Al-Muthanna J. For Agric Sci | Print ISSN: 2226-4086 | Online ISSN:2572-5149
Vol. 12 , Issue 2. 2025

https://muthjas.mu.edu.iq/ http://doi.org/10.52113/mjas04/12.2/53

Phenological growth characteristics of some wheat genotypes respond to weed competition under the influence of different control treatments.

Hazim Hussien Farhood Al-jabri [1] , Shayma Ibrahim Mahmud [2] , Suhad Mathkoor Al-Safi [3]

[1, 2] Department of Field Crops, College of Agriculture, Al-Muthanna University, Iraq.

[3] Department of Field Crops, College of Agricultural Engineering Sciences, University of Baghdad, Iraq.

E- mail[1] : hazim.hussien@mu.edu.iq E- mail[2] : shaimaa.ibraheem@mu.edu.iq

E- mail[3] : suhad.mathkor@coagri.uobaghdad.edu.iq

Abstract

A field experiment was conducted at the Second Research Station, College of Agriculture, Al-Muthanna University (2 km from the city center of Samawa), during the winter season of 2024-2025. The experiment aimed to determine the response of certain wheat genotypes to competition from associated weeds under different control treatments. A randomized complete block design (RCBD) with split-plot arrangement and three replications was used. The main plots included the control treatments: Timeline Trio herbicide (1.5 L ha^{-1}), rye extract (18 L ha^{-1}), herbicide (750 ml ha^{-1}) + rye extract (9 L ha^{-1}), in addition to a weed control and a weed-free control. The subplots included the genotypes Buhooth22, Nwewya R3, G10Ru, ACSAD 1133, and ACSAD 59. The results showed that the herbicide-only treatment resulted in the lowest weed density and dry weight, and the highest inhibition percentage and number of days from flowering to maturity. It did not differ from the herbicide + extract treatment in weed dry weight. This was in contrast to the weed-infested treatment, which recorded the highest weed density and weed dry weight. The herbicide + extract treatment also achieved the highest average number of days to 50% flowering. The weed-free treatment achieved the highest average plant height, LAI, CGR, N.A.R., SPAD, and number of tillers. Regarding the genotypes, the Exad59 genotype achieved the lowest weed density, lowest weed dry weight, and highest average plant height. The Buhouth22 genotype gave the highest average inhibition percentage, number of days from flowering to maturity, and LAI. The Nwewya R3 genotype achieved the highest average number of days to 50% flowering and number of tillers. The variation in genetic makeup across most phenological traits, may be one of the criteria for determining the extent to which these variations affect the ability of species to compete with weedland.

Keywords: Phenological growth, wheat, genotypes respond, weed competition.

Introduction

Wheat (*Triticum aestivum* L.) occupies the first place in the world in terms of cultivated area and production and is the most important among cereal crops, and due to its importance as a major food source for more than 60 countries in the world, and its role in economic and social development [1].

Iraq is considered one of the original centers for the emergence of wheat and one of the countries where factors for the success of its cultivation are available. The cultivated area for the 2023 season was about 8420 thousand dunams, with a productivity of 4248 thousand tons and an average yield of 504.5 kg per dunam [2].

The total cultivated area does not reach global productivity levels. One reason for this may be the lack of adoption of modern crop management technologies, especially during critical stages of the crop's life cycle. Despite the crop's importance, its grain yield is significantly lower than the global average. One of the problems facing cereal crops, including wheat, is weed infestation. Weeds are among the most significant agricultural pests due to the losses they cause in production. This occurs through direct and indirect damage and competition with the crop. Weeds compete with economically important crop plants for nutrients, moisture, space, light, and many other growth factors, especially in the early stages of growth. As a result of this competition, crop growth is weak in the early stages, leading to a decrease in wheat yield of between 30-50% [3].

Improving the competitiveness of wheat varieties involves selecting varieties with high tolerance to competition or low yield impact from weeds, to reduce weed damage to the crop, modern control methods exist, including chemical methods. These are among the easiest methods and offer good economic returns due to the effectiveness and rapid action of herbicides. Chemical herbicides have been used to control wheat weeds in large areas of the world. This is due to their effectiveness in controlling weeds and increasing productivity by more than 50%, despite the emergence of environmental problems resulting from their use [4]. In addition to the environmental problems associated with herbicides, their ineffectiveness in controlling weeds has recently become apparent. This is due to the emergence of weed strains resistant to these herbicides [5].

