Scientific Journal of Agricultural Sciences

Print (ISSN 2535-1796) / Online (ISSN 2535-180X)

Response of White Mustard to Compost and Some Natural Extracts

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Citation: Abdou M.A.H., El-Syed A.A., Taha, Ragaa A. and Mahran Amira, G.A. (2025). Response of White Mustard to Compost and Some Natural Extracts. Scientific Journal of Agricultural Sciences, 7 (2): 20-32.
https://doi.org/10.21608/sjas.2025.423770
Publisher :
Beni-Suef University, Faculty of Agriculture

Received: 27 / 3 / 2024
Accepted: 21 / 4 / 2025

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ABSTRACT

This purpose of this experiment was to evaluate the effect of compost (0, 5, 7.5 and 10 t/fed.) and some natural extracts (control, active yeast at 5 and 10 g/l, seaweed extract at 1.5 and 3 ml/l and moringa leaf extract at 10 and 20%) on growth, yield and some chemical constituents of white mustard plants during 2022/2023 and 2023/2024 at the Farm of Medicinal plants, Faculty Agriculture, Minia University, Egypt.

Data showed that all vegetative growth parameters (plant height, number of branches, and fresh weight), yield traits (number of pods per plant and seed yield per plant), fixed oil production (percent and yield per plant) and some chemical constituents (NPK% and photosynthetic contents) were significantly increased with fertilizing plants with compost relative to control during both seasons with the highest values were obtained with 10 ton compost per feddan.

All six used treatments of natural extracts considerably increased all above-mentioned parameters comparing to the control through both seasons. Seaweed extract at 3 ml/l was superior in this regard.

The best interaction treatment was to fertilizing white mustard plants with compost at 10 t/fed. and seaweed extract (3 ml/l), followed by active yeast (10 g/l).

KEYWORDS: *Sinapis alba* – active yeast – seaweed extract – moringa leaf extract – vegetative growth – yield – fixed oil.

1. INTRODUCTION

A member of the Brassicaceae family, white mustard (*Sinapis alba*, L.) is an annual plant. It might alternatively be known as *Brassica hirta* or *Brassica alba*. Although it is now commonplace globally, its origins are most likely in the Mediterranean region. Cultivated for its seeds, it can be used as green manure, fodder, or to manufacture the condiment mustard. This oilseed crop is more tolerant of drought, moisture, heat, frost, and pests than oilseed rape, among other agronomic benefits (Meher *et al*., 2006 and Ciubota-Rosie *et al*., 2013).

To produce clean products, the researchers go to fertilizing medicinal plants with organic fertilization and enhancing growth by spraying plants with natural extracts. Many authors in different plants concluded that compost fertilizer significantly increased all vegetative growth, yield and fixed oil production such as Pathak and Godika (2010), Vimala *et al*. (2010), Ali (2013), Toaima (2016),

Hadiyal *et al*. (2017), Beenish *et al*. (2018), Cardoso *et al*. (2019), Sari *et al*. (2020), Geremew *et al*. (2021) and Muktamar *et al*. (2024) on mustard.

Likewise, many researchers pointed out that natural extracts like active yeast, seaweed extract and moringa leaf extract have a vital role to enhance plant growth and productivity such as Toaima (2016); Abdul-Hafeez and Soliman (2020); Abusaief *et al*. (2021) and Abd-Allah *et al*. (2022) for active yeast; Mafakheri and Asghari (2018); Mohamed *et al*. (2020); Abou El-Ghait *et al*. (2021); El-Gawwas and Soliman (2023) and Galal *et al*. (2024) concerning seaweed extract and Hassan *et al*. (2019); Prakash *et al*. (2019); Ayyat *et al*. (2021); Atteya *et al*. (2021); El-Salhy *et al*. (2023) and Soliman *et al*. (2024) regarding moringa leaf extract.

Therefore, this study aimed to examine the impact of compost and some natural extracts on *Sinapis alba* plants.

2. MATERIALS AND METHODS

Sinapis alba, L. seeds were obtained from the Agricultural Research Center (Medical and Aromatic Plants Institutes), Giza, Egypt, and sown on 4th October of the two seasons (2022 and 2023) in the field. After three weeks of sowing dates (25th October), the plants were thinned to 4-5 plants/hill, one week later (3rd November), the plants were adjusted to two plants/hill. As shown in Table (a), the physical and chemical analysis of the used soil was carried out using the procedures Jackson (1973) outlined.

Table a. The physical and chemical analysis of the used soil in both seasons of 2022/2023 and 2023/2024.

