}$), number of rhizomes (10.00) for (50% shading + 6 g $l^{-1}$), whereas the three conc. of Nano NPK + 50% shade increased significantly the root dry weight compared with other shading levels, finally the best treatment for total chlorophyll was for (50% shade +3 g $l^{-1}$).**

***KEY WORDS:*** *shaping, nano NPK* Fertilizers, Growth, ***RUSCUS ACCULATUS***.

## INTRODUCTION

The genus Ruscus has animated between several families including Convallariaceae, Ruscaseae, and Liliaceae, but now day, in the APG III classification system, it has been included in the Asparagaceae family **(Thomas, 2014)**. Its native to the Mediterranean, Southern and Western Europe **(Davis *et al*.,1984)**. Ruscus plant considered as a shrubs plant which can be used for special properties, it considered as shrubs that need to neutral pH soil, shady or semi-shady condition for their growth and it can't withstand winter frosts many time the plants were resemble as a ginger plant that produce false leaf which they are not seen often and this phenomenon called cladodes that produce flowers, **(Hallik *et al*, 2009).** Medicinally it uses as anti-cancer, anti-inflammatory capability. at floriculture industry the production of cut foliage component are become very important specially when making a flower bouquet and arranging it, for its evergreen long lasting and for its dark green color become used in a wide range as accent in floral arrangement and floral industry **(Alexandria, *et al*., 2014).**

There are several factors effecting the growth and development of Ruscus plant like temperature, humidity, shade, medium, and nutrition statues of plants. Nanotechnology is a strategy in order to increase the value of agriculture products and decreasing environmental problems (**Elfeky *et al*., 2013).** So, it become a very important material for providing agriculture sector around the world **(Singh *et al*., 2017)**. they are modified or synthesized from classical fertilizers, or extracted from different vegetative plant parts through different methods, physiological, chemical or physical way this nanotechnology way led to improving soil fertility therefor producing crops with high quality and quantity **(Brunnert, *et al* 2006). Elfeky *et al*. (2013)** reported positive effects of nano-iron on total carbohydrate, chlorophyll content, essential oil percentage and many growth characteristics of *Ocimum basilicum*. **Abdelkader *et al*., (2016)** found that treating the *Magnolia grandiflora* plants with 6 gm $L^{-1}$ of Nano-fertilizers increased the plant leaf area .**Qureshi *et al*., (2018)** found

that increasing concentration of Nano-fertilizers up to 6 gm $L^{-1}$ effect significantly on the plant growth and development by increased the number of leaves, and vegetative dry weight.

Shading is one of the most effective methods to protect plants from different environmental factors (e.g., cold, chilling, frost, hot, precipitation) **(Jiang *et al*., 2020).** Plants growing under low light displayed a higher leaf area per unit dry mass invested than sun plants. **(Niinemets and Kull, 1998). Valio, (2001)** Found that shading of *Trema micrantha* plant grown for 45, 30, 10.6, 4.8 and 1.8% of full sunlight for 60 days were influenced all growth parameter's measured and the total biomass decreased with decreasing irradiance, whereas the specific leaf area, leaf area ratio and leaf mass ratio increased with decreasing irradiance and in response to shading. **Zervoudakis *et al* (2012)** study the effects of four light intensities 25, 50, 75, 100 % of full light on the growth of *Salvia officinalis* they found that the plant's dry mass, number of leaves and physiological parameters indicated a strong positive correlation with the light intensity. On the other hand, the plant's height and leaf photosynthetic pigments were increased at low light treated plants. **Fadil, (2016)** demonstrated that exposure of ***Myrtus communis*** to the shade had a direct influence on studied parameters by decrease essential oil and leave thickness and increase plants height, leaves length and leaves width**. Singh *et al*., (2017)** found that 75% shade for the plant give the highest number of vegetative branches, leaf number and leaf dimeter than other levels**. Qasim, (2023)** found that 50% shade of *Myrtus communis* Significantly superior than the 0% shade (full sunny) and gave the best results in the plant high 36.21 cm, leaf area 3.41 $cm^2$, plant growth index 9230 cm3/plant, vegetative dry weight 14.62 gm/plant, root dry weight 6.06 gm/plant total chlorophyll content 57.41 (**SPAD)** Because of the highest ornamental demand of this plant for its widely used as filler plant in flower bouquet and as garden plants, this study was done to increase the number of leaves and its length, and the chlorophyll content which led to increase its coordinated value and the age of this leaves.

## MATERIAL AND METHODS

This experiment was carried out in the plastic greenhouse that belong to the nursery of Duhok University for the period from 1st Aug 2021. to 30th May 2022. The aim of this study was to study the effect of shade (0, 50) % and Nano NPK fertilizer with levels (0, 3, 6) g $L^{-1}$ on the growth of *Ruscus acculatues* plant, the three-month transplant was planted in the ground directly with Chemical characteristics of the media were pH 8.4, Ec 0.3 ds $m^{-1}$, $CaCo_3$ 15%, K 109.0 mg $L^{-1}$ . P 70 mg $L^{-1}$, N 800 mg $L^{-1,}$ Organic mater 1.4% and with (15 × 15) spaces between plants and Rows in two directions of the plastic greenhouse, the first with 0% shade (control) in southern direction which exposed to the sun light directly and the second 50% shade in the Northern direction which exposed to the shade and covered with green net to decreased the shading percentage to 50%. Whereas the Nano NPK fertilizer where spray twice monthly from the start to the end of experiment. All the agriculture peracted were done as the needs of the plant.