Using a single method to control weeds is often inefficient. An integrated pest management (IPM) approach, employing one or more pest control methods, is often necessary. Therefore, researchers have sought environmentally friendly and effective alternatives for weed control. Among the most important of these alternatives are plant-based herbicides, which are considered safer for the ecosystem, cheaper, and possess compounds similar to those found in conventional pesticides. One such alternative is allelopathy, or antagonism, which can be used as an IPM tool to eliminate weeds and reduce the use of chemical pesticides. Allelopathy is a biological phenomenon involving chemical interactions between plants. This phenomenon has significant potential for use as an effective and environmentally friendly management agent for weed control in field crops [6].

One of the most important plants that contains antagonistic or allelopathic compounds is rye (*Secale cereal* L.) [7, 8].

This study aims to demonstrate the phenological growth characteristics of some wheat genotypes responding to weed competition under the influence of different control treatments.

Material and methods

The experimental field was plowed twice in perpendicular directions, harrowed using disc harrows, and leveled with a leveler. A randomized complete block design with a split-plot arrangement and three replications was used, employing five wheat genotypes and five different control treatments. The experimental unit area was 4 m^2 (2 × 2 m), comprising 75 experimental units. Seeds were sown manually in rows spaced 20 cm apart at a seeding rate of 120 kg ha^{-1} on November 15, 2024. The control treatments used were Timeline Trio herbicide at 1.5 liters ha^{-1} and rye extract at 18 liters ha^{-1}, with half the herbicide volume (750 ml). 9 liters of ha^{-1} + 1.5 liters of rye extract. Added to both the weed-infested and weed-free treatments. Weeds were allowed to emerge naturally in all treatments. After 30 days from planting, at the 2-4 leaf stage, weeds were controlled by spraying the plants with the herbicide and rye extract. Weeds were not removed in the weed-infested treatment but were removed manually in the weed-free treatment. After drying and preparing rye powder, to obtain a 20:1 W:V concentration, 200 g of the powder was placed in a conical flask containing 1000 ml of deionized distilled water. The resulting mixture was stirred at 60-70°C for 15 minutes using a magnetic stirrer. It was left at room temperature for 48 hours, stirring continuously. The results were separated using Whatman No. 1 filter paper. The aqueous extract was stored at 4°C until use [5, 9, 10].

Weed density m-2

Weeds were identified in the experimental field during different growth stages of the wheat crop. The types and numbers of weeds were also recorded 30, 60, and 90 days after spraying. This was done by identifying and counting the number of weeds present in a 50 cm x 50 cm wooden square, which was then randomly placed in the experimental unit.

Weight of dry weedes at crop maturity and percentage of inhibition in dry weed weight.

At harvest, weedes were cut at soil level from each experimental unit, covering an area of one-quarter square meter. They were placed in a perforated paper bag and then placed in an electric oven at 70°C until weight stabilized. The samples were then weighed on a sensitive balance [5].

Percentage of weed inhibition in dry weight: The percentage of inhibition in dry weight was calculated using the following equation:

% of inhibition = 100 – A/B × 100

Where:

A is the dry weight of weeds in the control treatment

B is the dry weight of weeds in the control treatment (weed)

Number of days from planting to 50% flowering: Calculated based on the number of days from planting to 50% pollen dispersal [5].

Number of days from flowering to maturity (seed filling time SFD): Calculated from 50% flowering to maturity [5].

Plant Height (cm): Measured as the average of ten randomly selected plants from each experimental unit, from the base of the plant in contact with the soil surface to the tip of the spike, excluding the awns.

Leaf Area Index (LAI): According to the growth stages (beginning of elongation and flowering) and using the following equation [5]:

Leaf Area Index (LAI) = Total Leaf Area / Unit Land Area

Crop Growth Rate (CGR) (g m^2/day): According to the growth stages (beginning of elongation and flowering) and using the following equation [11]:

Crop Growth Rate (CGR) = (1/A)(W2-W1/T2-T1)

Where: A = Land area occupied by the plant (m^2), W2 and W1 = Second dry weight and first dry weight, measured in grams, T2 and T1 = Second time and first time, measured in days.

Net Assimilation Rate (NAR) (g m^2/day): According to the growth stages (beginning of elongation and flowering), the following equation was applied [11]:

(NAR) = W2 - W1 / T2 - T1 × LuLA2 - LuLA1 / LA2 - LA1 Net Assimilation Rate

Chlorophyll Content SPAD: Chlorophyll content in the leaves was estimated using a Spad-502 Chlorophyll Meter (German origin) by measuring the average of five readings from the flag leaf after flowering was complete in ten plants randomly selected from the center of the experimental unit and calculating the average.

Number of Tillers m²: The number of tillers was estimated from a 1 m² area of the center rows in each experimental unit at harvest.