Soil character	Values		Soil character	Values	
	2022/2023	2023/2024		2022/2023	2023/2024
Physical properties:			**Nutrients:**		
Sand (%)	28.28	28.17	**Total N (%)**	0.68	0.74
Silt (%)	32.42	32.46	**Available P (ppm)**	19.5	20.0
Clay (%)	39.30	39.37	**Na^+ (mg/100 g soil)**	1.31	1.35
Soil type	Clay loam	Clay loam	**K^+ (mg/100 g soil)**	0.89	1.00
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5)	7.87	7.90	**Fe (ppm)**	1.56	1.63
E.C. (dS/m)	1.03	1.08	**Cu (ppm)**	0.41	0.43
O.M.	1.63	1.75	**Zn (ppm)**	0.44	0.47
$CaCO_3$	3.14	3.35	**Mn (ppm)**	0.49	0.52

2.1. Layout of the experiment:

The study consisted of 28 distinct treatments arranged in a split plot design, featuring four main treatments (0, 5, 7. and 10 ton compost per feddan) across seven natural extracts (control, active yeast at 5 and 10 g/l, seaweed extract at 1.5 and 3 ml/l and moringa leaf extract at 10 and 20%), with three replicates for each treatment. The demission was 2.5 m length X 4.2 m width including 7 lines with 0.60 cm within rows, so the replicate demission was 11.5 m width X 4.2 m length. Each treatment unit included 1 line containing 5 hills (10 plants). The four compost treatments were allocated in the main plots and the seven natural extracts were allocated in the sub-plots.

Compost, was utilized at the soil preparation for cultivation during both growing seasons. The outcomes of the chemical analysis of the compost can be found in Table (b).

Active yeast (5 and 10 g/l), seaweed extract (1.5 and 3 ml/l) and moringa leaf extract (10 and 20%) were used as foliar spray on 18th November and repeated 3 times with 15 days intervals (3rd and 18th December). The plants were sprayed until runoff. The other agricultural practices were done as usual.

Table b. Physical and chemical analysis of the used compost in both seasons of 2022/2023 and 2023/2024.

Properties	Value	Properties	Value
Organic carbon (%)	27.9	**Total P (%)**	0.6
Humidity (%)	23	**Total K (%)**	1.11
Organic matter (%)	48	**Fe (ppm)**	610
C/N ratio	15.5	**Zn (ppm)**	53
pH (1:2.5)	8.2	**Mn (ppm)**	115
E.C. (mmhos/cm.)	5.2	**Cu (ppm)**	190
Total N (%)	1.8		

- In order to increase yeast activity, Skoog and Miller (1957) prepared a dry yeast suspension by dissolving dry yeast and sugar together (1:1, w/w) in worm water (about 35 to 37 ^{o}C). The active yeast (*Saccharomyces cervisia*) had a dry matter of 95% and live cells of 11.6 x 10^9 per gram. The chemical analysis of the used active yeast in both seasons of 2022/2023 and 2023/2024 was given in Table (c).

Table c. Chemical analysis of the used active yeast in both seasons of 2022/2023 and 2023/2024.

Protein (%)	Ash (%)	Glycogen (%)	Fat (%)	Cellulose (%)
34.87	7.55	6.54	2.09	4.92

- The seaweed extract used in the experiment was under the commercial name of Agromel Royal product and was acquired from AgroChemical Company, located on Kakr El-Ziat, Gharbia Governorate, Egypt. The chemical analysis of the used seaweed extract (as denoted in its label) was presented in Table d.

Table d. Chemical analysis of the used seaweed extract in both seasons of 2022/2023 and 2023/2024.

Properties	Value	Properties	Value
Organic matter (%)	> 50	**Total P_2O_5 (%)**	> 4
Alginate (%)	> 16	**Total K_2O (%)**	> 10
Amino Acids (%)	> 4	**pH**	8 – 10
Total N (%)	> 0.9	**Solubility in water**	100

2.2. Preparation of moringa leaf extract

To create an aqueous extract of moringa leaf extract, 100 g of young, fresh moringa leaves were gathered and mixed with one liter of distilled water. The suspension was homogenized for fifteen minutes using a home blender. A mutton cloth was then squeezed through the solution to filter it. Lastly, the solution was re-filtered through No. 2 Whatman filter paper (Fuglie, 2000). The extract was sprayed directly onto plants. Abdel-Rahman and AbdelKader (2020) state that the extract was sprayed within five hours of the collection and extraction process. If the extract was not yet ready for use, it was stored at 0.0 °C and removed only when it was time to utilize it. The chemical analysis of 100 g moringa fresh leaf extract was listed in Table (e).

Data recorded (in both season): plant height (cm), number of branches/plants, plant aerial parts fresh weight (g/plant), number of pods/plant, seeds yield/plant, fixed oil percentage (AOAC, 1970), fixed oil yield/plant, NPK% (ICARDA, 2013) and photosynthetic pigments (Fadl and Sari El-Deen, 1978).

