

Phytotoxicity and efficacy of some herbicide treatments on sugar beet fields

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ABSTRACT: Weeds are considered the primary enemy of sugar beet cultivation, where sugar beet crop is relatively vulnerable to weed competition due to its slow initial growth. Thus, weeds infestation is one of the most important factors threatening and significantly reducing sugar beet productivity. Therefore, the current study was conducted on sugar beet cultivation during two seasons, 2020/2021 and 2021/2022 to evaluate the phytotoxicity of some herbicide treatments on sugar beet (*Beta vulgaris*), the effectiveness of these herbicide treatments on weed control in sugar beet field was evaluated, as well as yield evaluation and quality of sugar beets after herbicide treatments. The field trial was conducted at the agricultural experiment station in Etay El-barod, El-Beheira Governorate, using a randomized complete block design (RCBD) with four replicates for each treatment and unweeded check. Herbicide treatments include a post-emergence application of [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], [Desmedipham7.1%+ Phenmedipham9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + one hand weeding after month] and [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + application again after 1 month]. The results indicated that biological parameters of sugar beet (plant height and growth stage) increased with all herbicide treatments utilized compared to unweeded check. All herbicide treatments utilized were presented a different response phytotoxicity of sugar beet plant, until registered low indexes of phytotoxicity on the plants, the symptoms of phytotoxicity disappeared over time, and completely were disappeared after 8 weeks after application (WAA) compared to unweeded check. As showed that, all investigated herbicide treatments had significant increase of carotenoids, chlorophyll a and chlorophyll b concentration after 2, 4 and 8 WAA comparative with unweeded check treatment. Also, the results indicated that all herbicide treatments reduced weed density and weed height and had a strong effect on the weed growth stage, either halting or significantly slowing growth comparing with the unweeded check. Herbicide treatments achieved the highest level of weed control, expressed as the lowest fresh weight 56 days after application for each weed species and its density. The results indicated that herbicide treatments recorded a significant increase in yield attributes [Root length, Root diameter and Root fresh weight (g/plant)], yield quality [Sucrose (%)] and yield evolution (Root yield & sugar yield) compared to unweeded check in both seasons. The maximum yield (root and sugar) was recorded by treatment [Desmedipham7.1%+ Phenmedipham9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] at the 1st season, followed by treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] at the 2ndseason compared to unweeded check.

Keywords: sugar beet, weeds, herbicide treatments, phytotoxicity, weed control effectiveness, yield attributes, yield quality, yield evaluation.

1. Introduction:

Sugar beet (*Beta vulgaris*) is of immense economic importance as a major global source of sugar, ranking second only to sugarcane in global sugar production, thus contributing to local food security. It is also a key crop for achieving self-sufficiency in sugar, particularly in regions where sugarcane production is challenging, and is vital for addressing sugar production

deficits and achieving self-sufficiency in countries like Egypt. It is also an important crop that helps in the establishment of integrated agro-industrial communities, especially in newly reclaimed areas. It contributes too many industries such as the sugar industry and high-value animal feed resulting from waste processing. In Egypt, sugar beet is a major strategic crop and one of the most important Egyptian commercial crops for sugar production, representing about 62.1% of the total sugar

crop production (**Shimaa et al., 2022**). Sugar beet was cultivated in Egypt on an area of 676.139 thousand feddans, with a production of 15.4 million tons in 2023/2024, according to statistics recorded in the Ministry of Agriculture by the agricultural directorates in the governorates. Egypt produces approximately 1.757 million tons of sugar annually, while, its consumption is estimated at around 2.600 million tons annually. This results in a deficit of approximately 843 thousand tons and a self-sufficiency rate of 68%. This deficit can be addressed by increasing domestic sugar production, thereby raising the overall output of sugar crops. This increase can be achieved either by expanding the cultivated area or increasing production or both. Increased sugar beet production can be achieved through horizontal expansion of newly reclaimed land cultivation and vertical expansion through the use of better agricultural practices, including the development of new varieties, genetic modification of local varieties and weed control (**Refat and Ghaffar, 2010**).

Weeds are the primary enemy of sugar beet cultivation in many countries worldwide. Sugar beet is particularly vulnerable to weed competition due to its slow initial growth. Weeds significantly impact sugar beet yield, competing with the plants for nutrients, moisture, space, light, and other growth factors. These results in substantial yield reductions of up to 99% in uncultivated plots compared to weed-free plots. Furthermore, yield reductions of 50% and 75% were observed when weed removal was delayed for 60 and 90 days post-planting, respectively (**Tamalika et al., 2020**). Controlling weeds at the beginning of the season is crucial for maximizing sugar beet productivity (**Farzin and Hussein, 2004**). Competition from weeds has led to a decrease in root yield up to 84% (**Majidi et al., 2017**). Dicotyledonous grasses from the Chenopodiaceae, Asteraceae, Brassicaceae, and Melonaceae families are of great importance in most sugar beet-growing regions. Monocotyledonous grasses are less important than dicotyledonous grasses. Broadleaf grasses typically grow to two or three times the height of sugar beets. Annual broadleaf grasses are more competitive than annual grasses (**Irena et al., 2015**).

In sugar beet fields, herbicides are used to control weeds due to their effectiveness and ease of application. Mixtures of different herbicides are commonly used to

achieve comprehensive weed control. Chemical weed control is one of the most important weed management methods in sugar beet plantations. Post-emergence herbicides are also reported to be used to control weeds, particularly broadleaf and grassy weeds. A wide range of post-emergence herbicides and their mixtures are available for controlling broadleaf weeds, such as chloridazon, cloperalide, ethofomycete, linakil, metameron, desmedivam, indothal, fenmedivam, and triflurosulfuron-methyl. Because sugar beet herbicides have sufficient residual activity to control weeds, the use of mixtures of different herbicides is common to achieve comprehensive weed control (**Tamalika et al., 2020**). Therefore, the main objective of this study was to evaluate the phytotoxicity of some herbicide treatments on sugar beet, evaluate the effectiveness of herbicide treatments in controlling weeds in the sugar beet field, also, evaluate the yield and quality of sugar beet after the application of herbicide treatments.

2. Materials and methods:

2.1. Herbicide treatments utilized:

The herbicide treatments utilized and their own type of formulation, chemical groups, mode of action, selectivity, rate of application used and application time as showed in Table (1)

2.2. Field experimental:

The experimental field was conducted in Agricultural Experimental Station of Etay El-barod (Zarzora), El-Beheira Governorate. Sugar beet (*Beta vulgaris*) cultivar Karam & Aminavhe was planted at the end of August and September during the 2020/2021 & 2021/2022 seasons, respectively. The experimental area was divided according to a completely randomized block design with four replicates for each treatment and one control. Each replicate was approximately (20 m²). Herbicide treatments were applied according to the experimental protocols as showed in Table (1).

The soil of the experimental site was classified as clay soil. The physical and chemical properties of the experimental soil were analyzed according to **Jackson (1973) and Page et al., (1982)** as recorded in Table (2).

Table (1): Herbicide treatments, formulation, chemical group, mode of action, selectivity, rate/feddan and application timing of used herbicides.

Treatments	Type of Formulation	Chemical groups	Mode of action	Selectivity	Rate of Application (Rate/ fed.)	Type and time of Application	
Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month	- EC 40% - EC 10.8%	Phenyl-carbamate Aryloxyphenoxy-propionate 'FOPs'	Inhibition of photosynthesis at photosystem II Inhibition of acetyl CoA carboxylase (ACCase)	Broad and Narrow leaves Narrow leaves (Grassy)	1 Liter 500 cm ³	(S praying at two-true-leaf stage of the beet plant) Post-emergence	
Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month	- EC 27.4% - EC 10.8%	Phenyl-carbamate Benzofuran Aryloxyphenoxy-propionate 'FOPs'	- Inhibition of photosynthesis at photosystem II - Inhibition of lipid synthesis Inhibition of acetyl CoA carboxylase (ACCase)	Broad and Narrow leaves Narrow leaves (Grassy)	1 Liter 500 cm ³		
Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month	- EC 26%	Phenyl-carbamate Aryloxyphenoxy-propionate 'FOPs'	- Inhibition of photosynthesis at photosystem II - Inhibition of acetyl CoA carboxylase (ACCase)	Broad and Narrow leaves (Grassy)	1 Liter		
Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month	- EC 26% - EC 26%	Phenyl-carbamate Aryloxyphenoxy-propionate 'FOPs'	- Inhibition of photosynthesis at photosystem II - Inhibition of acetyl CoA carboxylase (ACCase)	Broad and Narrow leaves (Grassy) Broad and Narrow leaves (Grassy)	1 Liter 1 Liter		
Unweeded check (Control)							

Table (2): Physical and chemical properties of experimental soil units.

Physico-Chemical properties	Seasons	
	2020/2021	2021/2022
E.C. (dS/m)	2.08	2.21
pH	8.00	8.01
CaCO ₃ %	3.51	3.00
O.M %	2.16	2.23
N(ppm) (available)	30.08	17.1
P(ppm) (available)	10.5	20.7
K(ppm) (available)	207.78	392.00
Ca ⁺⁺	2.85	2.90
Mg ⁺⁺	3.08	4.10
K ⁺	0.21	0.24
Na ⁺	7.28	8.30
Cl ⁻	7.61	8.0
CO ₃ ⁻	0.0	0.0
H CO ₃ ⁻	5.18	5.30
SO ₄ ⁻	2.29	3.3
Course sand %	7.26	6.59
Find sand %	26.91	27.64
Silt %	13.85	12.60
Clay %	51.98	53.17
Texture grade	Clay	Clay

2.3. Phytotoxicity estimates on sugar beet

2.3.1. Biological parameters

- Plant Height (cm): an average of 10 plant specimens per plot was determined before application and after 1, 2, 4, and 8 weeks after application by measuring the height from the soil surface to the tip of the uppermost leaf.
- Growth stages: were determined according to the BBCH scale before application and after 1, 2, 4, and 8 weeks after application during the vegetative growth of 2020/2021 and 2021/2022. The main growth stages of beet were monitored based on the BBCH scale according to (Meier *et al.*, 1993).