Results and Discussion

Effect of Calving Season on Milk Production and Its Components

Weed characteristics

Weed density (m²).

Table (1) shows the results of the different control treatments, indicating significant differences in the number of weeds present 90 days after application. The lowest average weed density was observed with the herbicide treatment, at 17.07 plants/m², followed by the herbicide + extract treatment with an average of 21.87 plants/m². The highest weed density was observed with the weeding treatment, at an average of 165.33 plants/m². The control treatments resulted in a decrease in the average weed density for most of the treatments compared to the weeding treatment. The herbicide Timeline Trio was effective in reducing weed density and targeted the control of both broadleaf and narrowleaf weeds in wheat. The herbicide combined with rye extract also demonstrated effectiveness, given rye's ability to control harmful weeds. This effect is partly attributed to antagonism, a finding consistent with Marzouk and Korrat [12].

Regarding the effect of genotypes on weed density, the genotypes differed at 90 days. The 59 genotype yielded the lowest average density of 42.60 plants per square meter (m²), while the 1133 genotype yielded the highest average density of 53.40 plants per square meter (m²). The variation in weed density among the genotypes may be attributed to differences in their morphological characteristics. This could, therefore, be a factor in their competitiveness and tolerance to this competition. Previous studies have shown a correlation between the intensity of competition between wheat genotypes and the number of accompanying weeds. These results are consistent with those of Al-Wagaa and Mohammad [13] and Abdulateef *et al.* [3]. The interaction between control treatments and genetic combinations also had a significant effect. The lowest average for the trait when the herbicide interacted with the Nwewya R3 combination was 14.00 plants/m², while the highest weed density was observed when the weed was treated with the Oxad 1133 combination, reaching 184.67 plants/m².

Weed Dry Weight (g/m²):

The results in Table 1 indicate significant differences in weed dry weight due to the influence of control treatments, genetic makeup, and the interaction between these factors. The herbicide treatment resulted in the lowest average dry weight, at 24.14 g/m², with no significant difference compared to the (herbicide + extract) treatment, which averaged 29.10 g/m². The extract treatment followed with an average of 56.65 g/m², while the weed treatment recorded the highest average at 298.47 g/m². The dry weight of weeds reflects the intense competition between weeds and wheat crops for various growth requirements, including moisture, nutrients, light, and other nutrient requirements. Therefore, a decrease in weed dry weight indicates that the herbicide and extract kill the photosynthetic tissues. This leads to catabolism (breakdown) over anabolic (building) in the weed tissues, resulting in reduced dry matter accumulation. These results are consistent with those of Khudur *et al.* [14] and Al-Khaz'ali *et al.* [15].

The results also indicate that wheat genotypes differ in their ability to reduce weed dry weight. The 59 genotype recorded the lowest

average weed dry weight at 68.58 g m². Conversely, the highest weed dry weight was recorded with the 1133 genotype, averaging 91.69 g m². This variation among genotypes in different treatments, in their ability to compete with weeds and influence their dry weight or inhibit their growth, indicates the competitive ability of genotypes against weeds and may therefore be a reason for the variation in their final yield. These results are consistent with those of Khudur *et al*. [14] and Hammood *et al.* [16]. The results also indicate a different interaction effect between different control treatments and genotypes on weed dry weight.
The interaction of a herbicide with the Nwewya R3 genotype resulted in the lowest average dry weight at 17.53 g m², while the highest average dry weight for this trait was observed with the treatment interaction. The density of the sludge with the composition of Oxad1133 reached 335.59 g m^2.

Percentage of inhibition (%) in dry weight of weeds

The results in Table (1) show significant differences in the percentage of inhibition due to the different control treatments, genetic makeup, and interactions between them. The herbicide treatment yielded the highest average inhibition at 92.12%, followed by the herbicide + extract treatment at 90.28%, and the lowest average at 82.75% for the extract only treatment. The results indicate the role of control treatments in influencing the percentage of inhibition, as the herbicide inhibits the ACCase enzyme, a key component in lipid synthesis in weeds, disrupting and halting plant cell growth [17]. This may also be attributed to the chemical composition of rye, as it contains various chemicals that can inhibit the growth of harmful weeds. The high inhibitory properties of rye can be used on both broadleaf and narrow leaf weeds to mitigate problems weeds [18].

The results also indicate a difference between the genotypes in the percentage of inhibition of weed dry weight. The variety Buhouth 22 gave the highest percentage of inhibition of dry weight, with an average of 53.26%, with no significant difference from the combinations Nwewya R3 and Aksad 1133, which had averages of 52.99% and 52.73%, respectively. The lowest average for the trait was with the combination Aksad 59, with an average of 51.99%. These results are consistent with those of Al-Wagaa and Mohammad [13] and Al-Khaz'ali *et al.* [15], who indicated a difference between the genotypes in the percentage of inhibition of weed dry weight.

