Journal homepage
www.ajas.uoanbar.edu.iq
Anbar Journal of Agricultural Sciences
(University of Anbar – Agriculture College)

IMPROVING MINI TUBER POTATO GROWTH AND YIELD BY SOME PLANTS AQUEOUS EXTRACT AND EARTH WORM COMPOST

A. D. Salman*[1] W. A. Hussein[1] A. O. Mhawesh[2]

[1]Dept. Hortic. and Landscape Gardening, Coll. of Agric. Eng. Sci., Univer. of Baghdad

[2]Ministry of Agriculture - Office of Horticulture

***Correspondence to:** Abeer Dawood Salman, Dept. Hortic. and Landscape Gardening, Coll. of Agric. Eng. Sci., Univer. of Baghdad, Iraq.
Email: abeer.dawood@coagri.uobaghdad.edu.iq

Article info

Received: 2023-09-22
Accepted: 2023-10-24
Published: 2023-12-31

DOI-Crossref:
10.32649/ajas.2023.144707.1098

Cite as:
Salman, A. D., W. A. Hussein, and A. O. Mhawesh. (2023). Improving mini tuber potato growth and yield by some plants aqueous extract and earth worm compost. Anbar Journal of Agricultural Sciences, 21(2): 656-666.

Abstract

The research was conducted at Research Station B of the College of Agricultural Engineering Sciences - University of Baghdad in the spring season 2022-2023 with the aim of studying the growth and yield of potato tubers when planted in earthworm fertilizer and spraying with plant extracts. It was implemented as a factorial experiment 3*5 within a completely randomized block design. RCBD with three replicates. The factors included cultivating the tubers under levels of earthworm fertilizer Vermicompost at concentrations of 0.5 and 1%, which are symbol V1 and V2, respectively, as well as the control treatment without the addition of V0. Then the plants were sprayed with the extracts, namely the aqueous extract of the roots of *Cypreus Rotundus*, at concentrations of 5 and 10 g L^{-1}. It has symbols T1 and T2, respectively, and the aqueous extract of *Silybum marianum* leaves at concentrations of 5 and 10 g L^{-1} has symbols T3 and T4, respectively. In addition to the Control treatment (spraying with distilled water only), which has symbol T0, the results showed a significant superiority for treating the planting with earthworm fertilizer and spraying with leaf extract. *Silybum marianum* (V2T4) in the percentage of nitrogen, phosphorus, and potassium in the leaves, their Chlorophyll content, plant height,

number of branches, total leaves, leaf area, and dry weight of branch. The weight of tubers, plant yield, and total yield 3.87, 0.380, 3.130%, 64.80 spad, 54.00 cm, 3.83 branch. plant^{-1}, 43.00 leaf.plant^{-1}, 94.85 dm^2.plant^{-1}, 38.50 g .plant^{-1}, 134.25 g.tuber^{-1}, 939.75 g. plant^{-1}, and 125.29 tons. ha^{-1}, respectively compared to the Control treatment (V0T0) which recorded the lowest values in all measured traits. Therefore, we recommend planting potatoes. Under a sustainable agriculture system, using 1% earthworm fertilizer and spraying with *Silybum marianum* leaf extract 10 g L^{-1} as a means of recycling and preserving the environment.

Keywords: Cypreus Rotundus roots, Silybum marianum leaves, Vermicomposting, Sustainable agriculture, Recycling.

تحسين نمو وحاصل دُرينات البطاطا باستخدام المستخلص المائي لبعض النباتات وسماد دودة الارض

عبير داود سلمان*[1] وفاء علي حسين[1] احمد عبيد مهاوش[2]