2.3.2. Phytotoxicity percentage:

Phytotoxicity (%) was visually assessed after 1, 2, 4, and 8 weeks after application. A percentage was used to evaluate the phytotoxicity of herbicide treatment, where zero (0%) being given to

phytotoxicity of the control and one hundred (100%) to the complete death of sugar beet plants, according to the methodology proposed by **SBCPD (1995)**.

2.3.3. Photosynthetic pigments:

Chlorophyll a, b and carotenoids were extracted and estimated in sugar beet plant after 2, 4 and 8 week after application of herbicide treatments according to **Hiscox and Israelstam (1979)**. One hundred mg of plant leaves were placed in a test tube containing 7 ml dimethyl sulphoxide (DMSO). Chlorophyll and carotenoids were extracted into the fluid without grinding at 55 °C by incubating over night. The extracted liquid was filtered and transferred to a graduated tube and its volume was topped up with DMSO to 10 mL. Absorbance was measured by Vis spectrophotometer model Alpha-1102 Shanghai Lab-spectrum instruments Co., Ltd at 662, 644 nm for (Chl. a, and Chl. b, respectively) and 470 nm for carotenoids at 662, 644 nm for (Chl. a, and Chl. b, respectively) and 470 nm for carotenoids.

Total chlorophyll, chlorophyll a, & b were calculated using **Arnon equation (1949)**, while **Canal et al., (1985)** was used for carotenoids.

Arnon equation:-

$$\text{Chl. a} = 12.7 \times \text{O.D } 662 - 2.69 \times \text{O.D } 644 \quad \text{mg/L}$$

$$\text{Chl. b} = 22.9 \times \text{O.D } 644 - 2.69 \times \text{O.D } 662 \quad \text{mg/L}$$

$$\text{Chl. t} = 20.2 \times \text{O.D } 644 + 8.02 \times \text{O.D } 662 \quad \text{mg/L}$$

Canal et al. equation:-

$$\frac{\text{O.D } 470 - 1.28 (\text{chl. a mg/L}) + 56.7 (\text{chl. b mg/L})}{256 \times 0.906}$$

2.4. Effectiveness of herbicide treatments on weed control in sugar beet crop:

Weeds were classified and after that assessed following:-

2.4.1. Biological parameters:

- Data for weed density (m⁻²) was recorded for each weed before application and after 1, 2, 4, and 8 weeks after application using standard procedures during the study period. A 50 x 50 cm square was randomly placed in 4 randomly selected locations in each experimental plot, and the density of each weed was recorded.
- The height of weeds (cm) was determined for each weed before application and after 1, 2, 4, and 8 weeks after application during the investigated seasons.
- Growth stages were determined according to the BBCH scale for each weed before application and after 1, 2, 4, and 8 weeks after application during the vegetative growth periods of 2020/2021 and 2021/2022. Described of the phonological growth stages and BBCH identification keys for weed species, (**Hess et al., 1997**).

2.4.2. Fresh Weight of Weeds:

Weeds were collected in one square meter after 56 days from treatment using a 50 cm x 50 cm square placed at 4 randomly selected locations in each experimental plot, and then recorded the fresh weight (g/m²) for each weed species and the total of

all weeds were calculated and weed control percentage was calculated by the following equation:

$$\text{Weeds control \%} = \frac{\text{Weight of control weeds} - \text{Weight of treated weeds}}{\text{Weight of control weeds}} \times 100$$

2.5. Yield evaluation and quality of sugar beet:

At harvest, ten protected sugar beet plants were randomly collected from each plot to determine the following characteristics: Root length (cm), Root diameter (cm) and Root fresh weight (g/plants).

2.5.1. Quality quantifications:

- **Sucrose (%)**: Total sugars were extracted from plants by 80% ethanol and were estimated by the phenol-sulphuric acid reaction of **Dubois et al., (1956)**. Hundred microliters of the extract were added into a colorimetric tube to 0.5 ml of phenol (20 percent w/v). Then 5 ml of concentrated sulfuric acid were added rapidly with shakin. The tubes were allowed to stand 10 min, then they were shaken and placed for 10-20 min in water bath at 25 to 30 °C before readings. Blanks were prepared by substituting distilled water for the sugar solution. The absorbance of characteristic yellow –orange color is measured at 490 nm against blank .Total carbohydrate is expressed as: µg glucose/gm fresh weight.

Reducing sugars were extracted and which was estimated by dinitrosilylic aid reagent, according to **Sadasivam and Manickam (1991)**.

Since sugar beetroot consists of sucrose as major sugar content, sucrose calculated by difference (**Quin et al., 1980**).

$$\text{Sucrose \%} = \text{Total sugar \%} - \text{reducing sugars \%}.$$

2.5.2. Yield evaluation:

- **Root yield (ton/fed)**: Roots and tops were separated and each was weighted to determine root yields/feddan.
- **Sugar yield (ton/fed)**: was calculated by multiplying root yield by sucrose%.

2.6. Statistical Analysis:

All data were analyzed using ANOVA software (SAS Institute, 2003), and means were separated using Duncan's multiple range test (DMRT) at 0.05. Data were analyzed separately by location due to variations in weather conditions, spraying dates, estimated dates, and weed types at each site.

3. Results and discussion:

Data in Table (3) indicated the dominant weeds species with sugar beet in the experimental location, Its major classification to the common broad leaved and narrow leaved (grassy) weeds during the two

seasons 2020/2021 and 2021/2022. Similar results were obtained by Mahmoud and Fouad, (2012) and Abd-Elaziz *et al.*, (2024). Also, finding is in conformity with Tamalika *et al.*, (2020) who reported that the broadleaved weeds approximately 70% of weed species widespread in sugar beet fields, while, 30% are grass weeds. Also, them mentioned the dicot weeds are more destructive compared to monocots, and the most important dicot weeds of sugar beet growing areas from the families of Amaranthaceae, Asteraceae and others but widespread grass weeds family was Poaceae (grass family), among them *Echinochloa spp* weed.

Table (3): Herbs dominant with sugar beet at experimental site during 2020/21 and 2021/22 seasons

Family	Names		Life cycle	Species
	Scientific	English		
Season 2020/2021				
Malvaceae	<i>Corchorus olitorius</i>	Jew's mallow	Annual	Broad leaved
Amaranthaceae	<i>Amaranthus ascendens</i>	Purple amaranth	Annual	Broad leaved
Asteraceae	<i>Xanthium strumarium</i>	cocklebur	Annual	Broad leaved
Poaceae (grass family)	<i>Brachiaria reptans</i>	Creeping signal grass	Annual	Narrow leaves(Grassy)
Poaceae (Grass family)	<i>Echinochloa colonum</i>	Jungle rice	Annual	Narrow leaves(Grassy)
Season 2021/2022				
Malvaceae	<i>Corchorus olitorius</i>	Jew's mallow	Annual	Broad leaved
Amaranthaceae	<i>Amaranthus ascendens</i>	Purple amaranth	Annual	Broad leaved
Poaceae (grass family)	<i>Brachiaria reptans</i>	Creeping signal grass	Annual	Narrow leaves(Grassy)
Solanaceae.	<i>Solanum nigrum</i>	Black nightshade	Annual	Broad leaved
Primulaceae	<i>Anagallis arvensis</i>	Scarlet pimpernel	Annual	Broad leaved

3.1. Phytotoxicity of herbicide treatments on sugar beet:

3.1.1. Effect of utilized herbicide treatments on biological parameters of sugar beet:

- **Plant height:** Data presented in Table (4) pointed out that utilized herbicide treatments have a significant ($P \leq 0.05$) effect on plant height of sugar beet. All utilized herbicide treatments during the entire two growing seasons increased the plant height of sugar beet after 1, 2, 4 and 8 weeks from application compared to unweeded check. The highest plants of

sugar beet were 13.00 and 28.75 cm obtained after 1WAA and 4WAA by treatment [Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + One hand weeding after month]. while after 2WAA maximum plant height was 20.00cm with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + Application again after 1 month] compared to unweeded check 11.50, 16.50 and 24.25 cm after 1WAA, 2WAA and 4WAA in first season respectively. As for the second season, maximum plant height of sugar beet 16.50, 35.00 and 43.98 cm after 1, 2 and 4 WAA with treatment [Phenmedipham 10% +

Desmedipham10% + Haloxyfop-p-methyl 6% + One hand weeding after month] respectively compared to unweeded check 13.75, 32.75 and 39.05 cm after 1, 2 and 4 WAA respectively. On the other side, the analyzed data cleared that the highest plants were observed after 8 WAA by treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8%+ One hand weeding after month] were 42.75 and 48.15 cm in seasons 2020/2021 & 2021/2022, respectively. These finding may be due to the role of herbicide treatments in controlling weeds and thus reducing competition between weeds and sugar beet plants .**Neama (2019)** reported that the weed control treatments were increased the tested yield parameters (plant height, blade and stem length; leaf area and width of blade) of sugar beet crop. While recorded increased plant height with Betasana Trio (Phenmedipham 7.5+ Desmedipham 1.5 + Ethofumesate 11.5) treatment was 37.3 and 44.2 cm compared with untreated (check) were 23.2 and 26.7cm during two seasons, respectively.

- **Growth stages:** Data illustrated in Table (4) indicated the significantly increase in different growth stages of sugar beet plants as affected by herbicide treatments, it was explicit that all treatments showed good increase of growth stages after 2, 4 and 8 weeks after application (WAA) compared to unweeded check during the 1st and 2nd investigated seasons. In the 1st season the highest values of growth stages were obtained 17.75 and 29.25 after 2 and 8 WAA when sprayed with treatment [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + Application again after 1 month] respectively, and 21.25 after 4 WAA when treated with treatment [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + One hand weeding after month] compared to unweeded check 16.75, 20.00 and 26.00 after 2, 4 and 8 WAA respectively. Where as in the 2nd season growth stages significantly surpassed in all herbicide treatments compared to unweeded check with note equaled when sprayed by most herbicide treatments at 2, 4 and 8 WAA. It's important to mention that the highest value of growth stage was noticed (34.50) at 8 WAA when plants sprayed with treatments [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + One hand

weeding after month], [Desmedipham7.1%+ Phenmedipham9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + One hand weeding after month] and [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + 1 H.W after month] compared to unweeded check (33.25).