The results showed a difference in the interaction effect between control treatments and genotypes. The interaction of a herbicide treatment with the Buhouth 22 variety resulted in the highest average for the trait, reaching 92.78%. Conversely, the interaction of an extract treatment with the Oxad 59 variety resulted in the lowest average, reaching 77.65%.

Table (1) shows the effect of control treatments, genotypes, and their interaction on weed population density(plants/m²), dry weight (g/m²), and inhibition percentage (%).

Weed population density(plants/m²)						
Varieties	Treatments					
	Herbicide	Rey Extract	Herbicide + Extract	Weedy check	Weed free	Mean
Buhooth22	17.00	37.00	18.33	174.00	0.00	49.27
Nwewya R3	14.00	35.67	21.33	163.00	0.00	46.80
G10Ru	18.33	37.33	26.33	166.00	0.00	49.60
ACSD 1133	20.33	38.67	23.33	184.67	0.00	53.40
ASAD 59	15.67	38.33	20.00	139.00	0.00	42.60
Mean	17.07	37.40	21.87	165.33	0.00	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	

	2.305		2.511		5.386	
Dry weight (g/m²)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	23.48	57.22	25.07	320.14	0.00	85.18
Nwewya R3	17.53	53.58	31.20	290.64	0.00	78.59
G10Ru	26.64	57.37	35.64	301.97	0.00	84.32
ACSD 1133	32.26	60.43	30.17	335.59	0.00	91.69
ASAD 59	20.81	54.67	23.41	244.02	0.00	68.58
Mean	24.14	56.65	29.10	298.47	0.00	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	5.715		4.773		10.730	
Inhibition percentage (%)						
Varieties	Treatments					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	92.78	81.22	92.28	0.00	0.00	53.26
Nwewya R3	94.14	81.62	89.21	0.00	0.00	52.99
G10Ru	91.37	81.21	88.35	0.00	0.00	52.19
ACSD 1133	90.56	82.04	91.03	0.00	0.00	52.73
ASAD 59	91.76	77.65	90.53	0.00	0.00	51.99
Mean	92.12	80.75	90.28	0.00	0.00	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	1.394		0.847		2.090	

Number of days from planting to 50% flowering (days):

Table (2) shows significant differences in the number of days from planting to 50% flowering among the control treatments. The herbicide + extract treatment resulted in the highest average duration of this trait, at 97.67 days, followed by the treatments (herbicide only, weed-free, and extract only), with averages of 97.13, 96.00, and 92.73 days, respectively. The lowest average duration was observed with the weed control treatment, at 90.00 days. This may be attributed to the effect of all control treatments in reducing the number of weeds and their competition with the crop (Table 1), as well as reducing the dry weight of the weeds compared to the weed control treatment. This result is consistent with that found by Mekonnen [19].

The results also indicate significant differences between genotypes, with the Nwewya R3 genotype exhibiting the highest duration. The average duration for the trait was 96.73 days. In contrast, the lowest average duration for the trait was observed with the Oxad 1133 formulation, at 90.67 days. This variation may be attributed to differences in the genotypes' requirements for temperature and photoperiod. Increased temperature and photoperiod accelerate the ongoing biological processes in some genotypes, thus promoting faster flowering. This demonstrates the significant variation between the genotypes and their differing genetic potential. These results are consistent with those of Al-Ziyadi [20].

The results also indicated a significant interaction effect between control treatments and genotypes. The interaction of pesticide + extract with the Oxad 1133 formulation resulted in the highest average duration for the trait, at 100.00 days. Conversely, the lowest average duration for the interaction with the

Medghla treatment and the Oxad 1133 formulation was 85.33 days.

Number of days from 50% flowering to maturity (days):

The results in Table (2) show significant differences between the different control treatments for this trait. The herbicide-only treatment gave the highest average maturity time of 53.33 days, followed by the herbicide + extract treatment and the weed-free treatment, with averages of 52.66 and 52.40 days respectively, with no significant difference between them. The extract-only treatment had an average of 49.73 days, and the lowest average maturity was observed in the weed-infested treatment, at 47.00 days. The delayed maturity may be attributed to the effectiveness of these treatments in weed control, in addition to reduced competition for moisture, light, and nutrients, and an increased available area due to optimal resource utilization. This is due to reduced weed resistance, which keeps the crop in the vegetative growth stage for a longer period, ultimately leading to a noticeable increase in maturity. These results are consistent with Mekonnen [19], who They pointed to the role of control treatments in reducing weed competition and its effect on extending the number of days to maturity.