[1]قسم البستنة وهندسة الحدائق – كلية علوم الهندسة الزراعية – جامعة بغداد

[2]وزارة الزراعة / دائرة البستنة

***المراسلة الى:** عبير داود سلمان، قسم البستنة وهندسة الحدائق، كلية علوم الهندسة الزراعية، جامعة بغداد، بغداد، العراق.

البريد الالكتروني: abeer.dawood@coagri.uobaghdad.edu.iq

الخلاصة

أُجري البحث في المحطة البحثية B التابعة الى كلية علوم الهندسة الزراعية – جامعة بغداد في الموسم الربيعي 2022– 2023 بهدف دراسة نمو وحاصل دُرينات البطاطا صنف Arizona عند الزراعة في سماد دودة الارض والرش بالمستخلصات النباتية، ونفذ كتجربة عاملية 3*5 ضمن تصميم القطاعات التامة التعشية RCBD وبثلاثة مكررات وشملت العوامل زراعة الدُرينات تحت مستويات من سماد دودة الارض Vermiompost بالتركيزين 0.5 و1% والتي رمز لها V1 وV2 على الترتيب فضلا عن معاملة المقارنة بدون اضافة V0 ثم رشت النباتات بالمستخلصات وهي المستخلص المائي لجذور السعد بالتركيز 5 و10غم لتر$^{-1}$ رمز له T1 وT2 على الترتيب والمستخلص المائي لأوراق الكلغان بالتركيز 5 و10 غم لتر$^{-1}$ رمز له T3 وT4 عل الترتيب فضلا عن معاملة القياس (الرش بالماء المقطر فقط) والتي رمز لها T0، اظهرت النتائج تفوقا معنويا لمعاملة الزراعة بسماد دودة الارض والرش بمستخلص اوراق الكلغان (V2T4) في النسبة المئوية

للنتروجين والفسفور والبوتاسيوم في الاوراق ومحتواها من Chlorophyll وارتفاع النبات وعددالافرع والاوراق الكلية والمساحة الورقية والوزن الجاف للمجموع الخضري ووزن الدرنات وحاصل النبات والحاصل الكلي 3.87 و0.380 و3.130% و64.80 spad و54.00 سم و3.83 فرع.نبات$^{-1}$ و43.00 ورقة.نبات$^{-1}$ و94.85 دسم^{2}.نبات$^{-1}$ و38.50 غم.نبات$^{-1}$ و134.25 غم.درنة$^{-1}$ و939.75 غم.نبات$^{-1}$ و125.29 طن.هكتار$^{-1}$ على الترتيب مقارنة بنباتات القياس (V0T0) التي سجلت اقل القيم في جميع الصفات المقاسة، لذا نوصي بزراعة البطاطا تحت نظام الزراعة المستدامة باستعمال سماد دودة الارض 1% والرش بمستخلص اوراق الكلغان 10غم لتر$^{-1}$ كوسيلة لإعادة التدوير والمحافظة على البيئة.

كلمات مفتاحية: جذور السعد، اوراق الكلغان، السماد الدودي، زراعة مستدامة، اعادة تدوير.

Introduction

Modern global thinking aims to solve the problem of plant nutrition by reducing reliance on chemical fertilizers because of their negative effects on the environment, animal health, and indirect effects on human health, in addition to their high prices and difficulty obtaining them, and moving towards alternative means that increase the yield per unit area and are safe for health, including: Organic fertilizers due to their high content of nutrients that encourage growth and increase crop productivity. Low levels of organic matter in the soil and the complete removal of biomass from the field when harvesting crops leads to the depletion of nutrients, which requires attention to fertilizing them and increasing their fertility. (16) concluded In their study on three varieties of beets, planting using Vermicompost fertilizer and spraying with calcium had a significant effect on the number of leaves and their content of N, P, and chlorophyll, while planting with the same fertilizer and spraying with silicon outperformed the leaves' K content, leaf and root yield, and percentage of dry matter. (15) when growing eggplant using Vermicompost fertilizer compared to chemical fertilization and the measurement treatment, the organic fertilizer treatment has a significant effect on plant growth and production cost. (19) indicated that adding earthworm fertilizer at different levels has a significant effect on the growth, yield and quality of pepper.

