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Effect of Mineral Fertilization with Some Growth Regulators on Growth of *Magnolia grandiflora* L. Seedling.
I. Effect on Vegetative Growth

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ABSTRACT

This study was carried out at the Experimental Station and Laboratory of Vegetable& Floriculture department, Fac. of Agriculture, Mansoura University during the two successive seasons of 2011/ 2012 and 2012/ 2013.It aimed to study the effect of monthly treatments of NPK rates (0, 1.5, 3.0, 4.5 g /plant) and foliar spray with GA_3 at 100 ppm and yeast at 5 g /l either alone or in combination from the 1st of April to the 1st of September on growth of containerized magnolia (*Magnolia grandiflora* L.) tree transplants. The results showed that GA_3 spray was the most effective compound to improving all growth parameters of magnolia transplants, followed by yeast spray, while mineral fertilization was the third in order. Among fertilizer treatments, the medium fertilizer level 3g/pot was optimum for growth of magnolia transplants. Monthly fertilization with Hyper feed NPK (19:19:19) fertilizer at 3 g/pot combined with foliar spray of both GA3 at 100 ppm and yeast at 5 g/l resulted in the highest significant values for plant height, stem diameter, number of leaves per plant, leaf area and fresh and dry weights of plant, fresh and dry weights of magnolia transplants. Data also showed that the previously mentioned combination resulted in the highest contents of N, P, K, carbohydrates, and chlorophyll in magnolia leaves.

INTRODUCTION

Magnolia grandiflora L. (Southern magnolia or Bull Bay) is a large evergreen tree that grows up to 30 m in height (Duncan and Duncan, 1988). It belongs to the family *Magnoliaceae* and is a native to the Southeastern United States. In Egypt, it is grown in botanical and private gardens.

The bark of magnolia pocesses medicinal properties as a diaphoretic, stimulant and tonic. In addition, it is used to treat malaria, reduces the blood pressure, and as a wash for sores (Odenwald and Turner, 1996).

Some botanists and horticulturists have acclaimed southern magnolia as the most beautiful of all evergreen trees (McDaniel, 1968 and Glitzenstein et al., 1986). In Egypt, it is grown in landscape in botanical and private gardens because of the combined beauty of its lustrous green leaves and fragrant white flowers.

Fertilization is an important practice for quality of tree seedlings grown in containers since the limited volume of the container seriously restricts their growth. Fertilization increases shoot and root growth of the plants, changes contents of tissue nutrients, improve rooting and growth of the transplants after transplanting (Landis, 1997; Shaw *et al*., 1998; Oliet et al., 2004).

Gibberellins were used to increase vegetative and root growth of seedlings of many tree species Taha (1994) *Parkinsonia aculata*, Ahmed (1995) on *leucaena leucocephala*, Shehata (1995) *Poinciana regia*, Ahmed (1998) *Robinia pseudoacacia*, Gul *et al*. (2006) *Araucaria hetrophylla*,

In the recent years, foliar application with active breed yeast (*Saccharomyces cervisiae*) has been used as a bio-fertilizer (or a natural bio-stimulant) to improve growth and yield of many crops (Ahmed and Ragab (2002); Abd El-Motty *et al*. (2010); Mahmoud *et al*. (2013); Kamal and Ghanem , 2012) due to its component of nutrients, proteins, vitamin B, cytokinins, and the release of CO2 which improves the net photosynthesis Hashem *et al*.,(2008).

The main purpose of this investigation was to study the effect of NPK at (0, 1.5, 3.0, 4.5 gm /plant), GA_3 at 100 ppm and Yeast at 3g / L or either alone in combination on subsequent seedling vegetative growth as well as chemical constituents of *Magnolia grandiflora* L.

MATERIALS AND METHODS

This study was carried out at the Experimental Station and Laboratory of Vegetable& Floriculture, Fac. of Agriculture, Mansoura University from April to September in the two successive seasons of 2011/2012 and 2012/2013 to study the effect of different NPK rates, GA_3 and yeast either alone or in combination on subsequent vegetative seedling growth and chemical constituents of *Magnolia grandiflora* L.

