



## Evaluation of the efficiency of some chemical herbicide in eliminating *Raphanus raphanistrum* L. weed associated with wheat crop

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<b>Received:</b> July 4, 2023	<b>Abstract</b> In order to assess how effectively different herbicides work in controlling the wild radish weed that are connected with the growth of the wheat crop, The experiment included one factor he four types of chemical herbicides: Navigator, Tatsteler, Decimate and Mark zone, in addition to comparison treatment. and with three replications, according to the randomized complete block design (R.C.B.D). When the process of preparing the soil of the field was carried out, artificial infection of the wheat seeds the Al-Wafia variety was carried out, by adding 0.5 gm of wild radish weed seeds. After that, the polluted wheat seeds were sown, and when the wild radish weeds reached the appropriate stage for control, herbicides were added according to the recommendation of the producing company some characteristics were taken from the wild radish weed after 60 and 90 days of control, as well as some characteristics of the wheat plant and its yield components, results were as follows: excellence the two herbicide, Navigator and Decimate, were superior in reducing most of the studied traits of wild radish weeds, as shown the results show Navigator excelled by giving it the highest average of chlorophyll index, which reached 50.71 SPAD, and in flag leaf area, which averaged 49.64 cm, in addition to its superiority in grain yield, with an average of 5.83 tons. ha <sup>-1</sup> and in the harvest index also gave the highest average of %36.92, as it was noted that Tatsteler herbicide was superior in the tillers number with an average of 472.33 tiller m <sup>-2</sup> and in the spikes number of also excelled with an average of 423.57 spike m <sup>-2</sup> . as for the Mark zone herbicide, it excelled in the weight of 1000 grains, with an average of 40.10 g. also it was noted that Decimate had superiority in biological yield with an average of 15.13 ton ha <sup>-1</sup> , but it did not differ significantly from the averages of Navigator and Tatsteler, which were 15.09 and 15.06 ton ha <sup>-1</sup> respectively.
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## Introduction

Wheat *Triticum aestivum* L. is one of the important and basic grain crops, as it ranks first in the ranks of food crops on which more than two-thirds of the world's population depend on as a staple food. It is a major source of carbohydrates in addition to its good content of protein and cellulose. It also contains some mineral elements, which made it an indispensable commodity [1]. The availability of chemical herbicides over the past years has allowed farmers to succeed in cultivating varieties of wheat and then breeding them to give a high grain yield under conditions free of weeds [2]. However, types of weeds appeared that were resistant to chemical herbicides, and thus the survival of the harmful weeds and their competition with the wheat crop for basic growth resources, in addition to acquiring the status of a secondary host for many pathogens, and thus a decrease in grain yield at high rates that may range between 20-70% [3]. This can explain why there is a large gap between the productivity of wheat in Iraq and what is produced by the first three countries in the order of wheat productivity in the world; As this gap can be estimated by a decrease 74% [4].

Among these Weeds is the wild radish, which spreads with various crops, especially with the wheat crop. This weed has multiple biological characteristics such as its rapid growth, different germination seasons and high seed production, as well as its passage through different stages of dormancy, which helped its spread in the fields of agricultural crops. The chemical method is one of the successful means in combating the wild radish because of its ease of use and rapid impact, as it is one of the best management practices to combat weeds. As the use of chemical herbicides has achieved advanced results in eliminating them and limiting their damage, and the use of herbicide mixtures to enhance efficiency and selectivity by discouraging different work sites [5]. Therefore, the aim of this study was to evaluate the efficacy of some herbicides in the control of the wild Radish weeds accompanying the wheat crop, sustainable management of weed control is represented in a way that meets the nutritional needs of the growing world population while ensuring minimal environmental damage and maintaining crop productivity through soil seed bank management and improving crop competitiveness, knowledge of biological factors and environmental characteristics. For weeds plants, the decision-making process on the basis of the critical period of control, the effective method is it mechanical, physical, biological, chemical, despite the basic role provided by weeds herbicide in maintaining general levels of food security, but some see it as an obstacle to achieving sustainability, And these insights are related to their negative effects on human health and environmental safety [6], which are often caused by wrong practices of this herbicide, including the application of Uncensored herbicide, lack of experience, lack of use of protective equipment, use of fake (not licensed) herbicide and the latter. It is a global problem the counterfeit herbicide trade [7]. To ensure the proper use of chemical herbicides, things to consider are licensing standards and their



sustainable use [8]. Therefore, the aim of this study was to evaluate the efficacy of some herbicides in the control of the Wild Radish weeds accompanying the wheat crop, in addition to knowing the extent of its impact on the wheat crop and its components.