The quantity and quality of production depend on fertilization during growth, so another trend has emerged in the field of plant nutrition that aims to use plant extracts that contain some substances that encourage the growth process in order to increase productivity and maintain the health of the consumer and the cleanliness of the environment, as these extracts are agricultural and chemical tools that push the plant to provide It has the highest physiological and genetic performance, which is reflected in the nature of its growth and yield, as it is considered one of the safe natural alternatives for obtaining the best production per unit area (18). Nutsedges (*Cyperus esculentus* L.) belongs to the Cyperaceae family and is considered one of the perennial grass-like plants and is distinguished by Its tubers are rich in starch, sugar, and protein, in addition to their content of organic and amino acids, growth stimulants, alkaloids, flavonoids, and vitamins C and E (23). Most of the extracts

from the tubers, stems, and leaves of Saad have a role as antioxidants (9), while the milk thistle plant (*Silybum marianum*) to the Asteraceae family and is characterized by chemical compounds with medicinal properties, including Silymarin, which is a mixture of different compounds of Flavonolignans that are found in the seeds, fruits and leaves of the plant, in addition to the fact that the various preparations from this plant are considered safe and good without any dangerous side effects (8). (22) found, when spraying with water extract of lemongrass and kujarat on lettuce plants, that the spraying treatment with 5% kujarat extract was significantly superior in most growth indicators as well as increasing yield. In an experiment conducted by (20) on red and green coral lettuce plants, they found the spraying treatment with the aqueous extract of sprouted jet seeds at a concentration of 10% was significantly superior in the chlorophyll content of the leaves, number of leaves, leaf area, dry weight of the shoot and root system, and plant yield compared to the other treatments. (17) indicated that the spraying treatment with the nettle leaf extract gave the best results. In plant height, number of leaves, chlorophyll content of leaves, and higher total dry seed yield when spraying two varieties of peas compared to spraying with fenugreek extract, nettle seeds, and licorice roots.

Potato (*Solanum tubersum* L.) has nutritional, industrial and medicinal importance, making it the most in-demand agricultural crop that adapts to climate change, in addition to its high productivity (2 and 7). Imported seeds are relied upon for the purpose of production in the spring season, from which the seeds are taken for the purpose of autumn planting, and to ensure that the seeds are free of viral diseases, tissue culture is relied upon, as the production of mini tuber seed tubers is an urgent need for the purpose of ensuring the multiplication of tubers from the high-grade micro tuber of potato seeds, in addition to the possibility of storing them for several months and the ease of transporting them, cultivating them directly, and producing them online. A wide range in every season to ensure that they are free of viruses (11). Therefore, the research aims to achieve one of the goals of sustainable development through responsible consumption and production by multiplying potatoes resulting from tuber cultivation under levels of earthworm fertilizer and spraying with aqueous extract of sedge and *Silybum marianum* roots as a means of recycling plant waste.

Materials and Methods

The study was conducted in spring season 2022-2023 in the fields of the Department of Horticulture and Landscape gardening - College of Agricultural Engineering Sciences - Al-Jadriya, by planting tubers of potato cultivar Arizona resulting from tissue culture on 2/1/2023 under levels of earthworm fertilizer Vermicompost at concentrations of 0.5 and 1%, which has the symbol V1 and V2, respectively, in addition to the control treatment without the addition of V0. Then I sprayed the plants at the four-leaf stage on 3/20/2022 three times until they were completely wet, with an interval of 10 days between one spray and another, with the extracts, namely the aqueous extract of *Cypreus Rotundusroots*, at concentrations of 5 and 10 g L^{-1}. It has symbols T1 and T2, respectively, attended accordingly (12) and the aqueous extract

of *Silybum marianum* leaves at concentrations of 5 and 10 g L^{-1} has symbols 3T and T4, respectively, in addition to the measurement treatment (spraying with distilled water only), which has symbols T0. Table 1 shows the chemical components of the extracts used in the research. The research was conducted as an experiment. Factorial 3*5 within a completely randomized block design (RCBD) with three replicates. The number of plants in the experimental unit was 20 plants, with a planting distance of 20 cm between one plant and another, to increase production per unit area and 75 cm between each line under a sustainable agriculture system.

