Plant Archives Vol. 19, Supplement 2, 2019 pp. 638- 641 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF SPERMIDINE AND ORGANIC FERTILIZER IN SOME GROWTH TRAITS FOR WHEAT (*TRITICUM AESTIVUM* L.) CULTIVAR (IPA 99)

Sabiha Hassoon Kadhim and Anaam Hameed Mohseen
Al-Musaib Technical College, University of Al-Furat Al-Awsat Technical, Iraq

Abstract

The experiment was conducted in the field of Ibn Al-Bitar preparatory school in Al-Husseiniya, 12 km north of Karbala province for the winter season (2016-2017) to study the effect of spermidine and Organic Fertilizer in Some Growth traits for Wheat cultivar (IPA 99) according to the arrangement of split-plots, with three replicates within the Randomized Complete Block Design (RCBD). The main plots included organic fertilizer at four levels (0, 2, 4, 6 tons.ha^{-1}), which are symbolized by (A1, A2, A3), respectively. The sub-plot contained on the spermidine concentrations (0, 25, 50, 75 mg.L^{-1}), which are symbolized by (S0, S1, S2, S3). The spraying was conducted using a 20 L sprayer in two stages (the beginning of the Tillering stage and booting stage). The study showed the following results:

1. The Fertilizer treatment at level (6 tons.ha^{-1}) was excelled in the traits of plant height, the area of flag leaf and the leaves content of chlorophyll by giving it (92.64 cm, 53.15 cm^2, 42.01 spads), respectively.
2. The concentration of spermidine (75 mg.L^{-1}) was excelled for all traits, especially for the above traits, the duration of grain filling and a number of tillers per plant by giving it (86.61 cm, 50.30 cm^2, 40.23 spads, 6.13, 37.00 days), respectively.
3. The interaction treatment (6 tons.ha^{-1} × 75 mg.L^{-1}) was excelled for all traits by giving it (99.67 cm, 58.93 cm^2, 7.33, 42.73, 39.67 days) for plant height, the area of flag leaf, number of tillers per plants, the leaves content of chlorophyll, and the duration of grain filling, respectively.

***Keywords*:** organic fertilizer, spermidine, wheat.

Introduction

Wheat crop (*Triticum aestivum* L.) is considered one of the most important strategic crops for their high nutritional value and containing it on a Gluten responsible for the quality of bread, as well as containing fat, vitamins and some mineral salts as well as the amino acids needed by humans and depends heavily on them in its food [Tony, 2006]. Wheat plays an important and major role in world food security [Cakmak, 2008]. Considering the annual increase in the population, we see the increasing need for this crop year after others. This requires constantly seeking to maintain the balance between the production of the world and the demand through the search for new scientific methods to develop the cultivation of this crop and the exploitation of the available possibilities and means in the best method, such as the use of organic agriculture, which leads to the exclusion or avoid the use of chemical fertilizers and reduce diseases to obtain high soil of production, it does not contain any contaminated traces from Metallic residues for chemical fertilizers [Costigan, 2001]. Organic fertilizer has an important role in improving chemical and physical soil traits such as permeability, porosity, movement of water, nutrients and air in the soil, root spread and penetration, moisture retention and soil temperature, affecting plant productive for crop [Abu Nuqta, 2004]. Therefore, the study aims to use organic fertilizer (sheep manure) in the productivity of wheat and guide the world to clean cultivation (organic cultivation) and do not use chemicals fertilizer. The use of plant growth regulators is considered one of the common methods in modern agriculture because it is used in very low concentrations. Therefore, it is economic, it encourages the plant to exploit its potential in the use of nutrients with high efficiently, The use of growth regulators helps wheat plant tolerate temporary dehydration when rainfall does not occur, as well as, resisting the early senescence of leaves [Al-Shammari, 2007]. Spermidine returns to the polyamines group, Contains in combination two or more amino groups and because of the nature of positive ions for polyamines that are freely or in combination with phenolic acids, low-weight compounds, or protein or nucleic acids [Childs *et al*., 2003]. where the use of growth regulators commercially in the cultivation of industrialized countries contributed to the development of agriculture well [Al-Hamdani *et al*., 1999]. Therefore, this study aims to:

1- Studying the effect of Spermidine in obtaining the best averages of growth for the studied traits.

2- Determining the best level of organic fertilizer to reach high averages of the studied traits.

3- Studying the interaction of the two experiment factors to obtain the highest averages of growth and production at the lowest levels as a result of the effect of interacting these factors.