2.3.Statistical analysis:

To make comparisons across treatment means easier, the data gathered for each feature was arranged into tables and statistically analyzed using MSTAT–C (1986) and the LSD test (at 0.05).

Table e. The chemical analysis of 100 g moringa fresh leaf extract.

Nutrient information	value	Nutrient information	Value	Amino acids	Value
Calories	92	**Sulfur (mg)**	137	**Arginine**	402
Protein (g)	6.7	**Selenium (mg)**	0	**Histidine**	141
Fat (g)	1.7	**Zinc (mg)**	0	**Isoleucine**	422
Carbohydrate (g)	13.4	**Oxalic acid (mg)**	101	**Leucine**	623
Fiber (g)	0.9	**Vitamin A (mg)**	6.8	**Lysine**	288
Calcium (mg)	440	**Vitamin B (mg)**	423	**Methionine**	134
Copper (mg)	1.1	**Vitamin B_1 (mg)**	0.21	**Phenylalanine**	429
Iron (mg)	7	**Vitamin B_2 (mg)**	0.05	**Threonine**	328
Potassium (mg)	259	**Vitamin B_3 (mg)**	0.8	**Tryptophan**	127
Magnesium (gm)	24	**Vitamin C (mg)**	220		
Phosphorus (gm)	70	**Vitamin E (mg)**	0		

3. RESULTS AND DISCUSSIONS

3.1. Vegetative growth traits

Fertilizing white mustard plant with the three levels of compost (5, 7.5 and 10 t/fed.) led to significant increase in plant height, number of branches per plants and aerial parts fresh weight per plant in both seasons relative to control (Table 1). The high values of the previous parameters were obtained from 10 t/fed. At the same time, there was not significant differences were observed between 7.5 and 10 ton compost per feddan.

Many researchers found that organic fertilization improved vegetative growth parameters of white mustard such as Susanti et al. (2020), Geremew et al. (2021), Sukerta et al. (2021) and Muktamar et al. (2024).

Data presented in Table (1) clarified that plant height, number of branches per plants and aerial parts fresh weight per plant of white mustard were noticeably augmented due to all used six natural extracts treatments (active yeast, seaweed extract and moringa leaf extract, each at 2 concentrations) facing the control treatment during both seasons. The best results were achieved from the treatment of seaweed extract at 3 ml/l, followed by active yeast at 10 g/l, then moringa leaf extract at 20%.

Natural extracts are effective when applied at suitable doses to plants, lead to the vigor growth improvement (Li and Ni, 1996 and Mau *et al*., 2001).

Many researchers observed the beneficial effect of seaweed extract on growth parameters such as El-Gawwas and Soliman (2023) on *Oenothera biennis* and Galal *et al*. (2024). Also, Toaima (2016) and Abd-Allah *et al*. (2022) on *Sinapis alba* regarding the effect of active yeast. Likewise, El-Salhy *et al*. (2023) on olive and Soliman *et al*. (2024) on chia concerning the impact of moringa leaf extract.

For all vegetative parameters under the study, there was a substantial interaction impact between compost levels and treatments with natural extracts. The plants that were sprayed with seaweed extract (3 ml/l) and fertilized with 10 tons of compost per feddan had the greatest values overall.

3.2.Yield parameters

It is obvious from Table (2) that supplying white mustard plant with compost at 5, 7.5 and 10 t/fed. considerably increased number of pods per plants and seed yield per plant (g) facing the control in both seasons. The highest values of the previous two parameters were obtained from 10 t/fed. compost.

The positive role of organic materials on yield parameters of white mustard were reported by Pathak and Godika (2010), Ali (2013), Toaima (2016), Hadiyal *et al*. (2017).

Data listed in Table (2) pointed out that both number of pods per plants and seed yield per plant of white mustard were significantly increased due to all used six natural extracts treatments (active yeast at 5 and 10 g/l, seaweed extract 1.5 and 3 ml/l and moringa leaf extract at 10 and 20%) relative to check treatment in both seasons. The highest values of both parameters were produced from the high concentration of the three used extracts with superiority for seaweed extract.

Table 1. Response of some growth parameters of white mustard to compost fertilization and some natural extracts during both seasons (2022/2023 and 2023/2024).