Plant material :

Seeds of Bull Bay (*Magnolia grandiflora* L.) tree were obtained from the Agricultural High School in Faraskur, Damietta Governorate, Egypt. The seeds were sown in seedling trays containing 1:1 (v / v) peat moss and sand inside unheated greenhouse and were irrigated 3 times a week. After 5 months from sowing (after the emergence of two to four true leaves), each seedling was transplanted to 8 cm plastic pot containing 1:1 (v / v) peat moss and sand and were irrigated 2 times a week. After 12 month from sowing, seedlings were transplanted to 20 cm plastic pots containing 2:1 (v / v) clay and sand and were placed inside a wooden greenhouse and were irrigated one time a week. After 18 month from sowing, transplants were around 7 cm high and carrying 5 true leaves and were approximately 2 mm in diameter.

Transplants were subjected monthly to the experimental treatments starting from the 1st of April to the 1st of September in each year.

Experimental design :

The experimental design was set in a split plot experiments design with three replicates; each replicate contained three pots. The main plot consisted of four

spray treatments with Distilled water (control), GA_3 at 100 ppm; Yeast extract at 5g/l and GA_3 at 100 ppm plus Yeast extract at 5g/l.

The subplot consisted of four NPK treatments; 0 NPK (control), 1.5 g, 3 g, and 4.5 NPK per pot.

Chemicals used:

The commercial NPK fertilizer Hyper Feed (19 – 19 – 19), GA_3 and yeast were obtained from the Company BIO NANO TECH. Company of Chemicals at Mansoura –Dakahlia – Egypt.

Data recorded

At the end of the experiment (September 30th of each year, the following measurements were recorded:

1: Plant height (cm): Plant height was measured starting from the soil surface to the top of plants.

2: Stem diameter (mm): stem diameter was measured at 3 cm above the soil surface.

3: Average leaf area

4 : Number of leaves / plant:

5: Plant fresh weight (g).

6 : Plant dry weight (g).

8 : leaves area (cm^2) :

2-Chemical analysis:

Chemical analysis was carried out in the Laboratory of Chemical Dept., Fac .of Agric. Mansoura Univ. Plant samples were oven dried at 70 ºC until constant weight then finely ground and were subsequently used for chemical determination according to AOAC (1970).

Determination of nitrogen percentage : The nitrogen was determined according to the micro-kjeldhl methd (Jackson, 1967).

Determination of phosphorus percentage : The phosphorus percentage was determined colorimetrically according to the method of Murphy and Reily (1962).

Determination of potassium percentage : The potassium percentage was determined by using the Atomic Absorption Spectrophotometer (3300) according to Wilde *et al* . (1985).

Determination of carbohydrates percentage : The carbohydrates percentage in plant leaf sample was determined according to the method of Herbert *et al* . (1971).

Chlorophyll pigments (mg/g fresh weight): Total chlorophyll was determined in the fresh plant leaf samples using the method described by Moran (1982) .

Soil analysis :

The media of the experimental soil pots were sandy clay loam texture and the soil physical and chemical properties before both seasons are presented in Table (A).

Table (A): Some Physical and chemical characteristics of the experimental. media in the two seasons (2011/2012 and 2012 /2013).

Mechanical Analysis				
Coarse Sand (%)	**Fine sand (%)**	**Silt (%)**	**Clay (%)**	**T.Class**
3.78	19.56	43.51	33.15	S.C.L
Chemical Analysis				
$Caco_3$ (%)	OM (%)	SP (%)	EC (ds/m) 1:5	PH 1:2.5
3.93	1.43	59.5	1.03	7.98
Available (ppm)				
N		P	K	
43.7		4.93	188.5	

Statistical analysis:

The obtained data were subjected to the statistical analysis using analysis of variance (ANOVA) of method and means were compared by using the least significant difference (L. S. D) test at 5 % level of probability as described by Gomez and Gomez (1984).

RESULTS

I. Effects on plant growth parameters

Table (1) showed the effect of growth regulating substances and mineral fertilization rates treatments on some vegetative growth parameters of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons. Data showed that the combination of any substance plus NPK resulted than better growth parameters compared with any comparable combination between distilled water and NPK fertilization. Data also showed that within any growth regulating substance treatment, the combination between this treatment and the medium dose of NPK (3g/plant) resulted in better growth than with the high NPK dose. This clearly indicated that the high NPK dose (4.5 g/plant) processes some retarding effect on any specific spray treatment used. In addition, within any NPK treatment, the combination between this treatment with GA_3 plus yeast resulted in the best growth parameters, followed by GA_3, the yeast treatment, while the control treatment (Distilled water) was the least.