3.1.2. Effect of utilized herbicide treatments on phytotoxicity percentage of sugar beet:

Data in Table (4) show phytotoxicity percentage in sugar beet by herbicide treatments, where, the phytotoxicity of sugar beet crop presented a different response the herbicide treatments applied. It registered low indexes of phytotoxicity on sugar beet plants. Where the least phytotoxicity of sugar beet after 1WAA (2.50 & 15.00%) caused by treatment [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + 1 H.W after month] whereas the maximum phytotoxicity (7.50 & 35.00%) caused by treatment [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + One hand weeding after month] in both seasons respectively. The symptoms of phytotoxicity disappeared over time, and were completely gone after 8 WAA during the 1st and 2nd investigated seasons. **Irena et al., (2015)** mentioned that no phytotoxicity symptoms in sugar beet plants after post-emergence application of metamitron when mixed with phenmedipham plus desmedipham plus ethofumesate plus raps oil application. No or less injury of sugar beet plants with the application of herbicides at reduced doses compared to full dose application. The phytotoxicity of herbicides decreased with time. To avoid injury, growth depressions, or leaf damage of sugar beet plants, herbicide use has to be carefully adjusted especially to the prevailing weather conditions.

3.1.3. Effect of utilized herbicide treatments on Photosynthetic pigments of Sugar beet:

Data illustrated in Table (5) show that, all investigated herbicide treatments had significant increase of carotene, Chl. a and Chl. b concentration after 2, 4 and 8 WAA comparing with unweeded check treatment.

- The highest values of carotene concentrations were 0.215 and 0.053 mg/g fresh weight when plants sprayed with treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8%+ one hand weeding after month] after 2 WAA in the two studied season respectively and at the same period there were not a significant between herbicide treatments [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8%+ one hand weeding after month] and [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6% + application again after 1 month] utilization in the 1st season, and so between herbicide treatments [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8%+ one hand weeding after month] and [Desmedipham7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] utilization in the second season. Same tendency was observed at 8 WAA. While, after 4 WAA herbicide treatments [Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] showed superiority during the two investigated seasons as showed in Table (5)
 - The maximum values of Chl. a concentrations obtained by treatment [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] were 0.933 and 1.373 mg/g fresh weight after 4WAA and 8WAA respectively, but top value of Chl. a 1.253 mg/g fresh weight after 2WAA with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month] compared to unweeded check were 0.868, 0.683 and 1.000 mg/g fresh weight after 2, 4 and 8 WAA respectively, in first season. As for the second season, it was recorded treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] the top of Chl. a 1.658 and 1.770 mg/g fresh weight after 4 and 8 WAA, respectively, but treatment [Desmedipham7.1%+ Phenmedipham9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] recorded top value 0.895 mg/g fresh weight after 2WAA compared to unweeded check were 0.803, 1.420 and 1.393 mg/g fresh weight after 2, 4 and 8 WAA respectively, as shown in Table (5).
 - Data illustrated in Table (5) indicat that maximum values of Chl. b concentrations in first season were 0.903 mg/g fresh weight (2WAA) with treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and 0.228 mg/g fresh weight (4WAA) obtained by treatments [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month]. Also 0.295 mg/g fresh weight (8WAA) obtained by treatments [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] compared to unweeded check 0.193, 0.180 and 0.233 mg/g fresh weight after 2, 4 and 8 WAA, respectively. As for the second season, upper values of Chl. b were 0.383 and 0.445 mg/g fresh weight after 4 and 8 WAA with treatment [Phenmedipham 20% +Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] respectively, while treatment [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] recorded 0.235 mg/g fresh weight after 2 WAA compared to unweeded check 0.208, 0.345 and 0.315 mg/g fresh weight after 2, 4 and 8 WAA, respectively.
- Abd El Lateef *et al.*, (2021)** reported the chlorophyll content of the tested herbicides showed no clear effect of the herbicides on sugar beet leaves. However, the herbicides Tigro (Phenmedipham 91 g/L + Desmedipham71 g/L+ Ethofumesate112 g/L) and Betasana-Trio (Ethofumesate 115 g/L + Phenmedipham75 g/L + Desmedipham15 g/L) recorded the highest chlorophyll content when applied at high doses compared to the other herbicide treatments, while the unweeded control recorded the lowest chlorophyll content. There was no significant difference between the other herbicide treatments and twice-plowing.

Table (4): Phytotoxicity of herbicide treatments on sugar beet includes biological parameters and phytotoxicity (%) during 2020/21 and 2021/22 seasons.

Treatments	Biological parameters										Phytotoxicity (%)			
	Plant height (cm)					Growth stages								
	B.A	1WAA	2WAA	4WAA	8WAA	B.A	1WAA	2WAA	4WAA	8WAA	1WAA	2WAA	4WAA	8WAA
	Season 2020/2021													
[Phen.+Desm.] followed by Halox.-p-meth.+1 H.W after month	8.00 ^a	12.20 ^{ab}	19.00 ^a	27.25 ^{ab}	42.75 ^a	13.25 ^a	15.75 ^{ab}	17.50 ^{ab}	20.75 ^{ab}	29.00 ^a	5.00 ^{ab}	0.00 ^a	0.00 ^a	0.00 ^a
[Desm.+Phen.+Etho.] followed by Halox.-p-meth.+1 H.W after month	8.25 ^a	13.00 ^a	19.50 ^a	28.75 ^a	40.25 ^b	13.50 ^a	15.25 ^b	17.25 ^{ab}	20.75 ^{ab}	28.50 ^{ab}	7.50 ^a	2.50 ^a	2.50 ^a	0.00 ^a
[Phen.+Desm.+Halox.-p-meth.]+1 H.W after month	8.00 ^a	12.00 ^{ab}	18.25 ^{ab}	27.00 ^{ab}	40.25 ^b	13.50 ^a	15.50 ^{ab}	17.00 ^{ab}	21.25 ^a	28.00 ^{ab}	2.50 ^{ab}	2.50 ^a	0.00 ^a	0.00 ^a
[Phen.+Desm.+Halox.-p-methyl]+ application again after 1 month	8.50 ^a	12.50 ^{ab}	20.00 ^a	26.50 ^{ab}	43.25 ^a	13.25 ^a	16.25 ^a	17.75 ^a	21.00 ^{ab}	29.25 ^a	5.00 ^{ab}	2.50 ^a	2.50 ^a	0.00 ^a
Unweeded check	7.75 ^a	11.50 ^b	16.50 ^b	24.25 ^b	39.25 ^b	13.75 ^a	15.25 ^b	16.75 ^b	20.00 ^b	26.00 ^b	0.00 ^b	0.00 ^a	0.00 ^a	0.00 ^a
	Season 2021/2022													
[Phen.+Desm.] followed by Halox.-p-meth.+1 H.W after month	11.00 ^a	16.25 ^{ab}	34.50 ^a	43.98 ^a	48.15 ^a	13.75 ^a	15.75 ^a	25.25 ^a	27.25 ^a	34.50 ^a	20.00 ^b	5.00 ^b	2.50 ^a	0.00 ^a
[Desm.+Phen.+Etho.] followed by Halox.-p-meth.+1 H.W after month	10.50 ^a	16.50 ^a	34.75 ^a	40.32 ^b	43.78 ^{bc}	14.00 ^a	15.75 ^a	25.00 ^{ab}	27.25 ^a	34.50 ^a	35.00 ^a	10.00 ^a	0.00 ^a	0.00 ^a
[Phen.+Desm.+Halox.-p-meth.]+1 H.W after month	11.25 ^a	16.50 ^a	35.00 ^a	43.98 ^a	45.80 ^b	13.75 ^a	16.00 ^a	25.25 ^a	27.00 ^{ab}	34.50 ^a	15.00 ^b	10.00 ^a	2.50 ^a	0.00 ^a
[Phen.+Desm.+Halox.-p-methyl]+ application again after 1 month	10.50 ^a	15.50 ^b	35.00 ^a	40.08 ^a	43.28 ^c	14.25 ^a	16.00 ^a	25.00 ^{ab}	27.00 ^{ab}	34.00 ^{ab}	15.00 ^b	2.50 ^b	0.00 ^a	0.00 ^a
Unweeded check	10.50 ^a	13.75 ^c	32.75 ^b	39.05 ^b	42.33 ^c	14.00 ^a	15.75 ^a	24.50 ^b	25.50 ^b	33.25 ^b	0.00 ^c	0.00 ^c	0.00 ^a	0.00 ^a

*B.A: Before application

*WAA: week after application.

*Different letters refer to significant difference (P≤0.05).

Table (5): Plant pigments (mg/g fresh weight) of sugar beet as affected by herbicide treatments after 2,4,8 weeks from application during 2020/21 and 2021/22season.

Treatments	Carotene			Chlorophyll [a]			Chlorophyll [b]		
	2WAA	4WAA	8WAA	2WAA	4WAA	8WAA	2WAA	4WAA	8WAA
Season 2020/2021									
[Phen.+ Desm.] followed by Halox.-p-meth.+ 1 H.W after month	0.215 ^a	0.045 ^{ab}	0.358 ^a	0.918 ^c	0.760 ^{ab}	1.193 ^{ab}	0.903 ^a	0.200 ^{ab}	0.295 ^a
[Desm.+Phen.+ Etho.] followed by Halox.-p-meth.+ 1 H.W after month	0.050 ^b	0.053 ^a	0.068 ^b	0.955 ^{cb}	0.933 ^a	1.373 ^a	0.223 ^b	0.228 ^a	0.295 ^a
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	0.053 ^b	0.048 ^{ab}	0.065 ^b	1.080 ^b	0.925 ^a	1.060 ^b	0.233 ^b	0.223 ^{ab}	0.278 ^{ab}
[Phen.+ Desm.+ Halox.-p-methyl] + Application again after 1 month	0.178 ^a	0.050 ^{ab}	0.063 ^b	1.253 ^a	0.915 ^a	1.190 ^{ab}	0.770 ^a	0.228 ^a	0.285 ^{ab}
Unweeded check	0.040 ^b	0.040 ^b	0.055 ^b	0.868 ^c	0.683 ^b	1.000 ^b	0.193 ^b	0.180 ^b	0.233 ^b
Season 2021/2022									
[Phen.+ Desm.] followed by Halox.-p-meth.+ 1 H.W after month	0.053 ^a	0.085 ^a	0.100 ^a	0.850 ^{ab}	1.658 ^a	1.770 ^a	0.228 ^{ab}	0.383 ^a	0.445 ^a
[Desm.+Phen.+ Etho.] followed by Halox.-p-meth.+ 1 H.W after month	0.053 ^a	0.078 ^{ab}	0.095 ^{ab}	0.895 ^a	1.495 ^b	1.563 ^{ab}	0.235 ^a	0.358 ^{ab}	0.418 ^{ab}
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	0.048 ^{ab}	0.083 ^{ab}	0.088 ^{ab}	0.815 ^{ab}	1.628 ^a	1.543 ^{ab}	0.213 ^{ab}	0.365 ^{ab}	0.390 ^{ab}
[Phen.+ Desm.+ Halox.-p-methyl]+ Application again after 1 month	0.050 ^{ab}	0.080 ^{ab}	0.093 ^{ab}	0.830 ^{ab}	1.453 ^{cb}	1.553 ^{ab}	0.215 ^{ab}	0.350 ^b	0.415 ^{ab}
Unweeded check	0.043 ^b	0.070 ^b	0.073 ^b	0.803 ^b	1.420 ^c	1.393 ^b	0.208 ^b	0.345 ^b	0.315 ^b

*WAA: week after application.