## Materials and Methods

A field experiment was carried out November 15 for the year 2022 according to a randomized complete block design, with three replications, with one factor, which is Chemical herbicides (Table1). after preparing the soil The field was fertilized by adding super fertilizer Calcium phosphate at a rate of 100 P kg h<sup>-1</sup> in one batch [9]. As for potassium, it was added in the form of potassium sulfate (K<sub>2</sub>SO<sub>4</sub>) at a rate of 200 K kg h<sup>-1</sup> [10]. As for urea fertilizer (46% N), it was added at a rate of 120 N kg h<sup>-1</sup> in two equal batches, the first at the beginning of the branching stage and the second at the elongation stage [11]. Then the wheat seeds were sown Al-Wafia variety were sown with 10 lines, the length of each line was 2 m, and the distance between one line and another was 20 cm for each experimental unit, with a seed quantity of 140 kg h<sup>-1</sup> [12]. At the same time, artificial infection was carried out by dispersing 0.5 gm per experimental unit of The weeds of wild radish that took its seeds from the holy city of Karbala (the study area). When the weeds reached the appropriate stage for control, herbicides were sprayed as recommended. the following Characteristics of the studied Wild Radish were measured:

### Characteristics of the studied Wild Radish

**Weed density (plant m<sup>-2</sup>):** The number of weeds per square meter was calculated after 60 and 90 days of control.

**Control Percentage:** taken as a percentage of the number of weeds after 60 and 90 days of control by the equation mentioned below [13].

$$\text{control percentage percentage} = \frac{\text{The number of Weed in the comparison treatment} - \text{The number of weeds in the control treatment}}{\text{The number of Weed in the comparison treatment}} \times 100$$

**Dry weight of weeds (g plant<sup>-1</sup>):** Weed samples were taken per square meter after 60 and 90 days of control, dried with air until the weight was constant, and then weighed.

**Inhibition Percentage:** It was calculated through the following equation:

$$\text{inhibition percentage} = \frac{\text{Dry weight of Weed in comparison treatment} - \text{Dry weight of weeds in control treatment}}{\text{Dry weight of Weed in comparison treatment}} \times 100$$

### Characteristics of the wheat under investigation

**Plant height (cm):** It was calculated as an average of ten randomly selected readings from the midlines of each experimental unit, and the height was measured from the base of the plant at soil surface level to the top of the spike (except for Awn) by means of a graduated ruler.

**Tillers number (Tiller m<sup>-2</sup>):** The number of main and secondary tillers of the wheat crop was calculated per square meter for each experimental unit.



**Chlorophyll content (SPAD):** It was estimated by the SPAD device for ten wheat plants at the flowering stage in each experimental unit, and the average was taken.

**Flag leaf area (cm<sup>2</sup>):** It was calculated from the average of ten random flag leaves for the main stems of each experimental unit according to the following equation: flag leaf area = flag leaf length x width at the center x 0.95% [14].

**Spikes number (spike m<sup>-2</sup>):** one square meter was allotted for each experimental unit and was calculated based on the number of spikes from the group of plants that were gathered from the median lines.

**Weighing 1000 grains (g):** A random sample of grains was taken for each experimental unit, 1000 grains were counted, and then weighed with a sensitive scale.

**Biological yield (ton ha<sup>-1</sup>):** It was calculated from the yield of dry matter (grain and straw) from the square meter area harvested from each experimental unit, and the weight was converted to ton per ha.

**Grain yield (ton ha<sup>-1</sup>):** Counted from harvested plants per square meter of each experimental unit. After the hay was isolated from the grain and cleaned well, the grain was weighed and converted to ton per hectare.

**Harvest index:** It was calculated from the following equation :

$$\text{Harvest index} = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$$

### Statistical analysis

The data were collected from the field experiment and the results were statistically analyzed according to the analysis of variance (ANOVA) as per the RCBD design in one-way anova [15]. The least significant difference (LSD 0.05) test was used to compare and separate the mean differences. The statistics software GenStat12 was employed.