The results indicated significant differences between the genotypes for this trait. The 'Buhouth 22' variety exhibited the highest average duration for the trait, reaching 54.86 days. This was followed by the 'Aksad 59', 'G10Ru', and 'Aksad 1133' genotypes, with averages of 52.53, 50.46, and 48.80 days, respectively. The lowest average duration for the trait was observed in the 'Nwewya R3' genotype, at 48.46 days. This was not significantly different from the 'Aksad 1133' genotype. The variation among the genotypes may be attributed to genetic differences, growth characteristics, and the time required to reach this stage, which differs from one genotype to another. This variation is governed by the balance between the time from planting to flowering and from flowering to maturity, as well as the climatic requirements of each genotype. This finding is consistent with Al-Ghanmi [21] and Al-Zubaidi [22].

The results indicated a significant effect of the interaction between control treatments and genetic combinations, as the interaction of a pesticide treatment with the Buhouth 22 variety gave the highest average for this trait, which was 60.00 days, while the lowest average for the trait was when the weed treatment interacted with the G10Ru combination, with an average of 44.66 days.

Table (2) Effect of control treatments, genetic compositions and the interaction between them on the trait of the number of days from planting until 50% flowering and the number of days from 50% until maturity (days).

The number of days from planting until 50% flowering (day)						
Varieties	Treatments					
	Herbicide	Rey Extract	Herbicide + Extract	Weedy check	Weed free	Mean
Buhooth22	96.00	91.00	96.00	87.33	92.67	92.60
Nwewya R3	98.67	97.00	98.33	91.67	98.00	96.73
G10Ru	97.33	90.33	95.33	87.33	95.00	93.07
ACSD 1133	90.33	88.00	100.00	85.33	89.67	90.67
ASAD 59	93.00	91.67	98.67	88.67	92.67	92.93
Mean	95.07	91.60	97.67	88.07	93.60	
L.S.D$_{0.05}$	Treatments		Varieties		Interaction	
	1.117		0.718		1.736	
The number of days from 50% until maturity (days)						

Varieties	Treatments					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	60.00	53.66	57.66	47.33	55.66	54.86
Nwewya R3	50.33	48.00	48.66	46.66	48.66	48.46
G10Ru	51.00	47.66	54.66	44.66	53.66	50.46
ACSD 1133	50.00	48.33	48.66	47.66	49.33	48.80
ASAD 59	54.66	51.00	53.66	48.66	54.66	52.53
Mean	53.33	49.73	52.66	47.00	52.40	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	0.8448		0.4609		1.1874	

Plant height (cm):

The results in Table (3) show significant differences between the various control treatments for both seasons. The weed-free treatment was the most effective, yielding an average height of 103.75 cm. This was followed by the herbicide treatment with an average of 102.95 cm, with no significant difference between them. Next came the treatments (herbicide + extract and extract only), with averages of 100.49 and 100.35 cm, respectively, also with no significant difference. The lowest average height was observed in the weed-infested treatment, reaching 93.88 cm. This may be attributed to the effectiveness of the control treatments—weed removal, herbicide and extract control, and a mixture of both—compared to the weed-infested treatment in reducing weed numbers and dry weights. This provides a suitable environment for crop growth without competition for growth requirements such as water, nutrients, and light. Consequently, photosynthesis and other vital processes are enhanced, including plant height. This result is consistent with Khudur *et al.* [14] noted the difference in plant height between pesticide treatments.

The results showed differences in plant height among different genotypes across both growing seasons. The genotype 59xd. produced the highest average height of 103.60 cm, while the 1133xd. genotype had the lowest average height of 95.29 cm. The variation in wheat genotypes regarding this trait may be attributed to its hereditary nature and the genetic variation in the number and length of internodes, especially the upper internodes, which constitute more than half of the plant's height. Their varying content of the hormones auxin and gibberellins, responsible for cell elongation and expansion, also significantly impacted plant height variation. These results are consistent with those of Siyal *et al.* [23] and Al-Ajili [24], who found the highest average interaction between a pesticide treatment and the Nwewya R3 genotype to be 108.50 cm. The lowest average interference for the trait when treated with the oxidizing agent and the composition Exad1133 was 89.53 cm.

Leaf Area Index (LAI)

Table (3) shows significant differences in LAI between the different control treatments. The weed-free treatment gave the highest mean score of 2.215, followed by the herbicide and herbicide + extract treatments with means of 2.193 and 2.157, respectively, with no significant difference between them. The extract-only treatment followed with a mean score of 2.008, while the lowest mean score was 1.437 for the weed-infested treatment. This is consistent with the findings of Kumar *et al.* [25].