Materials and Methods

The experiment was conducted in the field of Ibn Al-Bitar preparatory school in Al-Husseiniya, 12 km north of Karbala province for the winter season (2016-2017) in silty clay. The land of the experiment was plowed two perpendicular plowings by the moldboard plow, it was then smoothed, settled and divided into 16 plots, with dimensions of (4 x 3 m). Each plot contains (24) lines and the length of one line (4 m), the distance between the line and another (15 cm), and the plots were separated by banks with width of (0.5 m), the seeds were obtained from the Department of Agricultural Research in Abu Ghraib, which cultivated manually in the form of lines at (20-11-2016), the harvest process was conducted after the plant reaching full maturity stage on 20-5-2017. The experiment was conducted in the order of Split-Plots, with three replicates, in the Randomized Complete Block Design (RCBD). The main plots included organic fertilizer at four levels (0, 2, 4, 6 tons.ha^{-1}), which are symbolized by (A1, A2, A3), respectively. The sub-plot contained on the spermidine concentrations (0, 25, 50, 75 mg.L^{-1}), which are symbolized by (S0, S1, S2, S3). The spraying was conducted using a 20 L sprayer in two stages

(the beginning of the Tillering stage and booting stage). The sheep manures were placed in a hole after covering the hole with polyethylene. It was then wetted, 10 kg of urea was added to activate the microorganisms for 45 days. It was opened from time to time, wetted, turned and then extracted from the hole before cultivating.

Table 1: Percentage of some properties of used organic fertilizer in the experiment

Organic matter content	Zn ppm	Mn ppm	Fe ppm	Mg%	Ca%	K%	P%	N%
54.14	17	164	975	0.44	0.40	0.72	0.65	**1.85**

The Studied Traits

(i) Plant height (cm):

It was calculated from average of (10) readings for 10 plants within the experimental unit from the surface level of the soil to the apical of spike for the main tiller without Awn where the main stems were marked using colored plastic rings at the beginning of the Tillering stage [Wiersma *et al*., 1986] and it was measured when flowering was completed.

(ii) The area of the flag leaf (cm^2):

It was calculated from the average of (10) flag leaves for 10 plants for main stems for each experimental unit at the appearance of 50% flowering according to the following equation:

The area of the flag leaf = The length of the flag leaf × The width of the leaf at the middle × 0.95 [Thomas, 1975].

(iii) Number of spikes in plant

It was calculated manually for an area of (1 m^2) by taking 10 plants randomly for each experimental unit at the harvest stage.

(iv) The leaves content of chlorophyll (SPAD):

Total chlorophyll content was estimated by the chlorophyll meter as an average of three readings for five leaves randomly from the top, middle and bottom of the leaf to five plants from each experimental unit after the flowering stage was complete [**Peng *et al*., 1993**].

(v) The Duration of Grain Filling (GFD):

It was calculated by days from fertilization and inoculation until the physiologic maturity, where five of the main stems were taken during each week [Imrie, 1995].

Results and Discussion

Plant Height (cm):

Table (2) shows that the organic fertilizer has a positive effect on the average plant height, where the A3 treatment (6 tons.ha^{-1}) was excelled on the rest of the treatments by giving it the highest average of this trait amounted to (92.64 cm), while the lowest average for the trait of Plant height at the control treatment, which amounted to (73.68 cm). The reason can be attributed to the fact that the addition of organic matter has led to an increase in nutrient elements availability for absorption by the plant, which has led to the reduction of soil pH as well as contributed to the increase of cell division and its elongation and increases growth and development, thus increase the length of the internodes which in turn lead to increase plant height and this agrees with [Naji, 2011]. This trait was also affected by treatment with spermidine, where gave the highest average amounted to (86.61 cm) at the concentration of (75 mg.L^{-1}), while the lowest average was at the control treatment which amounted to (76.69 cm), because the growth regulator contained in it composition on two or more active groups with high biological effects and multiple roles in physiological processes in the plant. It exists in all parts of the plant, thus increasing the plant height, this result agrees with [Kusano *et al*., 2008]. The bi-interaction between the organic fertilization and spraying with spermidine had a significant effect on the plant height. The treatment of A3S3 was significantly excelled by giving it the highest average amounted to (99.67 cm) compared to the treatment of A0S0 (control treatment) which gave the lowest average amounted to (71.53 cm).

Table 2: Effect of organic fertilizer and spermidine and their interactions in plant height (cm).