*Different letters refer to significant difference ($P \leq 0.05$).

3.2. Herbicide effectiveness in weed control in sugar beet crops:

3.2.1. Effect of herbicide treatments on the biological parameters of weeds:

- **Weed density:** Statistical analysis displayed that herbicide treatment had a significant effect ($P \leq 0.05$) on weed density per m^2 . Overall, all tested herbicides resulted in a significant decrease in weed density compared to the unweeded check treatment throughout the growing seasons of 2020/2021 and 2021/2022.

At season 2020/2021, the highest weed density for all weed species, including *Corchorus olitorius*, *Amaranthus ascendens*, *Xanthium strumarium*, *Brachiaria reptans* and *Echinochoa colonum* was recorded 8 WAA in the unweeded check, reaching

14.75, 13.50, 3.25, 4.50 and 4.25 weeds/ m^2 . While the lowest weed density was recorded using treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxypop-p-methyl 10.8% + one hand weeding after month], reaching 2.50, 1.75, 0.00, 0.00 and 0.00 weeds/ m^2 , respectively, as shown in Table (6).

The data in Table (7) illustrated that the highest mean weed density for each of the weed species in 2021/2022 season, which includes: *Corchorus olitorius*, *Amaranthus ascendens*, *Brachiaria reptans*, *Solanum nigrum* and *Anagallis arvensis* after 8 WAA with the unweeded check were 8.00, 9.25, 11.25, 23.75 and 40.00weeds/ m^2 , respectively. While the lowest weed density for *Corchorus olitorius*, *Amaranthus ascendens*, *Brachiaria reptans* and *Solanum nigrum* was recorded with treatment [Desmedipham 7.1% +

Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], reaching 1.25, 0.75, 0.00 and 0.00 weeds/m², respectively. However weed *Anagallis arvensis* was recorded the lowest weed density with treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], reaching 2.50 weed/m². Similar results were obtained by **Abdel Latif et al., (2021)**. Also **Izadi-Darbandi et al., (2019)** reported that by applying the recommended rate of phenmedipham + desmedipham + Ethofumesate, the total density of weeds was controlled by 72.13 and 74.46%, and the total biomass of weeds was controlled by 60.89 and 79.83% at 3 and 5 weeks post-treatment, respectively.

- **Weed height:** The results indicate that all herbicide treatments applied in sugar beet fields resulted in a significant overall decrease ($P \leq 0.05$) in weed height (cm) per weed during both growing seasons, particularly after 8 WAA. This reduction in weed height is attributed to the high herbicide efficacy. The data in Table (6) indicate weed height during 2020/2021 season. The maximum weed height recorded with the unweeded check was 46.50, 38.00, 53.50, 45.75 and 45.75 cm after 8 WAA with *Corchorus olitorius*, *Amaranthus ascendens*, *Xanthium strumarium*, *Brachiaria reptans* and *Echinochoa colonum*, respectively. In contrast, the use of herbicides resulted in a significant decrease in weed height, reaching zero for *Xanthium strumarium*, *Brachiaria reptans* and *Echinochoa colonum*. The lowest weed height recorded for *Corchorus olitorius* and *Amaranthus ascendens* was 13.00 and 3.50 cm with the use of [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month] followed by 13.00 and 4.00 cm with the use of [Phenmedipham 20% +Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month]. Similarly, during 2021/2022 season, the maximum weed heights recorded with the unweeded check were 66.25, 39.50, 31.25, 73.75 and 21.25 cm. These weed heights were measured after 8 WAA treatments for *Corchorus olitorius*,

Amaranthus ascendens, *Brachiaria reptans*, *Solanum nigrum* and *Anagallis arvensis*, respectively. The weed height of both *Brachiaria reptans* and *Solanum nigrum* was reduced to 0.00 cm with most herbicide treatments, while the weed height of *Corchorus olitorius*, *Amaranthus ascendens* and *Anagallis arvensis* was reduced to 4.00, 5.00 and 2.75 cm with treatment [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], followed by 5.50, 5.00 and 3.75 cm with treatment [Phenmedipham 10% + Desmedipham10% + Haloxyfop-p-methyl 6%+ one hand weeding after month]., respectively as shown in Table (7). **Tamalika et al., (2020)** reported that broad leaved weed species are the most competitive annual weeds. These weeds often reach two to three times the height of sugar beets.

- **Growth stage:** Data in Table (6) signalized the effects of herbicide treatments on growth stage for each weed of weed species during the first growing season 2020/2021, where recorded the highest growth stage values in the unweeded check 60.00, 60.00, 54.50, 55.00 and 57.50 after 8 WAA for *Corchorus olitorius*, *Amaranthus ascendens*, *Xanthium strumarium*, *Brachiaria reptans* and *Echinochoa colonum*, respectively. While, the herbicide treatments used had a strong impact on the growth stage of weeds, resulting in stunted or very slow growth, as evidenced by the recorded growth stage values during the growing season. The use of all herbicide treatments has led to complete death and have zero growth stage for *Xanthium strumarium* and *Echinochoa colonum* also, gave zero growth stage for *Brachiaria reptans* by treatment [Phenmedipham 20% +Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month]. As for *Corchorus olitorius* recorded the least growth stage 20.75 with treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and *Amaranthus ascendens* recorded the least growth stage 12.75 with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month].

Table (6): Effect of herbicide treatments on biological parameters for each weed before application and after 1,2,4,8 WAA during 2020/21 season.