Natural extracts treatments (B)	Compost fertilization level, ton/feddan (A)									
	0.0	5	7.5	10	Mean (B)	0.0	5	7.5	10	Mean (B)
	First season (2022/2023).					Second season (2023/2024).				
Plant height (cm)										
Control	198.0	211.5	221.4	231.3	215.6	191.4	213.9	226.5	239.1	217.7
AY (5 g/l)	207.9	223.2	230.4	239.4	225.2	216.3	231.7	232.5	230.0	227.6
AY (10 g/l)	213.3	231.3	233.1	235.8	228.4	223.7	228.4	231.6	245.2	232.2
SAE (1.5 ml/l)	213.8	221.9	228.2	230.9	223.7	217.9	227.5	232.3	237.1	228.7
SAE (3 ml/l)	225.9	222.3	232.2	249.3	232.4	225.4	233.3	237.4	250.5	236.7
MLE (10%)	208.4	220.1	225.5	236.3	222.6	208.0	230.2	227.9	231.7	224.5
MLE (20%)	207.9	236.7	225.9	236.7	226.8	208.3	232.6	235.7	239.6	229.1
Mean (A)	210.7	223.9	228.1	237.1		213.0	228.2	232.0	239.0	
L.S.D. at 5 %	A: 13.1		B: 4.0		AB: 8.0	A: 14.2		B: 4.3		AB: 8.6
Number of branches/plant										
Control	10.33	11.13	11.66	12.50	11.41	10.83	11.63	12.16	13.00	11.91
AY (5 g/l)	11.00	11.92	12.62	13.27	12.20	11.60	12.52	13.12	13.87	12.78
AY (10 g/l)	11.56	12.37	13.02	13.61	12.64	12.46	13.27	13.92	14.51	13.54
SAE (1.5 ml/l)	11.33	12.00	12.71	13.42	12.37	11.33	12.00	12.71	13.42	12.37
SAE (3 ml/l)	11.78	12.54	13.13	13.69	12.79	12.78	13.54	14.13	14.69	13.79
MLE (10%)	11.19	11.99	12.65	13.34	12.29	11.89	12.69	13.35	14.04	12.99
MLE (20%)	11.43	12.26	12.90	13.58	12.54	12.23	13.06	13.70	14.38	13.34
Mean (A)	11.23	12.03	12.67	13.34		11.87	12.67	13.30	13.99	
L.S.D. at 5 %	A: 0.70		B: 0.16		AB: 0.32	A: 0.75		B: 0.25		AB: 0.50
Aerial parts fresh weight (g/plant)										
Control	484.8	517.8	542.1	566.3	527.8	468.5	523.6	554.5	585.3	533.0
AY (5 g/l)	509.0	546.5	564.1	577.3	549.2	529.5	567.2	569.1	563.0	557.2
AY (10 g/l)	522.2	566.3	570.7	586.1	561.3	547.6	559.1	566.9	600.2	568.5
SAE (1.5 ml/l)	523.5	543.3	558.7	565.3	547.7	533.4	556.9	568.7	580.4	559.8
SAE (3 ml/l)	553.1	544.3	568.5	610.4	569.1	551.8	571.1	581.1	613.2	579.3
MLE (10%)	510.2	538.9	552.1	578.6	545.0	509.2	563.5	557.9	567.2	549.4
MLE (20%)	509.0	579.5	553.1	579.5	555.3	509.9	569.4	577.0	586.5	560.7
Mean (A)	516.0	548.1	558.5	580.5		521.4	558.7	567.9	585.1	
L.S.D. at 5 %	A: 28.1		B: 15.2		AB: 30.4	A: 35.2		B: 16.3		AB: 32.6

Where: AY (active yeast), SWE (seaweed extract) and MLE (moringa leaf extract).

The improvement role of seaweed extract on yield parameters was mentioned by Amin (2018) on sesame plant, El-Gawwas and Soliman (2023) on *Oenothera biennis* L. and Galal *et al*. (2024) on black cumin. Also, the stimulatory Impact of active yeast was reported by El-Azzony *et al*. (2018) on jatropha and Abdul-Hafeez and Soliman (2020) on *Nigella sativa*. Likewise, the supportive effect of moringa leaf extract was showed by Prakash *et al*. (2019) on sesame, Ayyat *et al*. (2021) on black cumin and Farhat *et al*. (2023) on sunflower.

For both yield parameters under the study, there was a significant interaction effect between compost levels and treatments with natural extracts. The plants that were fertilized with 10 tons of compost per feddan and sprayed with seaweed extract (3 ml/l) had the greatest values overall.

Table 2. Response of some yield parameters of white mustard to compost fertilization and some natural extracts during both seasons (2022/2023 and 2023/2024).