**Table (1):** Chemical herbicides used in the experiment and as recommended

Code	Treatment	Recommendation
T0	Weedy	-----
T1	Navigator	125 L ha <sup>-1</sup>
T2	Tatsteler	400 g ha <sup>-1</sup>
T3	Decimate	0.5 L ha <sup>-1</sup>
T4	Mark zone	2.4 L ha <sup>-1</sup>

### Results and discussion

#### Wild radish weeds density (plant m<sup>-2</sup>)

The results are shown in Table (2) showed that the use of chemical herbicide caused a significant decrease in the density of weeds after 60 and 90 days of spraying, as the

lowest mean of weeds density was 9.18, 9.16 plant m<sup>-2</sup> when treated with herbicide Navigator for the two consecutive periods, compared to weedy, which gave an average of 19.10, 19.61. plant m<sup>-2</sup> for the two consecutive periods, which did not differ significantly from the mean of herbicide Decimate treatment, which reached 10.15 and 10.18 plant m<sup>-2</sup> for the two consecutive periods as well. This may be due to the role of these herbicides in inhibiting the enzyme ALS and the enzyme ACCase, and thus inhibiting the biosynthesis of amino and fatty acids, which leads to preventing the formation of new leaves through its effect on cell division and differentiation. This result reinforced what was found by [16], who indicated that herbicides have a significant effect in reducing the number of weeds and inhibiting their dry weights.

### **Control Percentage of wild radish weeds**

The results are shown in Table 2 showed that control Percentage after 60 and 90 days of from spraying, it reached the highest mean when treated with herbicide Navigator %51.93, %53.28 for the two periods respectively, while herbicide Tatsteler gave the least average control percentage of %28.53 and %33.14 for the two periods, respectively. The superiority of Navigator herbicide in the percentage of control is evidence of the efficiency of these chemicals in killing living plant tissues and thus showed a clear role in reducing the number of weeds per square meter.

**Table (2):** Effect of chemicals herbicide on weed density and percentage control weeds wild radish after 60 and 90 days of spraying

<b>Treatments</b>	<b>Weed density after 60 days (m<sup>-2</sup>)</b>	<b>Weed density after 90 days (m<sup>-2</sup>)</b>	<b>Control Percentage after 60 days (%)</b>	<b>Control Percentage after 90 days (%)</b>
<b>Weedy</b>	19.10	19.61	00.00	00.00
<b>Navigator</b>	9.18	9.16	51.93	53.28
<b>Tatsteler</b>	13.65	13.11	28.53	33.14
<b>Decimate</b>	10.15	10.18	46.85	48.08
<b>Mark zone</b>	13.91	11.83	29.17	39.67
<b>L.S.D 0.05</b>	2.16	2.47	4.95	5.32

### **Dry weight and inhibition Percentage of wild radish weed**

The results of Table 3 showed the superiority of Navigator in reducing dry weight, with an average of 38.57 and 44.10 g plant<sup>-1</sup> for the two consecutive periods, with an inhibition rate of %40.04 and %39.20 for the two consecutive periods, and it did not differ significantly from the average of Decimate, which amounted to 40.62 and 47.34 g plant<sup>-1</sup>, with an inhibition rate. They amounted to %36.85 and %34.73, respectively. while the treatment with Tatsteler herbicide gave the highest average dry weight in the wild radish weed, which amounted to 47.29 and 56.73 g plant<sup>-1</sup> for the two periods,

respectively, with an inhibition rate of %26.48 and %21.79 for the two consecutive periods, and it did not differ significantly from the average treatment with Mark zone herbicide, which amounted to 46.78 and 54.39 g plant<sup>-1</sup> for the two periods, respectively, and with an inhibition rate. it reached %27.28 and %25.02 for the two periods respectively. The decrease in the dry weight of the weeds under the influence of herbicides indicates that these herbicides have affected the living tissues that perform the process of photosynthesis, which indicates that the catabolism process has surpassed the anabolic process in plant tissues, and thus the accumulation of dry matter decreased. This result coincided with [17].