Treatments	Biological parameter	Weeds density (number/m ²)								Weed height (cm)							
		B.A	1WAA	2WAA	4WAA	8WAA	B.A	1WAA	2WAA	4WAA	8WAA	B.A	1WAA	2WAA	4WAA	8WAA	
[Phen.+ Desm.] followed by Halox.-p- meth.+ 1 H.W after month	<i>Corchorus olitorius</i>	16.50 ^{ab}	14.50 ^b	9.25 ^b	11.00 ^b	2.50 ^b	6.00 ^{ab}	3.25 ^b	5.50 ^b	17.75 ^b	13.00 ^b	15.50 ^{ab}	14.00 ^a	13.25 ^b	27.25 ^{ab}	20.75 ^b	
	<i>Amaranthus ascendens</i>	10.25 ^b	12.50 ^b	4.25 ^b	10.25 ^b	1.75 ^b	4.50 ^b	3.25 ^b	4.00 ^b	7.25 ^b	4.00 ^b	15.75 ^{bc}	14.50 ^{ab}	14.75 ^b	21.00 ^b	14.25 ^b	
	<i>Xanthium strumarium</i>	1.75 ^d	0.50 ^b	0.50 ^b	0.50 ^b	0.00 ^b	13.00 ^a	7.00 ^b	13.25 ^b	16.25 ^d	0.00 ^b	17.75 ^{ab}	17.00 ^c	12.00 ^b	22.50 ^b	0.00 ^b	
	<i>Brachiaria reptans</i>	3.50 ^b	5.75 ^{ab}	0.50 ^b	1.50 ^b	0.00 ^b	3.25 ^b	3.00 ^b	1.75 ^b	5.50 ^b	0.00 ^b	13.50 ^b	14.50 ^a	11.00 ^b	15.25 ^{bc}	0.00 ^b	
	<i>Echinochloa colonum</i>	5.25 ^a	2.50 ^b	3.25 ^b	0.75 ^b	0.00 ^b	8.25 ^a	7.25 ^a	8.75 ^b	3.50 ^b	0.00 ^b	15.25 ^a	14.50 ^a	14.00 ^b	14.00 ^b	0.00 ^b	
	<i>Corchorus olitorius</i>	16.00 ^b	14.00 ^b	10.00 ^{ab}	13.50 ^a	3.75 ^b	6.50 ^b	7.50 ^a	11.25 ^b	25.25 ^{ab}	16.50 ^b	18.75 ^{ab}	16.25 ^a	18.75 ^{ab}	30.00 ^{ab}	25.50 ^b	
	<i>Amaranthus ascendens</i>	15.75 ^{ab}	14.50 ^b	8.50 ^{ab}	11.75 ^b	2.25 ^b	3.50 ^b	2.75 ^b	5.25 ^b	9.25 ^{ab}	5.75 ^b	16.00 ^{bc}	15.00 ^a	16.00 ^{ab}	21.25 ^b	19.00 ^b	
	<i>Xanthium strumarium</i>	3.00 ^b	2.25 ^b	1.25 ^{ab}	2.50 ^{ab}	0.00 ^b	5.50 ^b	7.50 ^b	16.50 ^b	18.25 ^{ad}	0.00 ^b	10.00 ^b	18.00 ^{bc}	15.75 ^b	20.25 ^b	0.00 ^b	
	<i>Brachiaria reptans</i>	4.75 ^{ab}	4.75 ^b	0.50 ^b	0.50 ^b	0.25 ^b	4.75 ^a	4.50 ^b	2.00 ^b	1.00 ^b	2.25 ^b	16.00 ^a	15.75 ^a	14.00 ^b	13.50 ^a	12.75 ^b	
	<i>Echinochloa colonum</i>	1.00 ^c	3.500 ^{ab}	1.50 ^b	0.50 ^b	0.00 ^b	5.25 ^b	7.50 ^a	5.75 ^b	2.00 ^b	0.00 ^b	11.75 ^c	14.75 ^a	14.25 ^b	11.75 ^b	0.00 ^b	
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	<i>Corchorus olitorius</i>	15.25 ^b	10.50 ^d	4.75 ^c	13.00 ^{ab}	3.75 ^b	5.75 ^b	6.00 ^b	13.25 ^b	19.50 ^{ab}	17.00 ^b	16.00 ^a	14.25 ^{ab}	17.00 ^{ab}	27.75 ^{ab}	28.00 ^b	
	<i>Amaranthus ascendens</i>	17.50 ^{ab}	13.25 ^b	7.25 ^{ab}	8.25 ^b	2.50 ^b	4.00 ^b	3.00 ^{ab}	5.50 ^b	8.50 ^b	7.00 ^b	17.00 ^a	13.75 ^b	14.50 ^b	15.25 ^c	12.75 ^b	
	<i>Xanthium strumarium</i>	6.75 ^a	2.00 ^b	0.50 ^b	1.00 ^b	0.00 ^b	10.75 ^a	10.25 ^b	10.75 ^b	25.75 ^b	0.00 ^b	19.00 ^{ab}	19.25 ^b	14.50 ^b	21.00 ^b	0.00 ^b	
	<i>Brachiaria reptans</i>	4.75 ^{ab}	5.75 ^{ab}	2.50 ^{ab}	1.75 ^b	1.25 ^b	4.75 ^a	3.25 ^{bc}	4.50 ^b	2.50 ^b	7.50 ^b	15.00 ^a	14.00 ^a	13.00 ^b	18.25 ^{bc}	16.75 ^b	
	<i>Echinochloa colonum</i>	6.25 ^a	2.75 ^{ab}	1.75 ^b	0.00 ^b	0.00 ^b	7.75 ^a	4.00 ^b	5.25 ^b	0.00 ^b	0.00 ^b	13.50 ^b	12.00 ^b	10.75 ^b	10.25 ^b	0.00 ^b	
	<i>Corchorus olitorius</i>	18.00 ^a	12.00 ^c	10.00 ^{ab}	11.75 ^{ab}	3.25 ^b	6.25 ^{ab}	5.75 ^b	11.00 ^b	15.75 ^b	13.00 ^b	15.00 ^b	15.75 ^{ab}	15.75 ^{ab}	19.50 ^{ab}	21.75 ^b	
	<i>Amaranthus ascendens</i>	12.25 ^{ab}	19.50 ^a	6.25 ^{ab}	11.75 ^b	2.75 ^b	3.75 ^b	3.75 ^{ab}	3.75 ^b	6.75 ^b	3.50 ^b	15.50 ^c	14.25 ^{ab}	14.75 ^b	21.25 ^b	13.75 ^b	
	<i>Xanthium strumarium</i>	3.50 ^b	2.50 ^b	2.00 ^{ab}	1.50 ^{ab}	0.00 ^b	12.50 ^a	7.25 ^b	18.00 ^b	18.75 ^c	0.00 ^b	20.00 ^a	12.75 ^d	15.50 ^b	19.50 ^b	0.00 ^b	
	<i>Brachiaria reptans</i>	4.00 ^{ab}	2.25 ^b	1.75 ^b	1.25 ^b	1.00 ^b	4.25 ^{ab}	2.00 ^b	3.00 ^b	1.75 ^b	9.75 ^b	15.75 ^a	10.75 ^b	13.50 ^b	22.75 ^b	13.50 ^b	
	<i>Echinochloa colonum</i>	3.00 ^b	2.75 ^{ab}	2.25 ^{ab}	0.50 ^b	0.00 ^b	8.25 ^a	6.00 ^b	5.75 ^b	1.00 ^b	0.00 ^b	16.25 ^a	15.50 ^a	13.75 ^b	10.75 ^b	0.00 ^b	
Unweeded check	<i>Corchorus olitorius</i>	18.00 ^a	18.00 ^a	12.50 ^a	13.75 ^a	14.75 ^a	6.00 ^{ab}	7.50 ^a	21.25 ^a	28.25 ^a	46.50 ^a	15.50 ^{ab}	15.75 ^{ab}	24.25 ^a	37.50 ^a	60.00 ^a	
	<i>Amaranthus ascendens</i>	19.50 ^a	21.00 ^a	14.25 ^a	26.50 ^a	13.50 ^a	4.00 ^a	4.25 ^a	8.75 ^a	14.25 ^a	38.00 ^a	16.50 ^{ab}	15.25 ^a	17.50 ^a	23.25 ^a	60.00 ^a	
	<i>Xanthium strumarium</i>	2.25 ^{ad}	2.75 ^a	3.00 ^a	3.75 ^a	3.25 ^a	12.00 ^a	22.50 ^a	40.25 ^a	41.25 ^a	53.50 ^a	19.75 ^a	22.50 ^a	38.75 ^a	47.75 ^a	54.50 ^a	
	<i>Brachiaria reptans</i>	6.25 ^a	6.75 ^a	6.25 ^a	5.50 ^a	4.50 ^a	4.00 ^{ab}	6.50 ^a	16.75 ^a	20.50 ^a	45.75 ^a	15.25 ^a	16.00 ^a	23.00 ^a	30.50 ^a	55.00 ^a	
	<i>Echinochloa colonum</i>	4.75 ^a	5.00 ^a	7.75 ^a	5.75 ^a	4.25 ^a	5.25 ^a	7.00 ^a	22.75 ^a	37.50 ^a	45.75 ^a	13.75 ^b	15.75 ^b	22.25 ^a	37.50 ^a	57.50 ^a	

*WAA, week after application.

*Different letters refer to significant difference ($P \leq 0.05$).

Table (7): Effect of herbicide treatments on biological parameters for each weed before application and after 1,2,4,8 WAA during 2021/22 season.