Fertilizer	Spermidine				Average of Fertilizer
	S_0	S_1	S_2	S_3	
A_0	71.53	73.73	74.37	75.10	73.68
A_1	74.67	75.83	77.17	78.33	76.50
A_2	75.33	85.20	87.03	93.33	85.23
A_3	85.23	92.67	93.00	99.67	92.64
Average of spermidine	76.69	81.86	82.89	86.61	
LSD 0.05	**Organic Fertilizer**		**Spermidine**		**Interaction**
	1.19		1.26		2.38

The Area of Flag Leaf (cm^2)

Table (3) shows that there are significant differences between the average area for the flag leaf paper as a result of organic fertilization, where the A3 treatment (6 tons.ha^{-1}) was excelled on the rest of the treatments by giving it the highest average of this trait amounted to (53.15 cm^2), while the lowest average for the trait of Plant height at the control treatment, which amounted to (42.47 cm^2). The reason may be due to the organic fertilizer content of the essential nutrient elements, which in turn play an important role in the expansion of the area of the flag leaf, and this result agrees with the [Ibrahim, 2008]. As for spraying with spermidine, there were significant differences between the average area of the flag leaf, where the treatment S3 (75 mg.L^{-1}) was significantly excelled by giving it (50.30 cm2), while the lowest average was at control treatment which amounted to (44.97 cm^2). This is due to the fact that polyamines compounds participate in many metabolic processes such as growth, development and biochemical reactions, and treating with it led to increasing the area of flag leaf for the wheat plant, this result agrees with [Heshmat *et al*., 2013]. As for the interaction, the interaction treatment A3S3 (6 tons.ha^{-1}, 75 mg.L^{-1}) gave the highest average area of the flag leaf amounted to (58.93 cm^2), while the control treatment (A0S0) gave the lowest average amounted to (41.47 cm^2).

Table 3: Effect of organic fertilizer and spermidine and their interactions in the area of flag leaf (cm^2).

Fertilizer	Spermidine				Average of Fertilizer
	S_0	S_1	S_2	S_3	
A_0	41.47	42.31	42.63	43.45	**42.47**
A_1	43.23	44.81	46.07	46.49	45.15
A_2	44.67	50.64	51.10	52.32	49.68
A_3	50.50	51.50	51.67	58.93	53.15
Average of spermidine	44.97	47.31	47.87	50.30	
LSD 0.05	**Organic Fertilizer**		**Spermidine**		**Interaction**
	0.37		**0.91**		1.68

Number of active tillers per plant

Table (4) shows that treating with organic fertilizer has a significant effect on the average number of active tillers per plant, where the treatment A3 (6 tons.ha^{-1}) gave the highest average amounted to (6.23 spikes) compared to the control treatment which gave the lowest average amounted to (5.11 spikes) for one plant. The reason for the low number of spikes in one plant at the control treatment due to the lack of provision of nutrient elements for the growth of the plant, which affected in this trait, on the contrary, we note the increase in the number of spikes for one plant in other fertilization treatments due to the availability of nutrient elements in the roots region, Which contributed to the formation of lateral buds and the growth and development of crown roots and reduce the competition between the formed tillers by nutrients, Which led to its survival and the completion of its growth effectively, and this result agrees with [Ibrahim, 2008]. The same table showed the effect of spraying with spermidine in the average number of active tillers. The treatment S3 (75 mg.L^{-1}) gave the highest average amounted to (6.13 spike) compared to the control treatment S0 which gave the lowest average amounted to (5.30 spike). The tillers in wheat are affected by crop service operations, prevailing environmental conditions, plant density, and cell division when spraying with growth regulators. This result agrees with [Hussein *et al*., 2015]. As for bi-interaction showed significant differences between organic fertilizer and spraying with spermidine. The treatment of A3S3 (6 tons.ha^{-1} and 75 mg.L^{-1}) showed the highest average (7.33 spike) compared with other treatments, while the lowest average at the treatment A0S0 amounted to (4.83 spikes).