**Table (3):** Effect of chemical herbicide on dry weight and inhibition percentage of weeds wild radish after 60 and 90 days of control

<b>Treatments</b>	<b>Dry weight after 60 days (g plant<sup>-1</sup>)</b>	<b>Dry weight after 90 days (g plant<sup>-1</sup>)</b>	<b>Inhibition Percentage after 60 days (%)</b>	<b>Inhibition Percentage after 90 days (%)</b>
<b>Weedy</b>	64.33	72.54	0.00	0.00
<b>Navigator</b>	38.57	44.10	40.04	39.20
<b>Tatsteler</b>	47.29	56.73	26.48	21.79
<b>Decimate</b>	40.62	47.34	36.85	34.73
<b>Mark zone</b>	46.78	54.39	27.28	25.02
<b>L.S.D 0.05</b>	7.43	6.81	4.95	4.33

### **Characteristics of the wheat crop**

#### **Plant height (cm)**

The results of Table (4) showed that the treatment with Tatsteler herbicide caused an increase in the height of the wheat crop, as it gave an average of 98.04 cm, and it did not differ significantly from the averages of the Navigator, Decimate, and Mark zone treatments, which amounted to 97.78, 98.04, and 96.62 cm, respectively, compared to weedy treatment, which gave the lowest average of the height wheat crop, which amounted to 86.41cm. The increase in the height of the wheat crop when adding chemical herbicides compared to the weedy treatment is due to the effectiveness of these herbicides in reducing the number of weeds and their dry weights especially the weed of wild radish (Tables 2, 3), which provided a suitable environment for the crop to grow without competition for the basic growth requirements, thus increasing the efficiency of the photosynthesis process and thus increasing Representation of the food item, which was reflected in the length of one internode and the number of internodes



, and this was reflected positively in the height of the wheat crop. These results coincided with what [18] concluded that the use of herbicides in controlling the weeds associated with the wheat crop leads to an increase in the height of the wheat crop.

### **Tillers number (Tiller m<sup>-2</sup>)**

The results of Table (4) showed that the herbicides used in the study caused a significant increase, as the treatment with Navigator herbicide gave an average of 472.33 Tiller m<sup>-2</sup>, and it did not differ significantly from the mean of the treatment with Mark zone and Tatsteler, which amounted to 471.12 and 463.82 tiller m<sup>-2</sup>, compared to the weedy treatment, which amounted to the least average of 357.11 tiller m<sup>-2</sup>, while the treatment with Decimate herbicide gave 458.00 tiller m<sup>-2</sup>. The increase in the tillers number for some control treatments is due to the role of these herbicides in reducing the number of weeds and then reducing their dry weights (Tables 26, 27), which allowed the crop to form the optimal number of tillers as a result of reducing competition for growth requirements such as water, nutrients, air and place, which was reflected in Efficiency of the metabolism process and thus increasing the efficiency of the vital processes in the plant, which positively affects the tillers number, These results were in agreement with what was reached [19].

### **Chlorophyll (SPAD)**

The results of Table (4) showed that there was a significant difference in the chlorophyll index of the wheat crop, as the treatment Navigator gave an average of 50.71 SPAD, and it did not differ significantly from the treatment Tatsteler, which gave an average of 47.29 SPAD, compared to the weedy treatment, which gave an average of 35.24 SPAD, while the treatment with Decimate and Mark zone gave two averages of 44.28. and 46.86 SPAD, respectively. The increase in chlorophyll content in the wheat crop when compared to the weedy treatment may be attributed to the efficiency of the plant's ability to absorb water and important nutrients in building the chlorophyll molecule, and thus increase the activity of effective hormones and enzymes, including cytokinins, which are necessary to construct the crana, which is the most concentrated in chlorophyll [20]. or it may be attributed to the ability of these herbicides to reduce the number of weeds (Table 2) per unit area, which allowed the plants of the crop to grow without competition for water, nutrients and light, and thus increased the efficiency of the photosynthesis process, which was reflected positively on the chlorophyll content of the leaves.