Treatments	Biological parameter	Weeds density (number/m ²)								Weed height (cm)							
		B.A	1WAA	2WAA	4WAA	8WAA	B.A	1WAA	2WAA	4WAA	8WAA	B.A	1WAA	2WAA	4WAA	8WAA	
[Phen.+ Desm.] followed by Halox.-p- meth.+ 1 H.W after month	<i>Corchorus olitorius</i>	9.25 ^b	9.25 ^b	7.00 ^{ab}	6.50 ^b	2.00 ^b	5.25 ^{ab}	8.50 ^b	16.75 ^{ab}	22.50 ^{ab}	4.00 ^b	16.50 ^b	17.00 ^b	18.50 ^b	20.25 ^b	17.50 ^b	
	<i>Amaranthus ascendens</i>	26.75 ^{bc}	20.00 ^b	17.50 ^b	15.00 ^{ab}	1.00 ^b	3.25 ^b	6.25 ^b	8.25 ^b	16.25 ^b	5.00 ^b	15.75 ^b	17.50 ^b	21.25 ^b	21.25 ^b	15.75 ^b	
	<i>Brachiaria reptans</i>	1.25 ^b	0.75 ^b	0.50 ^b	0.00 ^b	0.00 ^b	2.50 ^{ab}	2.50 ^{ab}	2.50 ^b	2.50 ^b	0.00 ^b	13.50 ^{ab}	16.00 ^b	10.00 ^b	0.00 ^b	0.00 ^b	
	<i>Solanum nigrum</i>	15.50 ^{ab}	15.00 ^{ab}	7.50 ^{ab}	3.75 ^b	1.25 ^b	2.25 ^b	3.00 ^b	9.50 ^{ab}	18.75 ^{ab}	5.00 ^b	15.00 ^b	16.75 ^b	16.25 ^{ab}	10.75 ^{ab}	12.50 ^b	
	<i>Anagallis arvensis</i>	26.75 ^b	12.50 ^b	10.50 ^b	9.75 ^b	2.50 ^b	1.50 ^b	1.25 ^b	4.50 ^b	6.25 ^b	2.75 ^b	13.75 ^b	13.75 ^b	15.00 ^b	17.00 ^b	13.75 ^b	
	<i>Corchorus olitorius</i>	10.25 ^{ab}	11.50 ^{ab}	8.75 ^{ab}	7.50 ^{ab}	1.25 ^b	5.50 ^b	6.75 ^b	18.75 ^{ab}	18.75 ^b	10.50 ^{bc}	16.50 ^b	17.00 ^b	22.00 ^b	21.75 ^b	19.75 ^b	
	<i>Amaranthus ascendens</i>	30.00 ^{ab}	18.75 ^b	13.50 ^b	12.50 ^{ab}	0.75 ^b	3.25 ^b	5.25 ^{ab}	9.25 ^b	11.25 ^b	7.50 ^b	15.25 ^{ab}	16.00 ^{ab}	20.75 ^b	20.50 ^b	15.25 ^b	
	<i>Brachiaria reptans</i>	0.75 ^b	1.50 ^b	1.25 ^b	0.00 ^b	0.00 ^b	1.00 ^{ab}	4.00 ^{ab}	3.50 ^b	0.00 ^b	0.00 ^b	12.25 ^b	12.25 ^b	18.00 ^b	0.00 ^b	0.00 ^b	
	<i>Solanum nigrum</i>	21.25 ^b	2.50 ^b	0.75 ^b	0.00 ^b	0.00 ^b	2.25 ^b	1.75 ^b	3.75 ^b	0.00 ^b	0.00 ^b	15.00 ^b	15.50 ^b	10.75 ^b	0.00 ^b	0.00 ^b	
	<i>Anagallis arvensis</i>	11.25 ^b	12.50 ^b	11.25 ^b	8.50 ^b	3.75 ^b	1.25 ^b	1.25 ^b	1.50 ^b	1.75 ^b	1.75 ^b	13.50 ^b	13.75 ^b	12.50 ^b	13.50 ^b	12.50 ^b	
[Desm.+Phen.+ Etho.] followed by Halox.-p- meth.+ 1 H.W after month	<i>Corchorus olitorius</i>	9.25 ^b	9.00 ^b	6.00 ^b	8.00 ^b	1.50 ^b	3.75 ^b	7.50 ^b	14.25 ^{ab}	22.50 ^{ab}	5.50 ^b	15.00 ^b	17.25 ^{ab}	22.25 ^b	20.50 ^b	17.25 ^b	
	<i>Amaranthus ascendens</i>	22.50 ^{bc}	10.00 ^b	12.50 ^b	8.75 ^b	1.00 ^b	2.75 ^b	6.00 ^{ab}	7.75 ^b	20.50 ^b	5.00 ^b	14.75 ^{ab}	17.00 ^{ab}	20.50 ^b	21.00 ^b	15.50 ^b	
	<i>Brachiaria reptans</i>	1.75 ^a	0.50 ^b	1.00 ^b	4.50 ^b	0.00 ^b	3.25 ^b	1.50 ^b	5.00 ^b	0.00 ^b	0.00 ^b	14.25 ^a	15.00 ^a	12.50 ^a	0.00 ^b	0.00 ^b	
	<i>Solanum nigrum</i>	13.00 ^b	2.25 ^b	5.50 ^{ab}	4.50 ^b	0.00 ^b	4.25 ^b	3.25 ^b	18.00 ^{ab}	20.00 ^{ab}	0.00 ^b	15.75 ^a	15.75 ^a	25.75 ^{ab}	26.50 ^{ab}	0.00 ^b	
	<i>Anagallis arvensis</i>	20.00 ^{ab}	15.00 ^b	12.00 ^b	12.50 ^b	8.00 ^b	1.50 ^b	1.75 ^b	1.50 ^b	2.00 ^b	2.00 ^b	12.25 ^b	12.25 ^b	12.75 ^b	15.25 ^b	11.25 ^b	
	<i>Corchorus olitorius</i>	9.00 ^b	10.25 ^{bc}	7.75 ^{bc}	8.00 ^b	6.50 ^b	4.25 ^b	7.00 ^b	8.25 ^b	22.25 ^{ab}	18.75 ^b	15.25 ^{ab}	16.75 ^b	18.75 ^b	21.75 ^b	20.75 ^b	
	<i>Amaranthus ascendens</i>	18.50 ^b	16.25 ^b	12.50 ^b	8.75 ^b	6.25 ^b	2.75 ^b	5.00 ^b	7.75 ^b	12.50 ^b	16.25 ^b	14.25 ^b	15.25 ^b	19.00 ^b	21.00 ^b	20.75 ^b	
	<i>Brachiaria reptans</i>	0.75 ^b	0.25 ^b	0.25 ^b	0.00 ^b	0.00 ^b	0.50 ^b	0.50 ^b	2.50 ^b	0.00 ^b	0.00 ^b	13.50 ^{ab}	15.00 ^a	10.50 ^b	0.00 ^b	0.00 ^b	
	<i>Solanum nigrum</i>	10.00 ^b	11.50 ^{ab}	10.50 ^{ab}	9.75 ^{ab}	1.50 ^b	2.25 ^b	5.25 ^b	9.00 ^{bc}	22.5 ^{ab}	10.00 ^b	15.25 ^{ab}	15.75 ^{ab}	15.50 ^{ab}	18.75 ^{ab}	10.75 ^b	
	<i>Anagallis arvensis</i>	11.25 ^b	23.75 ^a	8.75 ^b	7.50 ^b	3.75 ^b	1.75 ^b	1.75 ^b	2.00 ^b	5.25 ^b	6.50 ^b	12.50 ^b	12.25 ^b	13.50 ^b	13.00 ^b	13.25 ^b	
Phen.+ Desm.+ Halox.- p-methyl.+ Application again after 1 month	<i>Corchorus olitorius</i>	15.75 ^b	12.25 ^b	9.25 ^b	8.25 ^b	8.00 ^b	4.50 ^{bc}	7.75 ^{ab}	23.50 ^b	27.50 ^b	66.25 ^a	15.75 ^{ab}	17.75 ^a	35.00 ^a	46.25 ^a	58.75 ^a	
	<i>Amaranthus ascendens</i>	38.00 ^a	42.50 ^a	40.00 ^a	18.75 ^a	9.25 ^b	3.25 ^b	6.25 ^b	16.75 ^b	31.25 ^a	39.50 ^a	15.25 ^{ab}	17.25 ^a	38.25 ^a	45.00 ^a	49.75 ^a	
	<i>Brachiaria reptans</i>	1.50 ^{ab}	4.00 ^b	4.50 ^b	6.50 ^b	11.25 ^b	2.75 ^b	6.00 ^b	16.25 ^b	20.00 ^b	31.25 ^a	14.00 ^b	15.75 ^a	19.25 ^a	26.00 ^a	50.00 ^a	
	<i>Solanum nigrum</i>	15.00 ^{ab}	20.00 ^a	28.75 ^a	27.50 ^a	23.75 ^a	2.25 ^b	6.25 ^b	30.00 ^a	32.50 ^a	73.75 ^a	15.50 ^{ab}	16.75 ^a	30.75 ^a	35.00 ^a	60.00 ^a	
	<i>Anagallis arvensis</i>	15.50 ^b	25.00 ^a	27.50 ^a	37.50 ^a	40.00 ^a	1.25 ^b	2.25 ^b	10.00 ^a	17.50 ^a	21.25 ^a	13.00 ^{ab}	15.75 ^a	20.25 ^a	24.50 ^a	51.25 ^a	
	Unweeded check	<i>Corchorus olitorius</i>	9.25 ^b	9.25 ^b	7.00 ^{ab}	6.50 ^b	2.00 ^b	5.25 ^{ab}	8.50 ^b	16.75 ^{ab}	22.50 ^{ab}	4.00 ^b	16.50 ^b	17.00 ^b	18.50 ^b	20.25 ^b	17.50 ^b
		<i>Amaranthus ascendens</i>	26.75 ^{bc}	20.00 ^b	17.50 ^b	15.00 ^{ab}	1.00 ^b	3.25 ^b	6.25 ^b	8.25 ^b	16.25 ^b	5.00 ^b	15.75 ^b	17.50 ^b	21.25 ^b	21.25 ^b	15.75 ^b
		<i>Brachiaria reptans</i>	1.25 ^b	0.75 ^b	0.50 ^b	0.00 ^b	0.00 ^b	2.50 ^{ab}	2.50 ^{ab}	2.50 ^b	2.50 ^b	0.00 ^b	13.50 ^{ab}	16.00 ^b	10.00 ^b	0.00 ^b	0.00 ^b
		<i>Solanum nigrum</i>	15.50 ^{ab}	15.00 ^{ab}	7.50 ^{ab}	3.75 ^b	1.25 ^b	2.25 ^b	3.00 ^b	9.50 ^{ab}	18.75 ^{ab}	5.00 ^b	15.00 ^b	16.75 ^b	16.25 ^{ab}	10.75 ^{ab}	12.50 ^b
		<i>Anagallis arvensis</i>	26.75 ^b	12.50 ^b	10.50 ^b	9.75 ^b	2.50 ^b	1.50 ^b	1.25 ^b	4.50 ^b	6.25 ^b	2.75 ^b	13.75 ^b	13.75 ^b	15.00 ^b	17.00 ^b	13.75 ^b
<i>Corchorus olitorius</i>		10.25 ^{ab}	11.50 ^{ab}	8.75 ^{ab}	7.50 ^{ab}	1.25 ^b	5.50 ^b	6.75 ^b	18.75 ^{ab}	18.75 ^b	10.50 ^{bc}	16.50 ^b	17.00 ^b	22.00 ^b	21.75 ^b	19.75 ^b	
<i>Amaranthus ascendens</i>		30.00 ^{ab}	18.75 ^b	13.50 ^b	12.50 ^{ab}	0.75 ^b	3.25 ^b	5.25 ^{ab}	9.25 ^b	11.25 ^b	7.50 ^b	15.25 ^{ab}	16.00 ^{ab}	20.75 ^b	20.50 ^b	15.25 ^b	
<i>Brachiaria reptans</i>		0.75 ^b	1.50 ^b	1.25 ^b	0.00 ^b	0.00 ^b	1.00 ^{ab}	4.00 ^{ab}	3.50 ^b	0.00 ^b	0.00 ^b	12.25 ^b	12.25 ^b	18.00 ^b	0.00 ^b	0.00 ^b	
<i>Solanum nigrum</i>		21.25 ^b	2.50 ^b	0.75 ^b	0.00 ^b	0.00 ^b	2.25 ^b	1.75 ^b	3.75 ^b	0.00 ^b	0.00 ^b	15.00 ^b	15.50 ^b	10.75 ^b	0.00 ^b	0.00 ^b	
<i>Anagallis arvensis</i>		11.25 ^b	12.50 ^b	11.25 ^b	8.50 ^b	3.75 ^b	1.25 ^b	1.25 ^b	1.50 ^b	1.75 ^b	1.75 ^b	13.50 ^b	13.75 ^b	12.50 ^b	13.50 ^b	12.50 ^b	

*WAA, week after application.

*Different letters refer to significant difference (P≤0.05).

Data in table (7) indicate a similar trend in second season 2021/2022, where the highest growth stage recorded at unweeded check 58.75, 49.75, 50.00, 60.00 and 51.25 after 8 WAA with *Corchorus olitorius*, *Amaranthus ascendens*, *Brachiaria reptans*, *Solanum nigrum* and *Anagallis arvensis* respectively. There was complete death and zero growth stage was given by all herbicide treatments with *Brachiaria reptans*. Also it gave zero growth stage in *Solanum nigrum* by treatments [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month]. While, the treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6%+ one hand weeding after month] recorded the lowest growth stages 17.25 and 11.25 for *Corchorus olitorius* and *Anagallis arvensis*, respectively. For *Amaranthus ascendens* gave the lowest growth stage 15.25 with treatment [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8%+ One hand weeding after month]. Comparable findings were reported by Irena *et al.*, (2015), where they mentioned that all herbicide combinations acted similarly on reduction of the weed species.