Table 1 Chemical analysis of aqueous extracts used in research (College of Science, Uni.of Baghdad).

aqueous extracts	N	P	K	Ca	Mg	Fe	Zn	Mn	Cu	B
	%					mg L^{-1}				
***Cypreus Rotundus* root 10%**	21.0	1.7	38.0	56.3	14.6	0.26	0.06	Nil	Nil	2.1
***Silybum marianum* leaves 10%**	84.0	5.1	378.0	150.0	25.3	0.33	0.20	0.08	0.92	4.5

Nitrogen (%) in the leaves was estimated using a Kjeldahl device (13), the percentage of phosphorus in the leaves was estimated using ammonium molybdate and ascorbic acid using a spectrophotometer at a wavelength of 620 nm (6), and the percentage of potassium in the leaves was estimated using a device. Atomic Absorption (6) the concentration of chlorophyll in the leaves was estimated using a SPAD meter. The plant height (cm), the number of branches (branch $plant^{-1}$), and the number of total leaves (leaf $plant^{-1}$) were calculated at harvest, and the leaf area was measured using the Digimizer program, and the dry weight of vegetative growth. (g $plant^{-1}$), which was dried in an oven and then measured with a sensitive balance. As for the yield indicators, the number of tubers (g.$tuber^{-1}$), the weight of the tuber (g. $tuber^{-1}$), the yield per plant (g.$plant^{-1}$), and the total yield (tons.ha^{-1}) were calculated [(10000 m^2/1.5 m^2)*(yield per plant g. $plant^{-1}$* number of plants in the experimental unit) /1000000].

Results and Discussion

The results of Table 2 show that plants growing in Vermicompost fertilizer with a concentration of 1% (V2) were significantly excelled on in the percentage of nitrogen, phosphorus and potassium in the leaves, their chlorophyll content, plant height, number of branches and leaves, and leaf area, which reached 3.43, 0.318, 2.953%, 60.28 spad, 44.90 cm, 2.89 branches.$plant^{-1}$, 37.10 leaves.$plant^{-1}$ and 68.67 dm^2.$plant^{-1}$, respectively, compared to the Control treatment which recorded 3.18, 0.296, 2.909%, 58.06 spad, 41.10 cm, 1.88 branch.$plant^{-1}$, 30.40 leaf.$plant^{-1}$ and 41.65 dm^2.$plant^{-1}$, respectively.

The effect of foliar spraying with aqueous extract of *Silybum marianum* leaves, 10 g.L^{-1} (T4), was significant on the percentage of nitrogen, phosphorus, and potassium in the leaves, their chlorophyll content, plant height, number of leaves, and leaf area, reaching 3.77, 0.362, 3.119%, 62.43 spad, 45.33 cm, 37. 66 leaves.$plant^{-1}$ and 78.23 dm2.$plant^{-1}$, respectively, compared to the Control treatment, which recorded 2.91,

0.259, and 2. .835%, 55.66 spad, 39.50 cm, 29.50 leaf.plant^{-1}, and 38.61 dm^2.plant^{-1}, respectively.

The interaction between planting with Vermicompost fertilizer at a concentration of 1% and spraying with aqueous extract of *Silybum marianum* leaves 10 g L^{-1} (V2T4) had a significant effect on the percentage of nitrogen, phosphorus and potassium in the leaves, their chlorophyll content, plant height, number of branches and leaves, and leaf area, which amounted to 3.87, 0.380, 3. 130%, 64.80 spad, 54.00 cm, 3.83 branches.plant^{-1}, 43.00 leaves.plant^{-1}, and 94.85 dm^2.plant^{-1}, respectively, compared to Control treatment which recorded 2.80, 0.250, and 2.803%, 52.70 spad, 35.50 cm, 1.50 branch.plant^{-1}, 26.00 leaf.plant^{-1}, and 23.81 dm^2.plant^{-1} on Relay.

Table 2 The effect of planting earthworm fertilizer and spraying with plant extracts on the chemical indicators of leaves and vegetative growth indicators of potato plants for the spring season 2022-2023.