The results also indicate differences in the genotypes between the different varieties. The 'Buhouth 22' variety gave the highest mean score of 2.185, while the G10Ru genotype had the lowest mean score of 1.755. This result is consistent with the findings of Jańczak-

Pieniążek *et al.* [26]. Regarding the interaction of the LAI trait between control treatments and genotypes, the interaction of a pesticide treatment with the Buhouth 22 variety resulted in the highest mean LAI, reaching 2.530. Conversely, the interaction of a weed treatment with the G10Ru genotype resulted in the lowest mean LAI, reaching 1.252.

Table (3) shows the effect of control treatments, genotypes, and their interaction on plant height (cm) and leaf area index (LAI).

Plant height (cm)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	107.10	107.20	99.37	97.73	105.73	103.42
Nwewya R3	108.50	97.53	101.47	94.07	107.47	101.81
G10Ru	98.93	97.40	100.10	89.90	100.21	97.31
ACSD 1133	97.37	95.13	97.00	89.53	97.43	95.29
ASAD 59	102.87	104.50	104.20	98.53	107.90	103.60
Mean	102.95	100.35	100.49	93.88	103.75	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	1.568		1.908		4.036	
Leaf area index (LAI)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	2.530	2.240	2.493	1.263	2.400	2.185
Nwewya R3	2.250	2.023	2.223	1.803	2.493	2.159
G10Ru	1.780	1.950	1.950	1.252	1.843	1.755
ACSD 1133	2.287	1.980	1.987	1.490	2.120	1.973
ASAD 59	2.120	1.847	2.120	1.537	2.217	1.970
Mean	2.193	2.008	2.157	1.437	2.215	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	0.0863		0.0957		0.2048	

Crop Growth Rate (CGR):

Table (4) shows significant differences between the various control treatments for the CGR trait in g m²/day. The weed-free treatment resulted in the highest average CGR of 47.33 g m²/day. This was followed by the treatments (herbicide + extract, herbicide only, and extract only) with averages of 38.87, 36.60, and 32.13 g m²/day, respectively. Conversely, the weed-infested treatment resulted in the lowest average CGR of 25.73 g m²/day.

The results also indicate a significant difference between the genotypes for the CGR trait. The genotype AXAD1133 resulted in the highest average CGR of 40.93 g m²/day. The lowest average CGR was observed with the Nwewya R3 genotype, with no significant difference compared to the AXAD59 genotype, both reaching 33.73 g m²/day. 33.73 g m²/day. The results also indicated significant differences between the interaction of control treatments and genotypes. The interaction of a weed-free treatment with the G10Ru genotype resulted in the highest average value of 55.67 g m²/day. Conversely, the interaction of a weed-infested treatment with the G10Ru genotype resulted in the lowest average value of 19.33 g m²/day.

Net Photosynthetic Rate (NAR):

Table (4) shows significant differences between the different control treatments for net photosynthetic rate across both seasons. The weed-free treatment resulted in the highest average NAR at 21.81 g m²/day, followed by the herbicide + extract treatment with an average of 19.49 g m²/day. Conversely, the lowest average NAR was observed with the weed-infested treatment at 15.23 g m²/day. Net photosynthetic rate is defined based on leaf area and is the increase in dry matter per unit area of the leaf surface per unit time. It is therefore related to leaf area. Table (3) shows the results achieved with the weed-free and herbicide + extract control treatments and their effect on increasing net photosynthetic rate. This aligns with the findings of Sarita *et al*. [27].

The results also indicate significant differences between genotypes and across the two seasons for net photosynthetic rate. The genotype Exad 1133 gave the highest average weight gain of 21.05 g m²/day. This was consistent with the G10Ru genotype, which yielded an average weight gain of 20.46 g m²/day. The lowest average weight gain was observed with the Nwewya R3 genotype, at 15.46 g m²/day. This result is in agreement with Zaman *et al.* [28] and Yonas *et al*. [29].

Furthermore, the interaction results between control treatments and genotypes showed a significant difference. The interaction between a weed-free treatment and the G10Ru genotype resulted in the highest average weight gain of 30.20 g m²/day. The lowest interaction result was observed with the weed-infested treatment and the Buhouth 22 variety, at 11.41 g m²/day.

Table (4) Effect of control treatments, genotypes, and their interaction on the CGR (g.m^2.day) and N.A.R (g.m^2.day).