In the end of the experiment these parameters were records, height of plant (cm), Number of branches (branch/plant), number of leaves, leaf area ($cm^2$), number of tubers/plants, plant growth index ($cm^3$), Vegetative dry weight (gm), Root dry weight (gm), and Total Chlorophyll (SPAD). The experiment was performed by use a Randomized Complete Block Design (RCBD) with two factors 2×3= 12×3 replicate= 36 treatments units (each replicate I meter $^2$) and 3 plants for each replicate

## RESULTS AND DISCUSSION

### 1- Effect of Shading and Nano fertilizer on the growth of *Ruscus acculeatus* plant.

The data in the table (1) show that growing the plants under 50% shade caused significantly increased in the number of branches (20.61) branch/plant, plant leaves area (13705) $cm^2$, number of rhizomes (8.89) tuber/plant, plant growth index (73623) $cm^3$, Root dry weight (35.40) gm, total chlorophyll (17.62) SPAD compared with 0 % (control) which give the least values 14.78 branch/plant, 11530 $cm^2$, 6.44 tuber/plant, 62461 $cm^3$, 23.50 gm, 15.03 SPAD for the above

**Table (1):** Effect of Shading and Nano fertilizer on the growth of *Ruscus aculeatus* plant.

| Characteristics | Shade % | | Nano NPK fertilizer level (gm $L^{-1}$) | | |
|---|---|---|---|---|---|
| | 0 | 50 | 0 | 3 | 6 |
| **Plant height (cm)** | 51.44[a] | 49.06[a] | 44.92[b] | 49.50[b] | 56.33[a] |
| **Number of branches** | 14.78[b] | 20.61[a] | 16.25[a] | 18.67[a] | 18.17[a] |
| **Number of leaves** | 829.11[a] | 875.97[a] | 631.50[c] | 866.63[b] | 1059.50[a] |
| **Plant leaves area ($cm^2$)** | 11530[b] | 13705[a] | 9181[c] | 12228[b] | 16443[a] |
| **Number of tubers** | 6.44[b] | 8.89[a] | 6.92[a] | 7.58[a] | 8.50[a] |
| **Growth index ($cm^3$)** | 62461[b] | 73623[a] | 51964[b] | 72208[a] | 79953[a] |
| **Vegetative dry weight(gm)** | 41.46[a] | 35.59[b] | 28.93[c] | 36.66[b] | 49.98[a] |
| **Root dry weight (gm)** | 23.50[b] | 35.40[a] | 28.72[a] | 28.78[a] | 30.86[a] |
| **Total Chlorophyll (Spad)** | 15.03[b] | 17.62[a] | 16.68[a] | 17.55[a] | 14.75[a] |

Means with the same letter for each factor and for each characteristic are not significantly different at 5% level based on DMRT.

Characteristic respectively but the highest vegetative dry weight (41.46) gm obtained under 0% shade condition, Whereas the other characters plant height and number of leaves per plant show non-significant at both conditions.

In other hand the plants which were treated with 6 gm $L^{-1}$ of Nano NPK fertilizers gave the highest significant results for the plant height (56.33) cm, number of leaves (1059.50) leaves/plant, plant leaves area (16443) $cm^2$, plant growth index (79953) $cm^3$, Vegetative dry weight (49.93) gm compared with 0 gm $L^{-1}$ which gave the least values 44.92cm, 631.50 leaves/plant, 9181$cm^2$, 51964$cm^3$, 28.93gm for these characteristics respectively. Whereas the Number of branches, Number of tubers, Root dry weight, total chlorophyll didn't affect significantly with this factor.

**2- Effect of interaction between Shading and Nano fertilizer on the growth and development of *Ruscus aculeatus* plant:**

The data in the table (2) showed that the plants that grown in 0 % shade and sprayed with 6 gm $L^{-1}$ gave the best significantly results for the plant high (58.67) cm, Number of leaves (1083.3) leave/plant, plant leaves area (16515) $cm^2$, Vegetative dry weight (52.01) gm compared with the least value for the plant high (42.50) cm and Vegetative dry weight (23.86) gm for (50% shade + 0 mg $L^{-1}$) , Number of leaves **(**546.0) leave/plant and plant leaves area (7516) $cm^2$ for (0% shade + 0 mg $L^{-1}$).