Treatment	N	P	K	Chlorophyll	Plant height	No. of Stems	No. of Leaves	Leaf area
	%			Spad	Cm	Stem plant^{-1}	Leaf plant^{-1}	dsm^2. plant^{-1}
V0	3.18	0.296	2.909	58.06	41.10	1.88	30.40	41.65
V1	3.30	0.304	2.940	59.48	42.86	2.29	34.80	61.44
V2	3.43	0.318	2.953	60.28	44.90	2.89	37.10	68.67
LSD 5%	0.02	0.003	0.010	1.23	0.60	0.32	1.26	2.95
T0	2.91	0.259	2.835	55.66	39.50	2.15	29.50	38.61
T1	3.12	0.282	2.874	59.83	44.43	2.47	36.50	59.82
T2	3.25	0.300	2.892	59.06	42.66	2.22	33.16	54.05
T3	3.47	0.326	2.950	59.36	42.83	2.22	33.66	55.58
T4	3.77	0.362	3.119	62.43	45.33	2.71	37.66	78.23
LSD 5%	0.03	0.004	0.013	1.59	0.78	N.S	1.63	3.81
V0T0	2.80	0.250	2.803	52.70	35.50	1.50	26.00	23.81
V0T1	3.00	0.271	2.861	60.10	46.00	1.60	31.50	43.18
V0T2	3.15	0.296	2.878	58.40	41.50	2.00	32.50	47.35
V0T3	3.30	0.317	2.904	58.30	42.50	2.16	31.00	43.83
V0T4	3.67	0.348	3.103	60.80	40.00	2.16	31.00	50.12
V1T0	2.93	0.259	2.843	56.90	40.50	2.33	30.50	43.43
V1T1	3.10	0.278	2.876	58.40	43.30	2.66	37.50	73.20
V1T2	3.25	0.299	2.889	60.20	47.50	2.33	35.00	53.97
V1T3	3.49	0.325	2.967	60.20	41.00	2.00	32.00	46.91
V1T4	3.77	0.359	3.126	61.70	42.00	2.16	39.00	89.73
V2T0	3.02	0.268	2.860	57.40	42.50	2.63	32.00	48.60
V2T1	3.27	0.298	2.885	61.00	44.00	3.16	40.50	63.09
V2T2	3.37	0.307	2.910	58.60	39.00	2.33	32.00	60.83
V2T3	3.63	0.337	2.980	59.60	45.00	2.50	38.00	76.00
V2T4	3.87	0.380	3.130	64.80	54.00	3.83	43.00	94.85
LSD 5%	0.05	0.007	0.024	2.76	1.35	0.72	2.83	6.60

The results of Table 3 indicate Yield and its components in Vermicompost fertilizer with a concentration of 1% (V2) were significantly excelled in plant dry weight, tuber weight, plant yield, and total yield, as they recorded 33.75 g plant^{-1}, 109.58 g tuber^{-1}, 688.62 g plant^{-1}, and 91.81 tons ha^{-1}, respectively, compared to the Control treatment, which recorded 29.48 g plant^{-1}, 98.73 g tuber^{-1}, 511.51 g plant^{-1}, and 68.19 tons ha^{-1}, respectively. The foliar spray treatment with the aqueous extract of *Silybum marianum* leaves, 10 g L^{-1} (T4), was significantly excelled in plant dry weight, tuber weight, plant yield, and total yield, which recorded 34.44 g plant^{-1}, 128.08 g tuber^{-1},

666.05 g plant^{-1}, and 88.80. tons ha$^{-1,}$ respectively, which did not differ significantly from the spraying treatment with the aqueous extract of *Cypreus Rotundus* roots at a concentration of 5 g l^{-1} (T1) in plant dry weight, tuber weight, plant yield, and total yield compared to the measurement plants that recorded 29.06 g plant^{-1} and 80.86 g tuber^{-1}, 536.46 g plant^{-1} and 71.52 tons ha^{-1}, respectively.