Natural extracts treatments (B)	Compost fertilization level, ton/feddan (A)									
	0.0	5	7.5	10	Mean (B)	0.0	5	7.5	10	Mean (B)
	First season (2022/2023).					Second season (2023/2024).				
	Number of pods per plant									
Control	653.9	704.6	738.1	791.3	722.0	747.9	803.2	839.8	897.8	822.2
AY (5 g/l)	696.4	754.6	798.9	840.1	772.5	801.1	864.6	906.1	957.9	882.4
AY (10 g/l)	731.8	783.1	824.2	861.6	800.2	860.5	916.4	961.3	1002.1	935.1
SAE (1.5 ml/l)	717.2	759.7	804.6	849.6	782.8	782.4	828.7	877.8	926.8	853.9
SAE (3 ml/l)	745.7	793.8	831.2	866.7	809.4	882.6	935.1	975.8	1014.5	952.0
MLE (10%)	708.4	759.0	800.8	844.5	778.2	821.1	876.4	922.0	969.6	897.3
MLE (20%)	723.6	776.1	816.6	859.7	794.0	844.6	901.9	946.1	993.1	921.4
Mean (A)	711.0	761.6	802.1	844.8		820.0	875.2	918.4	966.0	
L.S.D. at 5 %	A: 44.3		B: 15.4		AB: 30.8	A: 49.1		B: 30.6		AB: 61.2
	Seed yield (g/plant)									
Control	21.59	31.74	37.26	43.09	33.42	22.26	32.72	38.41	44.92	34.58
AY (5 g/l)	26.51	36.23	40.65	55.79	39.80	26.34	38.42	42.98	58.98	41.68
AY (10 g/l)	28.19	47.91	60.01	85.47	55.40	29.06	49.39	61.87	88.51	57.21
SAE (1.5 ml/l)	35.27	51.50	56.21	62.87	51.46	36.36	53.09	57.95	65.21	53.15
SAE (3 ml/l)	40.29	57.62	61.35	86.87	61.53	41.54	59.40	63.25	89.96	63.54
MLE (10%)	30.23	42.02	44.16	49.00	41.35	31.17	43.32	45.53	50.92	42.74
MLE (20%)	34.78	53.58	58.99	71.99	54.84	35.86	55.24	60.81	74.62	56.63
Mean (A)	30.98	45.80	51.23	65.01		31.80	47.37	52.97	67.59	
L.S.D. at 5 %	A: 13.71		B: 6.1		AB: 12.2	A: 14.51		B: 6.33		AB: 12.66

Where: AY (active yeast), SWE (seaweed extract) and MLE (moringa leaf extract).

3.3. Fixed oil production

Data listed in Table (3) indicated that applying white mustard plant with compost at any used level markedly increased fixed oil (%) and fixed oil yield per plant (g) facing the control in both seasons. The treatment of 10 t/fed. compost produced the highest values of the previous two parameters.

The beneficial impact of organic materials on fixed oil productivity of white mustard were mentioned by Ali (2013) and Toaima (2016).

Data presented in Table (3) revealed that all used six natural extracts treatments (active yeast at 5 and 10 g/l, seaweed extract 1.5 and 3 ml/l and moringa leaf extract at 10 and 20%) significantly increased fixed oil (%) and fixed oil yield per plant (g) of white mustard compared to check treatment in both seasons. The highest values of both parameters were produced from the high concentration of the three used extracts with superiority for seaweed extract.

The stimulatory role of seaweed extract on fixed oil production was mentioned by Zouari *et al*. (2020) on olive, El-Gawwas and Soliman (2023) on *Oenothera biennis* L. and Galal *et al*. (2024) on black cumin. Also, the improvement Impact of active yeast was reported by Toaima (2016) and Abd-Allah *et al*. (2022) on white mustard. Likewise, the supportive effect of moringa leaf extract was showed by Atteya *et al*. (2021) on jojoba, El-Salhy *et al*. (2023) on olive and Soliman *et al*. (2024) on chia.

The interaction effect between compost levels and some natural extracts treatments on fixed oil production was significant in both seasons. The plants that were fertilized with 10 tons of compost per feddan and sprayed with seaweed extract (3 ml/l) produced the greatest values overall.

Table 3. Response of fixed oil production of white mustard to compost fertilization and some natural extracts during both seasons (2022/2023 and 2023/2024).