Results also showed that the treatment combination among GA_3 plus yeast combined with medium NPK dose (3 g/plant) resulted in the highest significant values for plant height (22.7 and 23 cm), stem diameter (11.3 and 11.5 mm), number of leaves (14.7and 14.9 leaves /plant), leaf area (618 and 623 cm^2), and fresh (10.8 and 11.0 g/plant) and dry (6.7 and 7.0 g/plant) weights in the first and second seasons, respectively. The second best treatment was the combination between GA_3 plus yeast and the high NPK dose (4.5 g/plant).

Table (1): Effect of growth regulating treatments and mineral fertilization on final plant height, stem diameter, number of leaves, leaf area and fresh and dry weights of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons.

Treatments		Plant height (cm)		Stem diameter (mm)		Number of leaves per plant		Leaf area (cm2)		Fresh weight (g)		Dry weight (g)	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Distilled water	NPK (0.0 g)	9.6	10.0	5.5	5.7	7.4	7.6	296	300	5.0	5.3	2.7	2.9
	NPK (1.5 g)	9.9	10.3	6.0	6.2	8.0	8.2	325	320	6.3	6.6	3.7	3.6
	NPK (3 g)	10.6	11.0	7.0	7.2	8.4	8.6	356	360	7.7	7.9	4.5	4.7
	NPK (4.5 g)	10.3	10.7	6.5	6.7	8.1	8.3	348	344	7.0	7.4	4.2	4.3
GA_3	NPK (0.0 g)	16.3	16.7	6.6	6.8	8.3	8.6	332	336	6.3	6.0	3.6	3.5
	NPK (1.5 g)	18.6	19.0	9.0	9.2	9.0	9.2	394	390	8.0	8.2	4.8	4.9
	NPK (3 g)	20.2	20.6	10.0	10.2	13.6	13.8	574	578	9.9	9.7	5.7	5.5
	NPK (4.5 g)	19.5	19.9	9.5	9.7	12.0	12.2	515	510	9.2	9.5	5.0	5.3
Yeast	NPK (0.0 g)	16.0	16.4	6.0	6.2	8.0	8.2	320	325	5.9	5.6	3.3	3.2
	NPK (1.5 g)	16.3	16.7	10.2	10.4	8.7	8.9	383	378	7.7	7.8	4.5	4.4
	NPK (3 g)	17.5	17.9	9.2	9.4	11.8	12.0	502	507	9.1	9.0	5.3	5.2
	NPK (4.5 g)	17.3	17.7	8.2	8.4	11.0	11.2	475	470	8.7	9.0	4.7	4.8
GA_3 plus yeast	NPK (0.0 g)	17.6	18.0	6.4	6.6	9.3	9.5	372	377	6.7	6.5	3.8	3.6
	NPK (1.5 g)	18.6	19.0	10.4	10.6	10.5	10.7	455	450	9.2	9.3	5.9	5.7
	NPK (3 g)	22.7	23.0	11.3	11.5	14.7	14.9	618	623	10.8	11.0	6.7	7.0
	NPK (4.5 g)	21.0	21.4	10.3	10.5	13.0	13.2	525	520	10.0	10.2	6.1	6.1
L.S.D at 5 %		0.2	0.2	0.1	0.1	0.2	0.1	7	12	0.1	0.1	0.1	0.1

II. Effects on chemical composition

a . Effects on N, P, and K contents of the leaves

Table (2) showed the effect of growth regulating substance andmineral fertilization rates on N, P and K% of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons. Data showed that the combination of any substance plus NPK resulted in better N, P and K% compared with any comparable combination between distilled water and NPK fertilization. Data also showed that within any growth regulating substance treatments, the combination between this treatments and the medium dose of NPK (3g/plant) resulted in better concentrations of N, P and K% than with the high NPK dose. This clearly indicates that the high NPK dose (4.5 g/plant) processes some retarding effect on any specific spray treatment used. In addition, within any NPK treatment, the combination between these treatments with GA_3 plus yeast resulted in the best values of N, P and K%, followed by GA_3, then the yeast treatment, while the control treatment (Distilled water) was the least.