The interaction between planting with Vermicompost fertilizer at a concentration of 1% and spraying with the aqueous extract of *Silybum marianum* leaves 10 g l^{-1} (V2T4) recorded a significant effect on the dry weight of vegetative growth, the weight of the tuber, the plant yield, and the total yield, which recorded 38.50 g plant^{-1}, 134.25 g tuber^{-1}, and 939. 75 g plant^{-1} and 125.29 tons ha^{-1}, respectively, which did not differ significantly from the treatments V0T4, V0T1 and V2T1 in tuber weight compared to the control plants that recorded 24.96 g.plant^{-1}, 61.71 g. tuber^{-1} and 432.01 g. plant^{-1} and 57.60 tons ha^{-1}, respectively.

Table 3 Effect of planting earthworm fertilizer and spraying with plant extracts on the dry weight of the plant, the yield and its components of potato plants for the spring season 2022-2023.

Treatment	Dry weight of the plant	Number of tubers	Weight of tubers	Yield of plant	Total yield
	g.plant^{-1}	tubers plant^{-1}	g. tuber^{-1}	g.plant^{-1}	t.ha^{-1}
V0	29.48	5.50	98.73	511.51	68.19
V1	31.11	6.10	101.05	610.36	81.37
V2	33.75	6.30	109.58	688.62	91.81
LSD 5%	0.98	N.S	5.69	19.17	2.55
T0	29.06	6.66	80.86	536.46	71.52
T1	33.84	5.33	124.65	660.23	88.02
T2	29.89	6.00	90.53	542.99	72.39
T3	30.02	6.66	91.50	611.74	81.56
T4	34.44	5.16	128.08	666.05	88.80
LSD 5%	1.27	N.S	7.34	24.75	3.30
V0T0	24.96	7.00	61.71	432.01	57.60
V0T1	31.25	4.50	131.22	590.52	78.73
V0T2	26.82	5.50	86.68	476.78	63.57
V0T3	29.75	6.50	80.75	524.90	69.98
V0T4	34.64	4.00	133.33	533.34	71.11
V1T0	30.58	6.00	88.80	532.82	71.04
V1T1	34.92	6.50	117.62	764.59	101.94
V1T2	31.17	7.00	90.06	630.43	84.05
V1T3	28.73	6.50	92.13	598.89	79.85
V1T4	30.19	4.50	116.68	525.08	70.01
V2T0	31.64	7.00	92.08	644.58	85.94
V2T1	35.36	5.00	125.11	625.58	83.41
V2T2	31.68	5.50	94.86	521.78	69.57
V2T3	31.58	7.00	101.63	711.44	94.84
V2T4	38.50	7.00	134.25	939.75	125.29
LSD 5%	2.20	N.S	12.72	42.87	5.30

Vermicompost is a sustainable approach to crop production and a waste management method that improves the harmful effects on groundwater systems. Organic waste is converted into fertilizer that contains a high percentage of nutrients that contribute to enhancing soil fertility. Therefore, the reason may be due to the increased content of N, P and K in the leaves (Table 2) indicates the important nutrients this fertilizer

contains in forms that plants can easily absorb, as worms work to convert elements from their organic forms into inorganic forms that have high solubility and better readiness for plants (14), in addition to its content of polysaccharides, which works to improve Soil aeration and drainage, which is reflected in the effectiveness of the roots and their ability to absorb nutrients better, while humic acid and humus present in Vermicompost affect the pH of the soil and its available for nutrients, which makes it ideal for application as a biofertilizer in the context of sustainable and environmentally friendly agricultural techniques. This absorption of elements (N, P and k) affects the plant's nutrition and the chlorophyll content of the leaves, which by increasing it activates the process of carbon metabolism and its products, which affects the indicators of vegetative growth in the plant, or these significant differences in the height of the plant, the number of branches and leaves, and the leaf area may be due to the content of this fertilizer from plant hormones, as gibberellin leads to Increasing cell elongation (1), in addition to its role in the production of auxin, which encourages the processes of division and elongation and thus increases the height of the plant. It is an essential substance for building the IAA hormone (3). As for cytokinins in general and Kainten in particular, it may affect processes related to downstream development and its preparation, including reducing the apical dominance and the flow of auxin to the lateral branch, which encourages their growth and increases the number of branches (1), in addition to its role in regulating the distribution of the products of the carbon metabolism process and nutrients in the plant towards the growth areas, preserving chlorophyll, and delaying aging (10). This is reflected in the strength of vegetative growth and the increase in the number of leaves and leaf area, which in turn affects the dry weight of the vegetative growth. As for the increase in yield components (Table 3), most of them come from good vegetative growth, as the sources are sufficient to supply the estuaries with metabolites, which reflects positively on the plant yield and the total yield. Which is the final result of all the physiological activities that occurred during its growth. This result is consistent with what was found by (5) on beet plants when grown in Vermicompost.