Natural extracts treatments (B)	Compost fertilization level, ton/feddan (A)									
	0.0	5	7.5	10	Mean (B)	0.0	5	7.5	10	Mean (B)
	First season (2022/2023).					Second season (2023/2024).				
	Fixed oil (%)									
Control	13.05	14.85	15.75	18.45	15.53	13.50	15.30	16.20	18.90	15.98
AY (5 g/l)	13.95	16.65	22.50	25.65	19.69	14.40	17.10	23.40	26.55	20.36
AY (10 g/l)	19.35	22.50	24.75	28.35	23.74	19.80	23.40	25.65	29.25	24.53
SAE (1.5 ml/l)	18.00	18.90	22.50	24.30	20.93	18.45	19.35	23.40	25.20	21.60
SAE (3 ml/l)	26.10	27.45	28.80	31.50	28.46	27.00	28.35	29.70	32.40	29.36
MLE (10%)	15.30	20.25	23.40	24.30	20.81	15.75	20.70	24.30	25.20	21.49
MLE (20%)	17.10	21.15	22.50	24.30	21.26	17.55	21.60	23.40	25.20	21.94
Mean (A)	17.55	20.25	22.89	25.26		18.06	20.83	23.72	26.10	
L.S.D. at 5 %	A: 2.01		B: 1.96	AB: 3.92		A: 2.38		B: 1.99	AB: 3.98	
	Fixed oil yield (g/plant)									
Control	2.82	4.71	5.87	7.95	5.34	3.01	5.01	6.22	8.49	5.68
AY (5 g/l)	3.70	6.03	9.15	14.31	8.30	3.79	6.57	10.06	15.66	9.02
AY (10 g/l)	5.45	10.78	14.85	24.23	13.83	5.75	11.56	15.87	25.89	14.77
SAE (1.5 ml/l)	6.35	9.73	12.65	15.28	11.00	6.71	10.27	13.56	16.43	11.74
SAE (3 ml/l)	10.52	15.82	17.67	27.36	17.84	11.22	16.84	18.79	29.15	19.00
MLE (10%)	4.63	8.51	10.33	11.91	8.84	4.91	8.97	11.06	12.83	9.44
MLE (20%)	5.95	11.33	13.27	17.49	12.01	6.29	11.93	14.23	18.80	12.81
Mean (A)	5.63	9.56	11.97	16.93		5.95	10.16	12.83	18.18	
L.S.D. at 5 %	A: 2.39		B: 2.02	AB: 4.04		A: 2.67		B: 2.33	AB: 4.66	

Where: AY (active yeast), SWE (seaweed extract) and MLE (moringa leaf extract).

3.4. Chemical constituents

Data listed in Tables (4 and 5) provided that supplying white mustard plant with compost at any used of the three levels considerably increased NPK% and photosynthetic pigments (mg/g fresh weight) relative to the control in both seasons. The treatment of 10 t/fed. compost produced the highest values of the previous two parameters.

The stimulating effect of organic fertilizers on some chemical constituents of white mustard were reported by Chung and Wang (2000) and Geremew *et al*. (2021).

As can be seen from data presented in Tables (4 and 5) indicated that NPK% and photosynthetic pigments (mg/g fresh weight) were significantly improved due to all used six natural extracts treatments relative to control treatment in both seasons. The highest values of both parameters were produced from the high concentration of the three used extracts with superiority for seaweed extract.

The stimulatory role of seaweed extract on photosynthetic pigments and NPK% was mentioned by Abou El-Ghait *et al*. (2021) on chia, El-Gawwas and Soliman (2023) on *Oenothera biennis* L. and Galal *et al*. (2024) on black cumin. Likewise, the improvement Impact of active yeast was reported by Abd-Allah *et al*. (2022) on white mustard, Mahmoud *et al*. (2023) on lemongrass. Also, the supportive effect of moringa leaf extract was showed by Atteya *et al*. (2021) on jojoba, Farhat *et al*. (2023) on sunflower and Soliman *et al*. (2024) on chia.

The interaction effect between compost levels and some natural extracts treatments on NPK% and photosynthetic pigments was significant in both seasons. The greatest values overall were achieved from plants that were fertilized with 10 tons/fed. of compost and sprayed with seaweed extract (3 ml/l).

Table 4. Response of photosynthetic pigments (mg/g FW) of white mustard to compost fertilization and some natural extracts during both seasons (2022/2023 and 2023/2024).