Table 4: Effect of organic fertilizer and spermidine and their interactions in the number of active tillers per plant

Fertilizer	Spermidine				Average of Fertilizer
	S_0	S_1	S_2	S_3	
A_0	4.83	4.97	5.23	5.40	5.11
A_1	5.27	5.50	5.57	5.70	5.51
A_2	5.33	5.73	5.80	6.07	5.73
A_3	5.77	5.83	6.00	7.33	6.23
Average of spermidine	5.30	5.51	5.65	6.13	
LSD 0.05	**Organic Fertilizer**		**Spermidine**		**Interaction**
	0.24		**0.26**		**0.49**

The leaves content of chlorophyll (SPAD)

Table (5) shows that treating with organic fertilizers has a significant effect on the leaves content of the chlorophyll. where the treatment of A3 (6 tons.ha^{-1}) was excelled by giving it the highest average amounted to (42.01 SPAD units) compared to the control treatment A0 which gave the lowest average amounted to (32.39 SPAD units). The reason for role of organic fertilizer may be due to increase nutrient availability, which increases the absorption capacity, especially the nitrogen element, which in turn increases the formation of chlorophyll dye, as well as increases the surface area of the leaf in the wheat plant and the leaves content of chlorophyll, this result agrees with [Kumar *et al*., 2008]. The spraying with spermidine from the leaves content of chlorophyll, where the treatment S3 (75 mg.L^{-1}) was excelled by giving it the highest average amounted to (40.23 SPAD units) compared to the control treatment which gave the lowest average amounted to (35.18 SPAD units). The reason for the increase in the chlorophyll dye is that the addition of spermidine leads to improve the leaves content of chlorophyll and stimulate its construction as well as the role of large growth regulators by increasing the leaf area and the leaves content of chlorophyll when spraying it at the beginning of the tillers and these results agree with [Hussein *et al*., 2008]. The same table showed that the interaction between organic fertilizer and spraying with spermidine had a significant effect on the leaves content of chlorophyll. The interaction treatment of A3S3 (6 tons.ha^{-1} and 75 mg.L^{-1}) recorded the highest average amounted to (42.73 SPAD unit) while the treatment A0S0 (the control treatment) gave the lowest average amounted to (30.30 SPAD unit).

Table 5: Effect of organic fertilizer and spermidine and their interactions in the leaves content of chlorophyll (SPAD)

Fertilizer	Spermidine				Average of Fertilizer
	S_0	S_1	S_2	S_3	
A_0	30.30	31.33	32.47	35.47	32.39
A_1	32.67	38.35	39.34	40.13	37.62
A_2	37.00	40.67	41.51	41.60	40.44
A_3	40.76	42.23	42.30	42.73	42.01
Average of spermidine	35.18	38.14	38.91	40.23	
LSD 0.05	**Organic Fertilizer**		**Spermidine**		**Interaction**
	1.23		**1.04**		**2.06**

The duration of the grain filling (day)

Table (6) shows that there are significant differences in the average grain filling due to organic fertilization. where the treatment A0 gave the highest average for the duration of the grain filling amounted to (36.25) days. The duration of the grain filling (maturation) required a number of days to reach the dry matter transfer and accumulation it, While the lowest average was at the treatment A3 amounted to (32.58 days). This is due to the role of organic fertilizers in containing a wide range of compounds and micro and macronutrients, which contribute directly or indirectly to the growth and development of the plant are encouraging growth because they contain the nutrient elements and important to the plant, which reflected positively in increasing the duration of the grain filling. The same table shows significant differences when spraying with spermidine, where the highest average duration of the grain filling at the control treatment amounted to (37.00) days, the fullest time required to reach the maturity of the physiologic, while the treatment A3 gave the lowest average for the duration of the grain filling amounted to (31.42) days. The reason may be due to the fact that the seeds treated with the growth regulator started with an average filling higher compared to other treatments due to the improvement of most traits of the vegetative growth such as the area of the flag leaf. It is also due to that the growth regulator led to delayed the leaves senescence. Therefore, the plant retained an effective green leaf area in terms of photosynthesis and a longer period in increasing the production of carbohydrates after the fertilization (during the duration of grain filling), this may be useful in increasing the production of crops and this result agrees with [Austin, 1982]. The table showed significant differences in the traits of the duration of grain filling between organic fertilization treatments and spraying with spherminide which gave the highest average at A0S0 treatment amounted to (39.67) days, while the A3S3

interaction treatment gave the lowest average duration of grain filling amounted to (30.33 days).