Results also showed that the combination among GA_3 plus yeast combined with medium NPK dose (3 g/plant) resulted in the highest significant values for nitrogen percentage (3.15 and 3.16%), phosphorus percentage (0.360 and 0.358%) and potassium percentage (3.30 and 3.32 %) in the first and second seasons respectively. The second best treatment was the combination between GA_3 plus yeast and the high NPK dose (4.5 g/plant).

Table (2): Effect of growth regulating substances and mineral fertilization treatments on nitrogen, phosphorus, and potassium percentages in the leaves of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons.

Treatments		Nitrogen (%)		Phosphorus (%)		Potassium (%)	
		1st	2nd	1st	2nd	1st	2nd
Distilled water	NPK (0.0 g/plant)	1.94	1.95	0.237	0.238	2.11	2.13
	NPK (1.5 g/plant)	2.09	2.10	0.262	0.263	2.35	2.36
	NPK (3 g/plant)	2.32	2.33	0.291	0.290	2.53	2.55
	NPK (4.5 g/plant)	2.17	2.18	0.282	0.283	2.44	2.42
GA_3 (100 ppm)	NPK (0.0 g/plant)	2.08	2.09	0.257	0.256	2.29	2.30
	NPK (1.5 g/plant)	2.69	2.70	0.320	0.322	2.81	2.80
	NPK (3 g/plant)	2.90	2.91	0.334	0.332	3.03	3.05
	NPK (4.5 g/plant)	2.79	2.80	0.325	0.326	2.93	2.91
Yeast 5 g/ L.	NPK (0.0 g/plant)	1.96	1.97	0.246	0.245	2.18	2.20
	NPK (1.5 g/plant)	2.41	2.42	0.310	0.312	2.64	2.62
	NPK (3 g/plant)	2.60	2.61	0.322	0.320	2.90	2.93
	NPK (4.5 g/plant)	2.49	2.50	0.314	0.316	2.79	2.60
GA_3(100 ppm) plus yeast 5g/L	NPK (0.0 g/plant)	2.27	2.29	0.273	0.271	2.45	2.48
	NPK (1.5 g/plant)	2.93	2.94	0.349	0.351	3.09	3.07
	NPK (3 g/plant)	3.15	3.16	0.360	0.358	3.30	3.32
	NPK (4.5 g/plant)	3.03	3.05	0.334	0.336	3.19	3.17
L.S.D at 5 %		0.06	0.07	0.008	0.010	0.10	0.12

b :Effects on carbohydrates and chlorophyll contents in the leaves

Table (3) showed the effect of growth regulating substances and mineral fertilization rates and on total carbohydrates and total chlorophyll content (mg /g FW) of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons. Data showed that the combination of any substance plus NPK resulted in better values of these parameters compared with any comparable combination between distilled water and NPK fertilization. Data also showed that within any growth regulating substance treatments, the combination between these treatments and the medium dose of NPK (3g/plant) resulted in better values of these parameters than with the high NPK dose. This clearly indicates that the highest NPK dose (4.5 g/plant) processes some retarding effect on any specific spray treatments used. In addition, within any NPK treatment, the combination between these treatments with GA_3 plus yeast resulted in the best mean values of these parameters, followed by GA_3, then the yeast treatment, while the control treatment (Distilled water) was the least.

Table (3): Effect of the growth regulating substances and mineral fertilization rates on total carbohydrates and chlorophyll in the leaves of *Magnolia grandiflora* L. seedlings during 2011/ 2012 and 2012/ 2013 seasons.