Natural extracts treatments (B)	Compost fertilization level, ton/feddan (A)									
	0.0	5	7.5	10	Mean (B)	0.0	5	7.5	10	Mean (B)
	First season (2022/2023).					Second season (2023/2024).				
Chlorophyll a content (mg/g FW)										
Control	3.005	3.155	3.320	3.355	3.209	3.014	3.164	3.330	3.365	3.218
AY (5 g/l)	3.018	3.165	3.334	3.365	3.221	3.027	3.174	3.344	3.375	3.230
AY (10 g/l)	3.190	3.248	3.315	3.345	3.275	3.200	3.258	3.325	3.355	3.284
SAE (1.5 ml/l)	3.165	3.230	3.299	3.321	3.254	3.174	3.240	3.309	3.331	3.264
SAE (3 ml/l)	3.229	3.275	3.342	3.395	3.310	3.239	3.285	3.352	3.405	3.320
MLE (10%)	3.045	3.195	3.361	3.378	3.245	3.054	3.205	3.371	3.388	3.254
MLE (20%)	3.185	3.241	3.301	3.332	3.265	3.195	3.251	3.311	3.342	3.275
Mean (A)	3.120	3.216	3.325	3.356		3.129	3.225	3.335	3.366	
L.S.D. at 5 %	A: 0.006		B: 0.005		AB: 0.010	A: 0.008		B: 0.006		AB: 0.012
Chlorophyll b content (mg/g FW)										
Control	0.982	1.032	1.087	1.098	1.050	0.985	1.035	1.090	1.102	1.053
AY (5 g/l)	0.986	1.035	1.091	1.102	1.054	0.989	1.038	1.095	1.105	1.057
AY (10 g/l)	1.043	1.063	1.085	1.095	1.072	1.046	1.066	1.088	1.098	1.075
SAE (1.5 ml/l)	1.035	1.057	1.080	1.087	1.065	1.038	1.060	1.083	1.090	1.068
SAE (3 ml/l)	1.056	1.072	1.094	1.112	1.083	1.060	1.075	1.097	1.115	1.087
MLE (10%)	0.995	1.045	1.100	1.106	1.062	0.998	1.048	1.104	1.109	1.065
MLE (20%)	1.042	1.060	1.080	1.091	1.068	1.045	1.064	1.084	1.094	1.071
Mean (A)	1.020	1.052	1.088	1.099		1.023	1.055	1.091	1.102	
L.S.D. at 5 %	A: 0.004		B: 0.003		AB: 0.006	A: 0.005		B: 0.004		AB: 0.008
Carotenoids content (mg/g FW)										
Control	1.032	1.082	1.137	1.148	1.100	1.036	1.086	1.141	1.153	1.104
AY (5 g/l)	1.036	1.085	1.141	1.152	1.104	1.040	1.089	1.146	1.156	1.108
AY (10 g/l)	1.093	1.113	1.135	1.145	1.122	1.098	1.117	1.140	1.150	1.126
SAE (1.5 ml/l)	1.085	1.107	1.130	1.137	1.115	1.089	1.111	1.134	1.142	1.119
SAE (3 ml/l)	1.106	1.122	1.144	1.162	1.133	1.111	1.126	1.149	1.166	1.138
MLE (10%)	1.045	1.095	1.150	1.156	1.112	1.049	1.099	1.155	1.161	1.116
MLE (20%)	1.092	1.110	1.130	1.141	1.118	1.096	1.115	1.135	1.145	1.123
Mean (A)	1.070	1.102	1.138	1.149		1.074	1.106	1.143	1.153	
L.S.D. at 5 %	A: 0.005		B: 0.004		AB: 0.008	A: 0.006		B: 0.005		AB: 0.010

Where: AY (active yeast), SWE (seaweed extract) and MLE (moringa leaf extract).

4. DISCUSSIONS

It is noticed from our data that all used compost levels as organic fertilizer significantly increased all previously studied growth traits, yield parameters, fixed oil productivity and some chemical constituents.

These results may be due to the organic materials increased the vegetative growth through improve the physical, chemical and biological properties of the soil (Ryckeboer *et a*l., 2003 and Sukerta *et al*., 2021), which, consequently reflected in increasing yield and oil production.

Natural extracts like active yeast, seaweed extract and moringa leaf extract have a vital role to enhance plant growth and productivity may be due to its all components or any one of its components (Tables c, d and e) (Bhaskar and Miyashita, 2005 and Massoud *et al*., 2017). So, to produce clean products, according to our data, it could be advised to fertilize white mustard plants with compost and sprayed with one of used the natural extracts, specially, seaweed extract.

Table 5. Response of nitrogen, phosphorus and potassium (%) of white mustard to compost fertilization and some natural extracts during both seasons (2022/2023 and 2023/2024).