CGR (g.m^2.day)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	39.00	28.33	36.67	26.00	53.00	36.60
Nwewya R3	34.67	31.67	43.67	25.33	40.67	33.40
G10Ru	33.67	37.67	33.67	19.33	55.67	38.00
ACSD 1133	38.67	34.00	49.00	34.67	48.33	40.93
ASAD 59	37.00	29.00	40.33	23.33	39.00	33.73
Mean	36.60	32.13	38.87	25.73	47.33	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	2.921		1.429		0.726	
N.A.R (g.m^2.day)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	20.58	15.44	16.37	11.41	22.10	17.18
Nwewya R3	14.04	15.55	17.14	14.27	16.33	15.46
G10Ru	16.45	18.92	17.29	19.41	30.20	20.46
ACSD 1133	23.30	16.92	24.78	17.43	22.84	21.05
ASAD 59	15.18	17.45	21.87	13.62	17.60	17.14
Mean	17.91	16.86	19.49	15.23	21.81	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	0.844		1.207		2.515	

Chlorophyll SPAD Content:

The results in Table (5) indicate significant differences between the control treatments only for the chlorophyll SPAD content trait. The weed-free treatment gave the highest mean SPAD value of 48.74. This was followed by the herbicide + extract treatment, the herbicide + extract treatment, with mean SPAD values of 46.83, 46.41, and 42.65, respectively. There was no significant difference between these treatments. The lowest mean SPAD value was observed in the weed-free treatment, at 41.58. This result is consistent with El-Metwally *et al*. [30] and Yonas *et al*. [29].

Number of Tillers/m²:

The results in Table (5) show significant differences between the different control treatments for the number of tillers/m². The weed-free treatment gave the highest average for this trait, reaching 418.8 tillers/m². Meanwhile, the treatments (herbicide + extract, herbicide only, and extract only) gave averages of 445.9, 384.1, and 376.9 tillers/m², respectively, with no significant difference between them. The weed-infested treatment gave the lowest average for this trait, at 338.4 tillers/m². These results indicate that weeds reduce the number of tillers per unit area by competing for the crop's various growth requirements. The absence or reduction of accompanying weeds allows the crop to grow without environmental stress. This is reflected in increased photosynthetic efficiency and, consequently, good crop performance, especially during the tillering stage. Which This is one of the most important and early stages in crop growth, and it should be accompanied by the absence or reduction of weeds. This has a positive effect on increasing the number of ears, and it agrees with the findings of Khudur *et al*. [14] and Hammood *et al*. [16].

The results also showed significant differences between the genotypes in the number of tillers/m² trait. The Nwewya R3 genotype exhibited the highest average tiller count of 465.3 tillers/m², while the G10Ru genotype had the lowest average tiller count of 294.0 tillers/m². The variation in tiller count among the genotypes may be attributed to differences in their genetic makeup and their ability to utilize environmental conditions to produce metabolites. These metabolites support tiller growth and increase their number per unit area. Tillering is a trait linked to genotype and is affected to varying degrees by the surrounding environment. This finding is consistent with the results of Al-Zubaidi [22] and Fadala and Al-Tahir [31].

The results also showed differences between the control treatments and the genotypes. Significantly, the interaction between them was significant. The highest average interaction between a weed-free treatment and the Nwewya R3 genotype was 513.3 tillers/m², while the lowest average interaction for this trait was observed between a weed-infested treatment and the G10Ru genotype, with an average of 216.4 tillers/m².

Table (5) shows the effect of control treatments, genotypes, and their interaction on the chlorophyll content (SPAD) and number of tillers (tillers/m²).

chlorophyll content (SPAD)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	47.47	43.93	45.73	40.33	48.50	45.19
Nwewya R3	44.27	42.87	43.60	41.23	49.00	44.19
G10Ru	48.33	46.80	51.17	39.73	47.77	46.71
ACSD 1133	44.07	45.23	48.10	46.33	47.77	46.30
ASAD 59	47.93	43.33	45.57	40.27	50.90	45.64
Mean	46.41	44.47	46.83	41.58	48.74	

L.S.D$_{0.05}$	Treatments		Varieties		Interaction	
	2.656		N.S		N.S	
Number of tillers (tillers/m²)						
Varieties	**Treatments**					
	Herbicide	**Rey Extract**	**Herbicide + Extract**	**Weedy check**	**Weed free**	**Mean**
Buhooth22	419.6	371.2	417.5	319.2	456.1	396.7
Nwewya R3	435.8	462.1	461.2	454.2	513.3	465.3
G10Ru	317.5	286.2	307.5	216.4	344.4	294.4
ACSD 1133	355.0	371.4	344.2	344.6	375.8	358.2
ASAD 59	392.5	393.3	398.5	357.5	404.2	389.2
Mean	384.1	376.9	385.8	338.4	418.8	
L.S.D$_{0.05}$	**Treatments**		**Varieties**		**Interaction**	
	20.66		17.77		47.47	

Conclusions

From the results obtained, it is clear that the control treatments of herbicide and rye extract, as well as weed removal, had a significant effect on improving the phenological characteristics of the genotypes included in the study, which is reflected in increased yield and its components. Furthermore, differences were found in the response of the genotypes and their interaction with the various control treatments, as well as the ability of these genotypes to compete with weeds. This is an important characteristic in agricultural production, as a competitive genotype helps reduce the amount of herbicide required, thus positively impacting production costs and the environment in general.