Spraying with plant extracts from various sources, which can complement or increase the effectiveness of nutrition through the roots and cannot be a substitute for it, led to an increase in the leaves' content of nutrient elements (Table 2). This increase may be due to the direct addition of these nutrients through foliar spraying, which led to Increasing its absorption and then increasing its concentration in plant tissues, or the behavior of these parameters may be explained according to the positive roles played by its components. *Silybum marianum* leaf extract includes a number of nutritional elements (Table 1) and organic compounds dissolved in water that qualify it to have a significant effect on the process of carbon metabolism, so its primary and secondary products increase. Which improves vegetative growth indicators (Tables 2 and 3) and then converts some of it to the storage parts represented by tubers (Table 3). This result is consistent with what (21) reached on broccoli plants and (4). On carrot plants when sprayed with plant extracts. The reason for the excelled of the interaction treatment between earthworm fertilizer and

spraying with the aqueous extract of *Silybum marianum* (V2T4) leaves may be attributed to their complementary role in improving the plant's nutrient content, which is reflected in its manufacture, which may contribute directly to encouraging the growth and development of the plant and increasing enzymatic and hormonal activities within it. And transfer the surplus to the downstream to raise the efficiency of performance and maintain the quality level of the product, and make it suitable for current and future consumer requirements as well as reduce the cost and risk to the environment to work within the aim of sustainable development. Therefore, we recommend planting potato tubers resulting from tissue culture that are free of disease and viral infections and of high rank. In Vermicompost fertilizer at a concentration of 1% and sprayed with aqueous extract of *Silybum marianum* leaves at a concentration of 10 g/l and experimenting with these treatments on other vegetable crops.

Reference

1. Al-Asady, M. H., and Al-Kikhani, A. H. (2019). Plant hormones and their physiological effects. Al-Qasim Green University. National Library and Documentation House. Iraq, 332.
2. Al-Jeboori, K. D., Al-Mharib, M. Z. K., Hamdan, A. Q., and Mahmood, A. H. (2017). Effect of irrigation intervals and foliar of salicylic acid on growth and yield of potato. The Iraqi Journal of Agricultural Science, 48(1): 242-247.
3. Al-Khafaji, M. A. (2014) Plant Growth Organizations, the Horticultural Applications and Uses. University House for Printing, Publishing and Translation. Iraq, 348.
4. Al-Khafaji, A. M., and Al-jubouri, K. D. (2022). Influence of aqueous extract of barley sprouts, trehalose, and calcium on growth, quality and yield of carrot. Iraqi Journal of Agricultural Sciences, 53(1): 133-140.
5. Al-Khafaji, A. M., Al-Amri, N. J. K., and Al-Dulaimi, N. H. A. (2022). Growth, yield, and antioxidant traits of different parts of beetroot as affected by vermicompost and glutathione. Iraqi Journal of Agricultural Sciences, 53(5): 1107-1114.
6. Al-Sahaf, F. H. (1989). Applied plant nutrition. The Ministry of Higher Education and Scientific Research-Higher Education printing house-Iraq, 260.
7. Al-Zaidi, M. A. H., and Al-Jumaili, M. A. H. (2022). Impact safe nutrients in raising production and chemical contents of potato. Iraqi Journal of Agricultural Sciences, 53(6): 1397-1406.
8. Aziz, M., Saeed, F., Ahmad, N., Ahmad, A., Afzaal, M., Hussain, S., ... and Anjum, F. M. (2021). Biochemical profile of milk thistle (Silybum Marianum L.) with special reference to silymarin content. Food science and nutrition, 9(1): 244-250.
9. Buweizuohere, A., Deping, W., Siqun, J., and Yixian, T. (2021). Research progress on bioactivity of total flavonoids in *Cyperus esculentus* L. leaves. Cereals Oils, 34: 21-26.