Treatments		Total carbohydrates (%)		Total chlorophyll (mg /g fresh weight)	
		1st	2nd	1st	2nd
Distilled water	NPK (0.0 g/plant)	31.28	31.30	1.026	1.028
	NPK (1.5 g/plant)	31.93	31.92	1.079	1.077
	NPK (3 g/plant)	32.43	32.45	1.134	1.136
	NPK (4.5 g/plant)	32.08	32.06	1.120	1.118
GA_3 (100 ppm)	NPK (0.0 g/plant)	31.82	31.84	1.061	1.063
	NPK (1.5 g/plant)	33.21	33.19	1.203	1.200
	NPK (3 g/plant)	33.62	33.65	1.244	1.247
	NPK (4.5 g/plant)	33.48	33.46	1.222	1.220
Yeast 5 g/ L.	NPK (0.0 g/plant)	31.58	31.60	1.041	1.043
	NPK (1.5 g/plant)	32.60	32.58	1.188	1.186
	NPK (3 g/plant)	33.15	33.12	1.220	1.223
	NPK (4.5 g/plant)	32.90	32.88	1.203	1.200
GA_3 (100 ppm) plus yeast 5g/L	NPK (0.0 g/plant)	32.30	32.33	1.134	1.099
	NPK (1.5 g/plant)	33.04	33.00	1.244	1.242
	NPK (3 g/plant)	34.27	34.29	1.262	1.263
	NPK (4.5 g/plant)	33.93	33.90	1.253	1.252
L.S.D at 5 %		0.11	0.12	0.030	0.009

Results also showed that the combination among GA_3 plus yeast combined with medium NPK dose (3 g/plant) resulted in the highest significant values for total carbohydrate percentage (34.27and 34.29%) and total chlorophyll mg /g fresh weight (1.262 and 1.263 mg) in the first and second seasons respectively. The

second best treatment was the combination between GA_3 plus yeast and the high NPK dose (4.5 g/plant).

DISCUSSION

The results of this experiment showed that GA_3 spray improved all growth parameters of magnolia seedlings. Similarly, GA_3 spray increased stem length, stem diameter, number of branches, and fresh and dry weights of different tree seedlings ((El-Tantawy, 1981, Taha, 1994, and Ahmed, 1995 & 1998). The principal effect of GA_3 is the enhancement of the synthesis of several hydrolytic enzymes such as α-amylase and ribonuclease, and to bring about the synthesis of RNA (Maarten and Varner , 1967). GA_3 spray causes an increase in the rate of cell lengthening through the promotion of invertase synthesis as it does with a-amylase, which would result in release of reducing sugars that could be used in polysaccharide biosynthesis in elongating cells of the internodes (Peter *et al*., 1968). The results of this work showed that GA_3 increased carbohydrates contents of the leaves, which coincide with the previously mentioned view for the effect of GA_3.

The data also showed that all growth parameters were increased as a result of bread yeast foliar spray. Similarly, foliar spray with active dry yeast increased growth of *Leucaena leucupnaia* seedlings (Ahmed, 2002). The effects of active bread yeast to improving plant growth is due to its components of essential minerals and trace elements, and the B-complex vitamins, cytokinins, along with releasing CO_2 which improves the net photosynthesis of the plant (Hashem *et al*., 2008, and Marzauk *et al*., 2014). Our results also showed an increase in carbohydrates and chlorophyll in addition to NPK contents of magnolia leaves. Similarly, Yeast extract increased photosynthetic pigments, NPK in leaves of faba bean cv Giza 3 in addition to increasing endogenous auxins and cytokinins (Mady, 2009). Barnett *et al*. *(*1990) reported that yeast extract improves vegetative and reproductive growths due to its high auxin and cytokinins content and enhancement carbohydrates accumulation. Also, it was reported to have stimulatory effects on cell division and enlargement, protein and nucleic acid Wanas 2002 and Wanas, 2006).