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استجابة صفات النمو الفينولوجية لبعض التراكيب الوراثية من الحنطة لمنافسة الادغال تحت تأثير معاملات مكافحة مختلفة

حازم حسين فرهود الجابري[1]، شيماء ابراهيم محمود الرفاعي[2] وسهاد مذكور عبد الصاحب الصافي[3]

[1و2]قسم المحاصيل الحقلية، كلية الزراعة، جامعة المثنى، العراق.

[3]قسم المحاصيل الحقلية، كلية علوم الهندسة الزراعية، جامعة بغداد، العراق.

الخلاصة

اجريت تجربة حقلية في محطة الابحاث الثانية –كلية الزراعة- جامعة المثنى (2كم عن مركز مدينة السماوه) خلال الموسم الشتوي 2024-2025 . هدفت التجربة معرفة استجابة صفات النمو الفينولوجية لبعض التراكيب الوراثية من الحنطة لمنافسة الادغال المرافقة تحت تأثير معاملات مكافحة مختلفة، باستعمال تصميم القطاعات الكاملة المعشاة RCBD بترتيب الالواح المنشقة وبثلاث مكررات ، تضمنت الالواح الرئيسية معاملات المكافحة وهي (مبيد Timeline Trio 1.5 لتر.هـ$^{-1}$ و مستخلص الشيلم 18 لتر. هـ$^{-1}$ و المبيد 750 مل. هـ$^{-1}$ + مستخلص الشيلم 9 لتر.هـ$^{-1}$ اضافة لمعاملة المدغلة ومعاملة خالية من الادغال) و تضمنت الالواح الثانوية التراكيب الوراثية (Buhooth22 و Nwewya R3 و G10Ru وACSAD 1133 و ACSAD 59) ، اظهرت النتائج ان معاملة المبيد فقط حققت اقل كثافة عددية بلغت 17.07 نبات م^{2} ووزن جاف بلغ 24.14 غم م^{2} واعلى بنسبة تثبيط بلغت 92.12% وعدد الايام من التزهير حتى النضج بمتوسط بلغ 53.33 يوما ولم تختلف عن معاملة مبيد+ مستخلص في الوزن الجاف للأدغال قياسا بالمعاملة المدغلة التي سجلت اعلى كثافة لعدد الادغال 165.33 نبات م^{2} واعلى وزن جاف للأدغال 298.47 غم م^{2} ، كما حققت معاملة مبيد+ مستخلص اعلى متوسط لعدد الايام 50% تزهير بمتوسط بلغ 97.67 يوماً، وحققت معاملة خالية من الادغال اعلى متوسط لارتفاع النبات 103.75 سم و LAI 2.215 و CGR 47.33 غم.م^{2}.يوم وN.A.R 21.81 غم.م^{2}.يوم وSPAD 48.74 SPAD وعدد الاشطاء 418.8 شطأ م^{2} ، اما التراكيب الوراثية حقق التركيب اكساد59 اقل كثافة ادغال بلغ 42.60 نبات م^{2} واقل وزن جاف للأدغال 68.58غم م^{2} واعلى متوسط لارتفاع النبات 103 سم ، بينما اعطى التركيب بحوث22 اعلى متوسط لنسبة التثبيط بلغ 53.26% وعدد الايام من التزهير حتى النضج والتي بلغت 54.86 يوماً وLAI بلغ 2.185 ، اما التركيب Nwewya R3 فقد حقق اعلى متوسط لعدد الايام حتى50% تزهير بمتوسط بلغ 96.73 يوما وعدد الاشطاء التي بلغت 465.3 شطأ م^{2} . ان اختلاف التراكيب الوراثية في معظم الصفات الفينولوجية قد يكون احد المعايير في تحديد اختلاف هذه التراكيب في قابليتها على منافسة الادغال.

كلمات افتتاحية: النمو الفينولوجي، القمح، استجابة الأنماط الوراثية، منافسة الأعشاب الضارة.