3.2.2. Effect of herbicide treatments on fresh weight of sugar beet weeds after 56 days from treatment:

Data listed in Table (8) indicate clearly that fresh weight of all visible dominant weeds in sugar beet were significantly ($P \leq 0.05$) decreased by using all herbicide treatments compared to unweeded check treatment during 2020/2021 and 2021/2022 seasons. Also, these data indicate the predominant weed species in the experimental sugar beet field during the first season 2020/2021 was *Corchorus olitorius*, *Amaranthus ascendens*, *Xanthium strumarium*, *Brachiaria reptans* and *Echinochloa colonum*. Average fresh weight (g/m^2) of these weeds in unweeded check was 216.88, 187.30, 387.20, 328.78 and 95.00 g/m^2 , respectively. While, all used herbicide treatments significantly reduced the fresh weights of weeds and it reached disappearance of some

weeds, therefore gave high weed control percentage compared with unweeded check treatment. The highest percentages of weed control was 97.73 and 97.62% for treatments [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8%+ one hand weeding after month] and [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], respectively. In the second season 2021/2022, the predominant weed species in the experimental sugar beet field were *Corchorus olitorius*, *Amaranthus ascendens*, *Brachiaria reptans*, *Solanum nigrum* and *Anagallis arvensis*. Maximum fresh weed weights (g/m^2) recorded of these weeds in unweeded check were 70.00, 50.00, 52.50, 656.25 and 213.75 g/m^2 , respectively. The data of all herbicide treatments gave minimum fresh weight of weeds, thence gave high weed control percentage compared to unweeded check treatment was reached 97.84 and 97.28% with treatments [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] and [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8%+ one hand weeding after month] respectively. Similar results were obtained by Mahmoud and Fouad (2012). Also, conformity with Abdel Latif *et al.*, (2021), where that weed control treatments varied considerably in their effect on the fresh and dry weight of broadleaf, narrow leaf, and total weeds, as well as the number of broadleaf, narrow leaf, and total weeds (m^2) 90 days after planting. They showed that the herbicides Betasana-Trio (Ethofumesate 115 g/L+ Phenmedipham 75 g/L+ Desmedipham 15g/L) at 0.9 L/acre and Tigro (Phenmedipham 91 g/L + Desmedipham 71 g/L + Ethofumesate 112 g/L) at 1.0L/acre were able to effectively or reasonably control broadleaf weeds associated with sugar beet. Abd-Elaziz *et al.*, (2024) mentioned that all weed management strategies had a significant impact on the biomass of broad-leaved, grassy, and total weeds (both fresh and dry weight) during the growing seasons of 2021-2022 and 2022-2023. Where substantial reductions in weed biomass for broad-leaved, grassy, and total weeds were observed in plots treated and therefore gave high weed control efficiency compared with compared with untreated check.

Table (8): Fresh weight of weeds (gm/m²) as affected by herbicides after 56 days from herbicide application during 2020/21 and 2021/22 seasons.

Treatments	Season 2020/2021										Season 2021/2022				
	<i>Corechorus olitorius</i>	<i>Amaranthus ascendens</i>	<i>Xanthium strumarium</i>	<i>Bracharia reptans</i>	<i>Echinochloa colonum</i>	Total of all weeds	% of weed control	<i>Corechorus olitorius</i>	<i>Amaranthus ascendens</i>	<i>Bracharia reptans</i>	<i>Solanum nigrum</i>	<i>Anagallis arvensis</i>	Total of all weeds	% of weed control	
[Phen. + Desm.] followed by Halox.-p-meth. + 1 H.W after month	2.98 ^b	20.80 ^b	0.00 ^b	2.40 ^b	2.70 ^b	28.88	97.62	7.50 ^b	2.50 ^b	1.00 ^b	10.00 ^b	17.50 ^c	38.50	96.31	
[Desm. +Phen. + Etho.] followed by Halox.-p-meth. + 1 H.W after month	11.83 ^b	14.03 ^b	0.00 ^b	0.58 ^b	1.15 ^b	27.59	97.73	4.50 ^b	3.50 ^b	2.88 ^b	0.00 ^b	17.50 ^c	28.38	97.28	
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	11.83 ^b	17.30 ^b	0.00 ^b	20.63 ^b	2.28 ^b	52.04	95.72	5.00 ^b	6.25 ^b	2.50 ^b	0.00 ^b	8.75 ^d	22.50	97.84	
[Phen.+ Desm.+ Halox.-p-methyl] + application again after 1 month	53.3 ^b	39.23 ^b	0.00 ^b	10.35 ^b	9.15 ^b	112.03	90.78	66.25 ^a	28.75 ^{ab}	1.25 ^b	33.75 ^b	33.75 ^b	163.75	84.29	
Unweeded check	216.88 ^a	187.30 ^a	387.20 ^a	328.78 ^a	95.00 ^a	1215.16	0.00	70.00 ^a	50.00 ^a	52.50 ^a	656.25 ^a	213.75 ^a	1042.50	0.00	

*Different letters refer to significant difference (P≤0.05).

3.3. Effect of utilized herbicide treatments on yield attributes and quality of output of sugar beet:

Data illustrated in Table (9) indicate that the weeds affect yield attributes and quality of sugar beet as it competes with sugar beet for nutrients and other requirements to develop good sugar beet roots, therefore the minimum values of root growth attributes, yield and its quality were recorded in unweeded check treatment during two investigated seasons. Weed effects can be reduced by treating them with herbicides before the critical weed crop competition period, this is explained through following:-

- **Root length:** The least of root length was recorded in the unweeded check treatment 25.28 and 35.98 cm during the 1st and 2nd investigated seasons, respectively. The results showed that all herbicide treatments resulted in a significant increase ($P \leq 0.05$) in root length compared to the unweeded check treatment. In the first season the highest root length was recorded 28.23 cm with treatment [Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and it follows 27.98 cm with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month] and the rest of herbicide treatments have no significance between them. For the second season, highest root length was recorded 42.75 cm by treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] and it follows 42.38 cm by treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], but rest of the treatments have no significance difference between them. **Neama (2019)** mentioned that the herbicide treatments increased the yield parameters [plant, blade, stem weight, root length, diameter and total soluble solids (TSS)] in sugar beet crop (*Beta vulgaris*) during the two growing seasons, while it recorded increased root length by treatment Betasana Trio (Phenmedipham 7.5 +

Desmedipham 1.5 + Ethofumesate 11.5) was 21.75 and 20.3 cm compared with untreated (check) was 10.0 and 10.7 cm during two seasons, respectively.

- **Root diameter:** Results clear that using all herbicides treatments significantly ($P \leq 0.05$) increased the root diameter compared to unweeded check treatment, where a minimum average of root diameter was recorded in unweeded check 8.65 and 9.57 cm during two investigated seasons, respectively. While, the maximum average of root diameter was 9.90 cm achieved when plants were sprayed with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month]. Data also pointed out that root diameter no significant differences by utilizing treatments [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month], [Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] in the first season, but in the second season the top average of root diameter was 11.31 cm for treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and it follows 10.03 cm with treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month]. As for the rest of the utilized herbicide treatments, there is no large difference between them. Comparable findings were reported **Mahmoud and Fouad (2012)**, where they recorded high root width with treatment Betasana trio (Phenmedipham 7.5% + desmedipham 1.5% + ethofumesate 11.5%) + hand weeding and Betasana trio (Phenmedipham 7.5% + desmedipham 1.5% + ethofumesate 11.5%) 35.5 and 34.75 cm, respectively, compared to the unweeded check treatment (31.75 cm).

- **Root fresh weight:** Data pointed out that root fresh weight was significant ($P \leq 0.05$) increased affected by herbicide treatments compared to unweeded check treatment where recorded the minimum of root fresh

weight 650 and 1238 g/plant with unweeded check treatment during the 1st and 2nd seasons, respectively. While, it obtained the highest root fresh weight 925 and 1720 g/plant for treatments [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + application again after 1 month] and [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] during the 1st and 2nd seasons, respectively. **Abdel Aziz et al., (2024)** reported that weed control treatments resulted in a significant increase ($P=0.05$) in all targeted agricultural traits compared to the control treatment in both seasons studied, and demonstrated a significant impact of weed control treatments on the root length, root diameter and fresh weight/plant of sugar beets. While, the lowest values of this agronomic traits was recorded by untreated plots.

- **Sucrose (%)**: Data illustrate that sucrose % was significantly ($P\leq 0.05$) surpassed with all herbicide treatments compared with unweeded check treatment during the two investigated seasons. The highest sucrose % was 19.79 and 19.75 % in the first and second season, respectively, were taken when using treatment [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] + 1 H.W after month]. While, it recorded less 13.47 and 17.98 % with unweeded check treatment during the two investigated seasons, respectively. **Tamalika et al., (2020)** reported the weed control treatment significantly affected the TSS %, sucrose (%), and apparent purity % of sugar beet juice compared to the weed-containing control sample. Also, **Farzin and Hussein (2004)** reported that the use of herbicides increased the sugar content in sugar beet crop. While, minimum sucrose content recorded in the weed-infested control sample during 2000 and 2001.

- **Root yield**: Statistical analysis of data showed that different herbicide treatments had a significant increase in root yield compared to unweeded check, which recorded minimum root yield of 16.86 and 17.98 ton/fed in both seasons (2020-2021 and 2021-2022), respectively. Whilst maximum root yield in the first season of 19.92 ton/fed was produced by

treatment [Desmedipham 7.1% + Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month]. But in the second season treatment [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] recorded the highest root yield of 22.16 ton/fed. **Farzin and Hossein (2004)** mentioned that the maximum root yield of sugar beet was observed with desmedipham plus phenmedipham plus ethofumesate at 0.23 + 0.23 + 0.23 Kg/ha and desmedipham plus phenmedipham plus propaquizafop at 0.46 + 0.46 + 0.1 Kg/ha. As well **Abd El Lateef et al., (2021)** reported concerning the effect of weeding practices on sugar beet root yield ton/fed. these treatments significantly increased root yield ton/fed over the unweeded check, and then pointed out that results obtained the use of Betanal Max Pro (Desmedipham 47 g/L + Ethofumesate 75 g/L + Lenacil 27 g/L + Phenmedipham), two hand tillage, Tigro (Phenmedipham 91 g/L + Desmedipham 71 g/L + Ethofumesate 112 g/L) at a rate of 1.0 liters per acre, and Betasana Trio (Ethofumesate 115 g/L + Phenmedipham 75 g/L + Desmedipham 15 g/L) at a rate of 0.9 liters per acre was the best treatment in eliminating weeds and increasing root productivity per acre. **Tamalika et al. (2020)** reported that above ground weed biomass production affects sugar beet root weight. Therefore, a strong correlation was found between root and sugar yield and weed density in sugar beets. As weed density increased, root and sugar yields gradually decreased. An inverse relationship was also found between weed density in sugar beets and sugar yield.