**Table (2):** Effect of interaction between Shading and Nano NPK fertilizer on the growth of *Ruscus aculeatus* plant.

| Characteristics | Shade 0 % (without) | | | Shade 50 % | | |
|---|---|---|---|---|---|---|
| **Nano NPK fertilizer level (gm $L^{-1}$)** | 0 | 3 | 6 | 0 | 3 | 6 |
| **Plant height (cm)** | 47.33[bc] | 48.33[bc] | 58.67[a] | 42.50[c] | 50.60[a-c] | 54.00[ab] |
| **Number of branches** | 13.00[b] | 15.33[b] | 16.00[b] | 19.50[a] | 22.00[a] | 20.33[a] |
| **Number of leaves** | 546.0[c] | 858.0[ab] | 1083.3[a] | 717.0[bc] | 875.25[ab] | 1035.7[a] |
| **plant leaves area ($cm^2$)** | 7516[c] | 10558[bc] | 16515[a] | 10846[bc] | 13898[ab] | 16371[a] |
| **Number of tubers** | 6.67[b] | 5.67[b] | 7.00[b] | 7.17[b] | 9.50[a] | 10.00[a] |
| **Growth index ($cm^3$)** | 48447[c] | 60114[bc] | 78821[ab] | 55482[c] | 84303[a] | 81086[a] |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Vegetative dry weight (gm)** | 34.00$^{b}$ | 38.37$^{b}$ | 52.01$^{a}$ | 23.86$^{c}$ | 34.96$^{b}$ | 47.95$^{a}$ |
| **Root dry weight (gm)** | 23.03$^{b}$ | 22.51$^{b}$ | 24.97$^{b}$ | 34.41$^{a}$ | 35.05$^{a}$ | 36.75$^{a}$ |
| **Total Chlorophyll (SPAD)** | 17.4$^{ab}$ | 14.90$^{bc}$ | 12.80$^{c}$ | 15.95$^{bc}$ | 20.20$^{a}$ | 16.70$^{a-c}$ |

Means with same letter for the interaction between the factors for each characteristic are not significantly different at 5% level based on DMRT

Number of branch and Root dry weight increased significantly for the plants which grown in 50% shade and sprayed with all Nano NPK fertilizer and ranged between (19.50 to 22.00) branch/plant and (34.41 to 36.75) gm for the two characteristics respectively compared with the least value 13.00 branch/plant for (0% shade + 0 gm $l^{-1}$) and 22.51gm for (0% shade + 3 gm $l^{-1}$) respectively. Number of rhizomes (9.50, 10.00) tubers/plant and plant growth index (84303, 81086) $cm^3$ increased significantly for the plants which grown in 50 % shade and spray with 3 and 6 gm $L^{-1}$ respectively for the two characteristics and two fertilizer levels compared with the least value 5.67 rhizomes/plant for (0% shade + 3 mg $l^{-1}$) and 48447$cm^3$ for (0% shade + 0 mg $l^{-1}$) respectively. The chlorophyll increased significantly to (20.20) Spad for the plants which exposed to 50 % shade and spray with 3 gm $L^{-1}$ of Nano NPK fertilizer compared with the least value 12.80 Spad for (0% shade + 6 mg $l^{-1}$)

## DISCUSSION

The significant increasing of the most of studied characteristic of this study as a result to increase the levels of Nano-fertilizer may refer to its rule in improve the availability of nutrients to the growing plants that improves chlorophyll formation, photosynthesis rate, dry matter production and improves overall plant growth (**Salama, 2012; Suriyaprabha *et al*., 2012; Jameel and Al-Tai, 2018).** also increased the Nano-fertilizers to 6 mg $L^{-1}$ may lead to increase the length of internode then increased the height treated plants and effected on genetic pathway and gene expression of plants **(Ghormade *et al*., 2011).** These results were in agreement with **Salama, (2012)** on *Phaseolus vulgaris* and **Mahmoodi *et al*., (2018)** on *Borago officinalis* which indicate that hyper feed lead in increasing of chlorophyll content in plant and increasing of photosynthesis process rate led to increasing in nutrients in plants tissues as long increasing in total growth of plant.

In the other side 50% of shade resulted in increasing number of branches, plant leaves area, number of rhizomes, plant growth index, Root dry weight and total chlorophyll content of this plant. The effects of shading percentage on plant growth and biosynthesis of secondary metabolites have been previously reported in many species, so light intensity has a significant effect on plant growth, development, yield, and bioactive compounds (**Wang *et al*., 2012; Ayatullah, 2019)**.

the significant increase in chlorophyll and plant growth index with increasing in shading up to 50% may refer to chlorophyll molecules which are susceptible to photo oxidation and the equilibrium is reached in lower radiation levels and to increase of vegetative growth in order to capture more light, probably because of a shading avoidance mechanism **(Ballare, 1999 and Alvarenga and Magalhaes, 2003).**

## CONCLUSION

From this study it can be concluded the plant gave the best results with combination of Nano-NPK fertilizers at (6 gm $L^{-1}$) and 50% of shade condition, ***Ruscus acculatus*** gave the best vegetative growth including number of branches, number of leaves and other parameters that discussed above increased compared to other treatments. It could be recommended that application of Nano-NPK fertilizers with high level twice monthly and growing the plants under 50% of shades will lead to increase the ***Ruscus*** plant growth and improving the quality of produced oil because Ruscus plant considered as medicinal plant for its using in medicinal purposes.

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