Table 6: Effect of organic fertilizer and spermidine and their interactions in the duration of the grain filling (day)

Fertilizer	Spermidine				Average of Fertilizer
	S_0	S_1	S_2	S_3	
A_0	**39.67**	37.67	35.67	32.00	36.25
A_1	37.33	35.67	34.33	32.00	34.83
A_2	36.33	35.33	34.00	31.33	34.25
A_3	34.67	33.00	32.33	30.33	32.58
Average of spermidine	**37.00**	35.42	34.08	31.42	
LSD 0.05	**Organic Fertilizer**		**Spermidine**		**Interaction**
	1.16		**0.92**		1.85

Conclusions

In this study we conclude the following:

1. The level of fertilizer (6 tons.ha^{-1}) was excelled for all studied traits.
2. The treatment of spermidine concentration (75 mg.L^{-1}) was excelled to all studied traits.
3. The superiority of the interaction treatment (6 tons.ha^{-1} × 75 mg.L^{-1}) for all traits by giving it (99.67 cm, 58.93 cm^2, 7.33, 42.73, 39.67 days) for the traits of plant height, the area of flag leaf, number of spikes per plant, the leaves content of chlorophyll and the duration of grain filling, respectively.
4. The use of organic fertilizer improves the properties of physical and chemical soil.
5. Increasing the duration of grain filling led to a significant increase in the grain yield.

Recommendations

The researcher suggests the following:

1. the use of organic fertilizer (6 tons.ha^{-1}) and the concentration of spermidine (75 mg.L^{-1}) to give it a high yield of wheat.
2. Continue studies and research for more than one season and use other levels to know the best level of organic fertilizers.
3. Continue studies in the field of spermidine to determine the ideal concentration, which leads to an increase in the yield and its components.

References

Tony, W. (2006). Growing Food. A Guide to Food Production, pp. 333

Cakmak, I . (2008). Enrichment of cereal grain with zinc. Agronomic or Genetic Biocortific. 302: 1-17.

Costigan, P.A. (2001). Report of organic farming Ministry of Agriculture Fisheries and Food (MAFF). 19. September. London.

Abu Nuqta, F. (2004). Principles in Soil Science, University of Damascus, Syria. P. 281.

Al-Shammari, M.Z.F. (2007). Effect of the cultivar, Gibberellin concentration and spraying period in the growth and production of active substances for Fenuqreek plant. Ph.D. thesis, College of Education Ibn al-Haytham, University of Baghdad, Iraq.

Childs, A.C.; Mehta, D.J. and Gerner, E.W. (2003). Polyamines dependent gene Expression. US National Library of medicine national institutes of health. 60(7): 1394-406.

Al-Hamdani, Q.M. and Mohammed, S.F. and Al-Roumi, I.A. (1999). Effect of Some Growth regulators and Age stage on Growth and fruits set in Beans. Journal of Mesopotamia, 31(1): 102-110.

Wiersma, D.W.; Oplinger, E.S. and Guy, S.O. (1986). Environmental and cultivar effects winter wheat response to ethephon plant growth regulator. Agron. J. 78: 761-764.

Thomas, T.C. (1975). Visual quantification of wheat development. Argon. J., 65: 116 – 119.

Peng, S.; Garcia, F.V.; Laza, R.C. and Cassman (1993). Adjustment for specific leaf wheat improves cholorphyll meters estiate of Rice leaf nitrogen Concentration. Agron. J., 85: 987-900.

Imrie, S.E. and Beech, L.K. (1995). Effect of temperature on grain growth and protein accumulation in cultured wheat ears. Aust. J. pl. physiol. 10: 445 – 450.

Naji, F.S. (2011). The response of the wheat crop to organic fertilization and irrigation periods. Master Thesis. Al-Furat Al-Awsat Technical University. Al-Musaib Technical College

Kusano, T.; Berberich, T.T.C. and Takahashi, Y. (2008). Polyamines**:** essential factors for growth and survival. Plantae. 228(3): 367-381.

Ibrahim, M. S. (2008). Effect of irrigation regime, organic and inorganic N fertilizers on wheat yield and its component residual soil nitrate. J. Appl. Sci. Res., 4(8): 1008-1016.

Heshmat, S.A.; Baka, Z.A. and Mickky, B.M. (2013). Does exogenous application of kinetin and spermine mitigate the effect of seawater on yield attributes and biochemical aspects of grains. J . of stress Physiol. Biochem. 21-34.

Hussein, H.T. and Al-Baldawi, M.K.H. (2015). Effect of some growth regulators, plant extracts and its stages of spraying in the duration and average of grain filling and grain yield for the cultivars of bread wheat Triticum aestivum L. Ph.D. thesis, College of Agriculture, University of Baghdad. Iraq.

Kumar, K.C.; Halepyati, A.S. and Desai, B.K. (2004). Effect of organic manure and micronutrient on chlorophyll content and leaf area duration of wheat. Indian J. of Pl. Physiol. 9(1): 98-99.

Austin, R.B. (1982). Crop characteristics and the potential yield of wheat. J. Agric. Sci. Camb., 98: 447-453.