One of the most important considerations in container seedling fertility is the relatively small volume of most seedling containers which restrict their growth. Accordingly, fertilization is one of the most important cultural practices for plant quality in reforestation, especially for seedlings produced in containers (Landis, 1989). The results of this work showed that magnolia seedlings received monthly NPK fertilizer increased significantly in their growth compared with the control plants. Increasing NPK dose to 3g/pot increased all plant growth parameters. Seedling size has been shown to be positively correlated with nursery fertilization (Van den Driessche, 1980). Previous reports also showed that NPK fertilization produced best growth of *Thuja orientalis* (El-Khateeb and Salem 1988), *Cupressus sempervirens* (Hammad, 1994), and containerized *Acacia salicina* seedlings (Oliet *et al*., 2005). The results also showed that fertilizing magnolia seedlings increased their leaves contents of N, P, and K in addition to increasing their chlorophyll and carbohydrates contents. Similarly, in *Pinus roxburghii* and *Quercus leucontrichophora*, the N , P and K concentrations increased with increasing fertilizer concentration (Kiran and Bisht, 1993). The best values for all the previously mentioned growth parameters were achieved using 3 g NPK/pot. These results suggest that the optimum fertilizer level for magnolia seedlings was monthly application of 3 g of the NPK fertilizer (used in this work) per pot. Previous reports showed that NPK at 5 g per seedling, enhanced growth of *Kalmia angustifolia* (Malik, 1996) and walnut (Shi *et al* ., 2010) seedlings. The composition of NPK fertilizer and the size of containers used in this work are different from those used in the other two experiments. Moreover, the optimum nutrient range varies between different nutrients and plant species (Landis 1989). On the other hand, data also showed that the high dose (4.5 g NPK/pot) produced less growth parameters than the medium dose (3g/pot). These results suggest that the high dose (4.5 g/pot) was too high concentration to be used for magnolia seedlings. Mineral nutrition can have both positive and negative effects on seedling quality (Van den Driessche, 1980). In containerized olive, some damage was observed in plants that received the highest amount of N (Fernández-Escobar *et al*. 2004). Inorganic fertilizers are chemically considered salts and the small container volume also affects the salinity of the solution surrounding the particles of the growing medium. Rohsler and Wright (1984) reported that the main sources of soluble salts in container tree seedling nurseries are fertilizer residues, irrigation water, and the growing medium. When seedlings continue to take up additional nutrients and nutrient concentrations in seedling tissue reach extremely high levels, nutrient toxicity can occur and seedling growth will decrease. In addition, Landis (1985) reported that high N fertilization rates may adversely affect seedling morphology, and high levels of fertilizer salts in the growing medium was also reported to adversely affect the formation of some mycorrhizae of containerized tree seedlings (Torbert *et al*, 1986).

GA_3 spray was most effective to improving all growth parameters of magnolia seedlings, followed by yeast spray, while fertilization was the third in order.

CONCLUSION

In order to achieve optimum growth for magnolia seedlings, the best combination was monthly fertilization with Hyper feed NPK fertilizer at the rate of 3g /pot, plus foliar spray with GA_3 at 100 ppm and Yeast extract at 5g/l.

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تأثير التسميد المعدنى وبعض منظمات النمو على نمو شتلات المانوليا

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أجريت هذه الدراسة بقسم الخضر والزينة بكلية الزراعة جامعة المنصورة بمحافظة الدقهلية خلال موسمين متتاليين من عام ٢٠١١/٢٠١٢ و عام ٢٠١٢/٢٠١٣ . وتهدف هذه الدراسة إلى تأثير مستويات مختلفة من السماد المركب التجارى (هيبر فييد ١٩ -١٩ - ١٩) ورش ورقى من الجبريللين تركيز ١٠٠ جزء فى المليون والخميرة ٥ جرام / لتر، إما وحدها أو مجتمعة من أول أبريل إلى أول سبتمبر على نمو شتلات المانوليا جراند فلورا . وأظهرت النتائج أن الرش بالجبريللين كانت المعاملة الأكثر فعالية لتحسين نمو شتلات المانوليا يليها الرش بالخميرة بينما كانت معاملة التسميد فى المرتبة الثالثة وأن التركيز المتوسط من السماد المركب التجارى ٣ جرام / الأصيص هو التركيز الأفضل لنمو شتلات المانوليا وأوضحت النتائج أيضا أن التسميد بالسماد المركب التجارى هيبر فييد (١٩ – ١٩ – ١٩) ٣ جرام / الأصيص مع الرش بالجبريللين عند تركيز ١٠٠ جزء فى المليون والرش بالخميرة ٥ جرام / لتر شهريا أدى إلى تحقيق أعلى القيم من إرتفاع النبات وقطر الساق وعدد الأوراق فى النبات ومساحة الورقة والوزن الرطب والجاف من النبات وكذلك أعطى أعلى زيادة من محتويات ن ، فو ، بو والكربوهيدرات والكلوروفيل فى أوراق شتلات المانوليا .

التوصية :

من أجل تحقيق نمو سريع وجيد لشتلات المانوليا يوصى بتسميد النبات شهريا بالسماد التجارى المركب هيبر فييد (١٩ – ١٩ – ١٩) ٣ جرام / الأصيص والرش بالجبريللين عند تركيز ١٠٠ جزء فى المليون وخميرة الخبز النشطة ٥ جرام / لتر .