10. Hönig, M., Plíhalová, L., Husičková, A., Nisler, J., and Doležal, K. (2018). Role of cytokinins in senescence, antioxidant defence and photosynthesis. International journal of molecular sciences, 19(12): 4045.
11. Hussein, W. A. (2015). Propagation of potato tubers using fish pond water (Aquaculture) and microelements, Third Genetics and Environment Conference, 298-304.
12. Isitua, C. C., Lozano, M. J. S., Jaramillo, C., and Dutan, F. (2015). Phytochemical and nutritional properties of dried leaf powder of Moringa oleifera Lam. from machala el oro province of ecuador. Asian Journal of Plant Sciences, 5(2): 8-16.
13. Jackson, M. L. (1958). Soil chemical analysis prentice Hall. Inc., Englewood Cliffs, NJ, 498: 183-204.
14. Jusselme, M. D., Pruvost, C., Motard, E., Giusti-Miller, S., Frechault, S., Alphonse, V., ... and Mora, P. (2019). Increasing the ability of a green roof to provide ecosystem services by adding organic matter and earthworms. Applied soil ecology, 143: 61-69.
15. Kalika-Singh, S., Jaikishun, S., Ansari, A., Subramanian, G., and Gupta, R. (2021). Growth performance and production economics of eggplant (Solanum melongena) in response to vermicompost vis-a-vis a chemical fertilizer application. Journal of Natural Resource Conservation and Management, 2(2): 95-102.
16. Mageed, R. G., and Hussin, W. A. (2023). The Effect of the Combination of Organic Fertilizer and Spraying with Silicon and Calcium on the Growth and Production of Three Cultivars of Beet. In IOP Conference Series: Earth and Environmental Science, 1213(1): 012004.
17. Mohammed, A. S., and Estefo, J. I. (2018). Effect of seeds, leaves, and roots extract plants on growth and yield of pea. Tikrit Journal for Agricultural Sciences, 18(2): 60-67.
18. Nasralla, A. Y., Al-Hilfy, I. H., Al-Abodi, H. M., Mohammed, O. A., and Mhmood, M. (2014). Effect of spraying some plant extractions and anti-oxidant on growth and yield of sunflower. Iraqi Journal of Agricultural Sciences, 45(7-special issue): 651-659.
19. Rikza, I. J., Nishi, K. N., and Rahman, M. K. (2021). Growth and yield performance of green capsicum (Capsicum annuum L.) as influenced by vermicompost application grown at rooftop of Chandpur area. Journal of Biodiversity Conservation and Bioresource Management, 7(2): 13-22.
20. Salman, A. D. (2020). Effect of aqueous extracts of the sprouted seeds on the quantitative and qualitative yield of the coral lettuce cultured under the modified nutrient solution film NFT system. Revis Bionatura, 8(2): 80.
21. Salman, A. D., and Abdulrasool, I. J. (2022). Effect of ozone enrichment and spraying with coconut water and moringa extract on vegetative growth and yield of broccoli plant under hydroponic system with modified NFT technology. Iraqi Journal of Agricultural Sciences, 53(2): 406-414.

22. Salman, A. D., and Hussein, W. A. (2023). Effect of Blue and Red LED Light and some Plant Extract on Lettuce Growth and Yield in NFT Technique. In IOP Conference Series: Earth and Environmental Science, 1158(4): 042042.
23. Yu, H., and Jing, S. (2015) Research progress on chemical constituents and application of Cyperus. Food Ind, 36: 242-245.