Natural extracts treatments (B)	Compost fertilization level, ton/feddan (A)									
	0.0	5	7.5	10	Mean (B)	0.0	5	7.5	10	Mean (B)
	First season (2022/2023).					Second season (2023/2024).				
	Nitrogen (%)									
Control	0.90	1.02	1.10	1.15	1.04	0.91	1.03	1.10	1.15	1.05
AY (5 g/l)	1.00	1.06	1.13	1.30	1.12	1.01	1.08	1.14	1.32	1.14
AY (10 g/l)	1.20	1.33	1.43	1.52	1.37	1.21	1.34	1.44	1.53	1.38
SAE (1.5 ml/l)	1.08	1.14	1.22	1.38	1.21	1.09	1.15	1.24	1.40	1.22
SAE (3 ml/l)	1.28	1.39	1.53	1.64	1.46	1.29	1.40	1.55	1.66	1.48
MLE (10%)	1.04	1.11	1.18	1.32	1.16	1.06	1.13	1.20	1.35	1.19
MLE (20%)	1.13	1.20	1.29	1.42	1.26	1.14	1.22	1.30	1.49	1.29
Mean (A)	1.09	1.18	1.27	1.39		1.10	1.19	1.28	1.41	
L.S.D. at 5 %	A: 0.08		B: 0.05		AB: 0.10	A: 0.09		B: 0.06		AB: 0.12
	Phosphorus (%)									
Control	0.04	0.05	0.06	0.08	0.06	0.04	0.06	0.07	0.09	0.07
AY (5 g/l)	0.05	0.07	0.08	0.10	0.08	0.05	0.08	0.09	0.11	0.08
AY (10 g/l)	0.11	0.13	0.15	0.17	0.14	0.12	0.14	0.16	0.19	0.15
SAE (1.5 ml/l)	0.08	0.10	0.13	0.15	0.12	0.09	0.11	0.14	0.16	0.13
SAE (3 ml/l)	0.12	0.14	0.16	0.19	0.15	0.13	0.15	0.17	0.21	0.17
MLE (10%)	0.06	0.08	0.10	0.12	0.09	0.07	0.09	0.11	0.13	0.10
MLE (20%)	0.09	0.11	0.13	0.16	0.12	0.10	0.12	0.14	0.17	0.13
Mean (A)	0.08	0.10	0.12	0.14		0.09	0.11	0.13	0.15	
L.S.D. at 5 %	A: 0.02		B: 0.01		AB: 0.02	A: 0.02		B: 0.01		AB: 0.02
	Potassium (%)									
Control	1.71	1.87	1.96	2.03	1.89	1.79	1.95	2.05	2.12	1.98
AY (5 g/l)	1.91	2.02	2.14	2.17	2.06	2.01	2.12	2.25	2.28	2.16
AY (10 g/l)	2.31	2.40	2.49	2.58	2.45	2.43	2.52	2.61	2.71	2.57
SAE (1.5 ml/l)	2.14	2.15	2.27	2.40	2.24	2.21	2.23	2.35	2.48	2.32
SAE (3 ml/l)	2.42	2.53	2.64	2.76	2.59	2.54	2.66	2.77	2.90	2.72
MLE (10%)	2.01	2.12	2.24	2.38	2.19	2.07	2.18	2.31	2.45	2.25
MLE (20%)	2.23	2.32	2.41	2.51	2.37	2.34	2.43	2.53	2.63	2.48
Mean (A)	2.10	2.20	2.31	2.40		2.20	2.30	2.41	2.51	
L.S.D. at 5 %	A: 0.09		B: 0.05		AB: 0.10	A: 0.10		B: 0.06		AB: 0.12

Where: AY (active yeast), SWE (seaweed extract) and MLE (moringa leaf extract).

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الملخص العربي

استجابة الخردل الأبيض للكمبوست وبعض المستخلصات الطبيعية

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كان الغرض من هذه التجربة هو تقييم تأثير السماد العضوي بالكمبوست (٠، ٥، ٧.٥ و ١٠ طن / فدان) وبعض المستخلصات الطبيعية (الكنترول، الخميرة النشطة بمعدل ٥ و ١٠ جم / لتر، مستخلص الأعشاب البحرية بمعدل ١.٥ و ٣ مل / لتر ومستخلص أوراق المورينجا بمعدل ١٠ و ٢٠٪) على النمو والمحصول وإنتاجية الزيت الثابت وبعض المكونات الكيميائية لنباتات الخردل الأبيض خلال عامي ٢٠٢٢/٢٠٢٣ و ٢٠٢٣/٢٠٢٤ في مزرعة النباتات الطبية بكلية الزراعة جامعة المنيا، مصر.

أظهرت البيانات أن جميع صفات النمو الخضري المدروسة (ارتفاع النبات، وعدد الفروع للنبات، والوزن الطازج للنبات)، والصفات المحصولية (عدد القرون لكل نبات ومحصول البذور لكل نبات)، وإنتاج الزيت الثابت (النسبة المئوية للزيت ومحصول الزيت للنبات) وبعض المكونات الكيميائية (NPK% وصبغات التمثيل الضوئي) قد زادت بشكل معنوي مع تسميد النباتات بالكمبوست مقارنةً بالكنترول خلال كلا الموسمين، حيث تم الحصول على أعلى القيم عند ١٠ أطنان من السماد العضوي للفدان.

أدت جميع المعاملات السِت المستخدمة من المستخلصات الطبيعية إلى زيادة كبيرة في جميع المعايير المذكورة أعلاه مقارنةً بالكنترول خلال كلا الموسمين. وكان مستخلص الأعشاب البحرية بتركيز ٣ مل/لتر متفوقًا في هذا الصدد.

كانت أفضل معاملة تفاعل هي تسميد نباتات الخردل الأبيض بالسماد العضوي بتركيز ١٠ أطنان/فدان ومستخلص الأعشاب البحرية بمعدل (٣ مل/لتر)، يليه مع الخميرة النشطة بتركيز (١٠ جم/لتر).

الكلمات المفتاحية: سينابيس ألبا – الخميرة النشطة – مستخلص الأعشاب البحرية – مستخلص أوراق المورينجا – النمو الخضري – المحصول – الزيت الثابت.