### **Flag leaf area (cm<sup>-2</sup>)**

The results of Table (4) showed that there was a significant difference in the flag leaf area, The treatment excelled with Novicator herbicide was also superior, which gave an average of 49.64 cm<sup>-2</sup> which did not differ significantly from the mean of the

Tatsteler treatment which amounted to 46.93 cm<sup>2</sup>, compared to the weedy treatment, which reached the lowest average of 36.48 cm<sup>2</sup>, while the Decimate and Mark zone treatments gave averages of and 44.05 and 45.27 cm<sup>2</sup> respectively. The increase in the area of the flag leaf when adding herbicides is due to its role in providing a suitable environment for the plants of the crop, where they grow without competition for water, light and nutrients, which resulted in an increase in the efficiency of the photosynthesis process and an improvement in the performance of the crop for its vital processes, and then increased growth and other vital processes, so the area of the flag leaf increased due to the lack of competition between the crop and the weeds for growth requirements, and the increase in the flag leaf area can also be attributed to the increase in the size of the leaf tissue cells, which led to an ability to elongate and stretch, as well as an increase in the content of hormones that encourage growth and stimulate elongation Such as auxins and gibberellins, and thus its reflection on the growth processes of division, expansion, and cellular differentiation, or it may be due to the efficiency of control treatments in reducing the weeds density (Table 2), which allowed the wheat crop to make optimal use of the growth requirements and thus increase the rates of photosynthesis and increase its products, which effectively contributed to the increase the leaf area of the plant, including the area of the flag leaf, this is consistent with what [21] said.

**Table (4):** Effect of chemical herbicides on vegetative characteristics of the of wheat crop

<b>Treatments</b>	<b>Plant height (cm)</b>	<b>Tillers number (Tiller m<sup>-2</sup>)</b>	<b>Chlorophyll. (SPAD)</b>	<b>Flag leaf area (cm<sup>-2</sup>)</b>
<b>Weedy</b>	86.41	357.11	35.24	36.48
<b>Navigator</b>	97.78	463.82	50.71	49.64
<b>Tatsteler</b>	98.04	472.33	47.29	47.93
<b>Decimate</b>	96.62	458.00	44.28	47.05
<b>Mark zone</b>	97.15	471.12	46.86	46.27
<b>L.S.D 0.05</b>	8.65	10.39	3.46	3.80

#### **Spikes number (spike m<sup>-2</sup>)**

The results of Table (5) showed a significant increase in the characteristic of the spikes number and the presence of significant differences, as the Navigator treatment gave an average of 423.57 spikes m<sup>-2</sup>, compared to the weedy treatment that gave the lowest average of 314.25 spikes m<sup>-2</sup>, while the Tatsteler, Decimate, and Mark zone treatments gave averages of 417.02 and 409.10 and 400.39 spikes m<sup>-2</sup> respectively,



compared to the intrusive treatment that gave the lowest average of 314.25 spikes  $m^{-2}$ . The superiority of the Navigator herbicide treatment in the spikes number may be attributed to its superiority in the tillers number, due to the presence of a positive relationship between them, or it may be due to the lack of weeds, as it allows the crop to grow without environmental stress, which is reflected in increasing the efficiency of the photosynthesis process and thus the efficiency of crop performance, especially in the branching stage, which is considered one of the early stages of crop growth. Therefore, the absence of the competition factor at this stage has a positive effect on the tillers number and thus reflects positively on the number of spikes per unit area. These results agreed with both [22, 23], They indicated that the highest number of spikes may be achieved when the competition between the crop and the accompanying weeds decreases.

### **Weight of 1000 grains (g)**

The results of Table (5) showed that the In terms of weight of 1000 grains, Mark zone herbicide was superior by giving it the highest average of 40.10 g It did not differ significantly from the treatment with a herbicide Tatsteler, which gave an average 37.20 g compared to the weedy treatment, which gave the lowest average of 34.22 g while the Navigator and Decimate treatments gave Two averages were 35.61 and 36.57 g respectively. There is a negative relationship between the number of grains in the spike and the weight of the grain, or what is called the phenomenon of compensation. The weight of the grain is one of the important characteristics of the yield, as it is considered an indicator of the efficiency of the transfer of manufactured materials in the parts of the plant from the source to the downstream represented by the grain and the ability of the source to supply the grain with the products of representation. photosynthesis as the final downstream by pushing the plant as a result of the control to make better use of water and nutrients [24] , the positive role of the herbicide in affecting the growth of the weeds and reducing its competition with the plants of the crop provided the plants with the opportunity to grow and increase the leafy area exposed to light, which was reflected positively In increasing the processed food stuffs and then increasing the weight of the grain [25], and that a significant and clear increase in the rate of 1000 grains may be due to the normal performance in the ability of the crop to grow, the efficiency of the photosynthesis process and the manufacture of sugars after the absence of weeds competition for the necessary growth requirements. This result was in agreement with what was reached by researchers [26, 27].