- **Sugar yield**: Different herbicide treatments had a significant ($P\leq 0.05$) effect on sugar yield, with all treatments significantly out per forming the unweeded check treatment in sugar yield (ton/fed) during both growing seasons. Analysis of variance (ANOVA) showed that the highest sugar yield was recorded 3.84 and 3.95 ton/fed by treatments [Phenmedipham 10% + Desmedipham 10% + Haloxyfop-p-methyl 6% + one hand weeding after month] and [Phenmedipham 20% + Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] compared to

the unweeded check treatment, which recorded the lest sugar production of 2.29 and 3.18 ton/fed during both seasons, respectively. It's important to clear that, sugar yield equaled of significant between all herbicide treatments except under using treatment [Phenmedipham 20% +Desmedipham 20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] in 1st season. Similarly, in the second season sugar yield equaled of significant between all herbicide treatments. **Abd El Lateef et al., (2021)** mentioned that weed control treatments exhibited clear differences in sugar beet quality parameters, which affect sugar extraction. The highest sugar beet yield resulted from Tigro (Phenmedipham 91 g/L+ Desmedipham 71 g/L+ Ethofumesate 112 g/L) at 1.0 l

fed⁻¹ followed by hand weeding twice, which gave the greatest sugar yield fed⁻¹. Similar results were reported in a study by **Abdel Aziz et al., (2024)**, who indicated that, the increased productivity of sugar beet using hand hoeing or herbicide treatments may be attributed to their effect on weed control, thereby reducing the period of competition between weeds and sugar beet plants for space, light, nutrients, and water. The effectiveness of these treatments in improving sugar beet productivity characteristics may stem from the reduced competition posed by weeds during the early stages of sugar beet plant growth, which is reflected in the quantity and weight of different weed varieties. **Mahmoud and Fouad (2012)** reached similar conclusions.

Table (9): Yield attributes and quality of sugar beet affected by herbicides application during 2020/21 and 2021/22 seasons.

Treatments	Root growth attributes			Quality	Yields (ton/fed)	
	Root length (cm)	Root diameter (cm)	Root fresh weight (g/plant)	Sucrose (%)	Root yield	Sugar yield
Season 2020/2021						
[Phen.+ Desm.] followed by Halox.-p-meth.+ 1 H.W after month	26.05 ^{ab}	9.38 ^{ab}	850 ^{ab}	15.28 ^c	18.76 ^b	2.86 ^b
[Desm. + Phen.+ Etho.] followed by Halox.-p-meth.+ 1 H.W after month	28.23 ^a	9.58 ^{ab}	900 ^a	17.99 ^b	19.92 ^a	3.58 ^a
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	25.85 ^{ab}	9.33 ^{ab}	775 ^b	19.79 ^a	19.41 ^{ab}	3.84 ^a
[Phen.+ Desm.+ Halox.-p-methyl] + application again after 1 month	27.98 ^a	9.90 ^a	925 ^a	18.85 ^{ab}	19.72 ^{ab}	3.72 ^a
Unweeded check	25.28 ^b	8.65 ^b	650 ^c	13.47 ^d	16.86 ^c	2.29 ^c
Season 2021/2022						
[Phen.+ Desm.] followed by Halox.-p-meth.+ 1 H.W after month	42.38 ^a	11.31 ^a	1605 ^b	17.88 ^b	22.16 ^a	3.95 ^a
[Desm.+ Phen.+ Etho.] followed by Halox.-p-meth.+ 1 H.W after month	40.63 ^{ab}	9.96 ^{ab}	1555 ^b	19.03 ^a	20.27 ^{abc}	3.86 ^a
[Phen. + Desm+ Halox.-p-meth.] + 1 H.W after month	42.75 ^a	10.03 ^{ab}	1720 ^a	19.75 ^a	19.05 ^{bc}	3.76 ^a
[Phen.+ Desm.+ Halox.-p-methyl] + application again after 1 month	39.50 ^{ab}	9.61 ^b	1638 ^{ab}	19.45 ^a	20.58 ^{ab}	3.72 ^a
Unweeded check	35.98 ^b	9.57 ^b	1238 ^c	13.47 ^d	17.98 ^c	3.18 ^b

*Different letters refer to significant difference ($P \leq 0.05$).

Conclusion

In conclusion, this research clearly demonstrates that weed management is the cornerstone of ensuring abundant yields and high quality in sugar beet crops. Given the low competitiveness of sugar beet in its early growth stages, neglecting weed control leads to significant economic losses, both in crop quantity and sugar extraction rate, it is one of best agricultural practices to increase agricultural production of sugar beet, according to the obtained results, it was found that use of herbicide treatments in sugar beet fields for control of weeds leads to improve qualities of sugar beet, increasing production and high quality. Based on the above results the best herbicide treatments is [Desmedipham 7.1%+ Phenmedipham 9.1% + Ethofumesate 11.2% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] and [Phenmedipham 20% +Desmedipham20% followed by Haloxyfop-p-methyl 10.8% + one hand weeding after month] that recorded an maximum increase in production during two study seasons.

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السمية النباتية وفعالية معاملات بعض مبيدات الحشائش في حقول بنجر السكر

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الملخص العربي

تعتبر الحشائش العدو الرئيسي لزراعة بنجر السكر ويرجع ذلك لبطء نمو محصول بنجر السكر في مراحل الأولى مما يعرضه للمنافسة الشديدة للحشائش. لذا تشكل الإصابة بالحشائش أحد أهم العوامل التي تهدد إنتاجية بنجر السكر وتخفصها بشكل كبير. ونظرا لذلك تم اجراء هذه الدراسة على محصول بنجر السكر خلال موسمي 2021/2020 و 2022/2021 لتقييم تأثيرات السمية النباتية لبعض معاملات مبيدات الحشائش على نبات بنجر السكر. وتقييم فعالية هذه المعاملات في مكافحة الحشائش المصاحبة لمحصول بنجر السكر وتقييم محصول بنجر السكر وجودته بعد تطبيق هذه المعاملات. حيث أجريت التجربة الحقلية في محطة البحوث الزراعية في إيتاي البارود - محافظة البحيرة باستخدام تصميم قطاعات تامة العشوائية مع أربعة مكررات لكل معاملة من مبيدات الحشائش بالإضافة إلى معاملة الكنترول. تم تطبيق جميع معاملات مبيدات الأعشاب رشا بعد الانبثاق وتشمل معاملات مبيدات الحشائش المختبرة على كل من [فينميديفام 20% + ديسميديفام 20% متبوعاً بهالوكسيفوب-ب-ميثيل 10,8% + عملية عزيق مرة واحدة بعد شهر] و [ديسميديفام 7,1% + فينميديفام 9,1% + إيثوفوميسات 11,2% متبوعاً بهالوكسيفوب-ب-ميثيل 10,8% + عملية عزيق مرة واحدة بعد شهر] و [فينميديفام 10% + ديسميديفام 10% + هالوكسيفوب-ب-ميثيل 6% + عملية عزيق مرة واحدة بعد شهر] و [فينميديفام 10% + ديسميديفام 10% + هالوكسيفوب-ب-ميثيل 6% + رشة أخرى من نفس المبيد بعد شهر]. وقد أشارت النتائج إلى تحسن المعايير البيولوجية لبنجر السكر (طول النبات ومرحلة النمو) مع جميع معاملات مبيدات الحشائش المستخدمة مقارنةً بمعاملة الكنترول وقد أظهرت جميع معاملات مبيدات الحشائش المستخدمة استجابة مختلفة للسمية النباتية على محصول بنجر السكر حيث سجلت مؤشرات منخفضة للسمية النباتية على نباتات بنجر السكر، واختفت أعراض السمية النباتية تدريجيًا حتى اختفت تماما بعد 8 أسابيع بعد التطبيق مقارنةً بمعاملة الكنترول. كما أظهرت النتائج أن جميع معاملات مبيدات الحشائش المدروسة أدت إلى زيادة ملحوظة في تركيز الكاروتين والكلوروفيل (a) والكلوروفيل (b) بعد أسبوعين و 4 و 8 أسابيع من المعالجة مقارنةً بمعاملة الكنترول. وأشارت النتائج أيضا إلى أن جميع معاملات مبيدات الحشائش خفضت من كثافة الحشائش وارتفاعها، وكان لها تأثير قوى على مرحلة نمو الحشائش من حيث إيقاف النمو أو إبطائه بشكل ملحوظ مقارنةً بمعاملة الكنترول. وقد حققت معاملات مبيدات الحشائش أعلى مكافحة للحشائش المصاحبة لمحصول بنجر السكر واتضح ذلك في اقل وزن طازج لكل نوع من أنواع الحشائش والمجموع الكلى للحشائش وحساب نسبة المكافحة (%) بعد 56 يومًا من التطبيق. وبالأخذ في الاعتبار صفات محصول بنجر السكر وجودته فوجد ان معاملات مبيدات الحشائش أدت إلى زيادة ملحوظة في خصائص محصول بنجر السكر [طول الجذر، وقطر الجذر، والوزن الطازج للجذر (جم/نبات)] وايضا جودة المحصول من حيث [نسبة السكر (%)] وتقييم محصول بنجر السكر (محصول الجذور ومحصول السكر) مقارنةً بمعاملة الكنترول في كلا الموسمين وقد تم تسجيل اعلى محصول من (الجذور والسكر) في الموسم الاول عند استخدام معاملة [ديسميديفام 7,1% + فينميديفام 9,1% + إيثوفوميسات 11,2% متبوعاً بهالوكسيفوب-ب-ميثيل 10,8% + عملية عزيق مرة واحدة بعد شهر]، وفي الموسم الثاني عند استخدام معاملة [فينميديفام 20% + ديسميديفام 20% متبوعاً بهالوكسيفوب-ب-ميثيل 10,8% + عملية عزيق مرة واحدة بعد شهر]، وذلك مقارنةً بمعاملة الكنترول.

الكلمات الدالة:

بنجر السكر، الحشائش، معاملات مبيدات الحشائش، السمية النباتية، كفاءة مكافحة الحشائش، صفات المحصول، جودة المحصول، تقييم المحصول.