### **Biological yield (ton $ha^{-1}$ )**

The results of Table (5) showed that treatment with chemical herbicides also caused a significant increase in the characteristics of the biological yield, as the Decimate

treatment gave an average of 15.13 ton ha<sup>-1</sup>, It did not differ significantly from the averages of Navigator and Tatsteler, which were 15.09 and 15.06 ton ha<sup>-1</sup> respectively. compared to the weedy treatment, which amounted to 13.12 ton ha<sup>-1</sup>, While the treatment with Mark zone herbicide gave an average 14.91 ton ha<sup>-1</sup>. the ncrease in the biological yield in the control treatments compared to the weedy treatment may be attributed to the activity of the root system after the control period as a result of the reduction of the weeds density (Table 2), which led to the efficiency of roots and therefore, and the ability of the plant to absorb water and nutrients increased, and then the increase in the vital activities in the shoot system, which It was reflected in the increase in the height of the wheat crop, the increase in the number of tillers, and the increase in the of the flag leaf area (Table 4). the increase in the biological yield could also be attributed to the increase in the yield and its components which are an essential part of the components of the biological yield. This result agreed with [28].

### **Grain yield (ton ha<sup>-1</sup>)**

The results of Table (5) showed that the addition of herbicides caused a significant increase in grain yield, as the Navigator treatment gave an average of 5.83 ton ha<sup>-1</sup> compared to the weedy treatment, which amounted to 3.09 ton ha<sup>-1</sup> while the herbicide treatments Tatsteler, Decimate and Mark zone gave averages were 5.31, 5.50, and 5.37 ton ha<sup>-1</sup> respectively. The increase in grain yield is associated with the increase in the tillers number Table (4), the spikes number in the spike and the weight of 1000 grains, as the yield is related to its components [29], and the increase in yield can also be attributed to the superiority of these coefficients in the of the flag leaf area being the main source of nutrients to fill the grain [30], the increase in yield is also attributed to the absence of weeds of both broad and thin types in the control treatments from the beginning of crop growth until the stage of physiological maturity, which provided the opportunity for the wheat crop to make better and optimal use of the basic growth requirements. Which led to an increase in photosynthesis rates and growth rates, and its reflection on the accumulation of dry matter in grain. These results agreed with [31].

### **Harvest index (%)**

The results showed Table (5), the treatment with Navigator herbicide gave a rate of %36.92, and did not differ significantly from the treatment with Mark zone herbicide , which amounted to %35.52, compared to the weedy treatment, which amounted to %26.55, while the treatment with the herbicides Tatsteler and Decimate gave a rate of %35.25 and %35.16. The high percentage of the harvest index in some treatments to the increase in the yield of wheat grains relative to the biological yield, as the chemical herbicides caused a significant reduction in the weed density Table (2) and the inhibition rate (Table 3), which reduced the chance of weeds and thus the lack of competition

between the crop and the weeds on the resources of photosynthesis and thus improve the performance of the vital processes involved in the transfer of materials stored in the stem and leaves and thus increase the yield of grain to the biological yield, this result agreed with other researchers [32].

**Table (5):** Effect of chemical herbicides on some Characteristics of the studied Wild Radish of wheat crop

Treatments	Spikes number (spike m <sup>-2</sup> )	Weighing 1000 grains (g)	Biological Yield (ton ha <sup>-1</sup> )	Grain Yield (ton ha <sup>-1</sup> )	Harvest index %
Weedy	314.25	34.22	13.12	3.09	26.55
Navigator	417.02	35.61	15.09	5.83	36.92
Tatsteler	423.57	37.20	15.06	5.61	35.25
Decimate	409.10	36.57	15.13	5.50	35.16
Mark zone	400.39	40.10	14.91	5.47	35.52
<b>L.S.D 0.05</b>	6.92	3.34	0.23	0.15	1.61

It was observed that the herbicides Navigator and Decimate had superiority in the percentage of control and the percentage of inhibition of the weeds of wild radish

As noted observed that the Navigator herbicide had led to an increase in the chlorophyll index and the flag leaf area in addition to its role in increasing and improving the grain yield. It was also noted that the Tatsteler herbicide contributed to an increase in the tillers number in the wheat crop, while it was noted that the treatment with Mark zone herbicide was characterized by an increase in the grain weight.

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