Effect of foliar for Mineral and Biological Fertilizers on the Growth and Yield of tow Bread Wheat Cultivars (*Triticum aestivum* L.).

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Abstract

Wheat (*Triticum aestivum* L.) is widely cultivated around the world, particularly in Asia, and is considered the most important grain crop globally due to its significant contribution to human diets, providing 21% of caloric intake and 20% of protein. Despite its importance, wheat faces productivity challenges per unit area, often due to inadequate or incorrect use of fertilizers. Thus, there is a need to identify the most effective fertilizers to enhance productivity. During the 2021-2022 season, a field study was carried out to study the influence of various foliar mineral and biofertilizers on the growth and yield of two bread wheat cultivars at two locations in Nineveh Governorate: "Abbasiyya" in Tilkaif district and "Bartella". The study included two factors: fertilizers at five levels ("NPK", KINGLIFE + POLYAMIN, "ALGAREN TWIN + POLYAMIN", "HASCON + POLYAMIN", and "Control") and two wheat Cultivars ("Babel 113 "and "Ozkan"). The experiment was designed using the RCBD [randomized complete block design] within spilt plots arrangement with three replications , and the means were compared using the L.S.D under significant level 0.05. The data indicated that the "NPK" treatment significantly excelled in terms of the tillers number, spikes number, and grains yield, recording (484.02 and 440.34 tillers m^{-2}, 472.766 and 428.65 spikes m^{-2}, and 764.98 and 692.26 g m^{-2}) for the respective traits at both locations. The "KINGLIFE + POLYAMIN" and "HASCON + POLYAMIN" treatments also showed good results in most traits. The study revealed no significant differences between the Cultivars in most traits. Although the "NPK" treatment increased yield and its components, the high cost of these fertilizers compared to foliar fertilizers, which did not differ significantly in increasing wheat productivity, suggests that using foliar fertilizers is more economically beneficial and achieves better net profit than soil-applied fertilizers.

KEYWORDS: Bread wheat, Fertilizers, Wheat yield, Foliar fertilizers, Agricultural productivity, *Triticum aestivum* L.

Introduction

Wheat (*Triticum aestivum* L.) is one of the crucial grain crops belonging to "*Poaceae"*. It has been cultivated, produced, and improved by humans for thousands of years and continues to be a vital crop to this day [1]. Often referred to as the "King of Grains," wheat plays an essential role in the human diet globally, contributing significantly to daily caloric and protein intake more than any other grain [2]. Over one-third of the world's population relies on wheat as a primary food source [3]. With increasing population density and growth, the FAO predicts the global population to reach 9 billion by 2050, necessitating a doubling of crop production to meet future food demands [4]. According to global statistics, the total grain production in 2023/2024 is expected to be around 784.91 million metric tons [5].

Despite Iraq being one of the original homelands where wheat was discovered and having all the essential factors for successful cultivation, its productivity rate remains low compared to the global average. Agricultural statistics indicate that the total wheat cultivation area in Iraq for the 2022-2023 season was 8,420,000 donums, a 12.5%

increase compared to the previous season, which was 7,487,000 donums. Wheat production for the 2022-2023 season reached 4,248,000 tons, a 53.6% increase from the 2021-2022 season's total of 2,750,000 tons. The average productivity per donum, based on the total cultivated area, was 504.5 kg for the winter season of 2022-2023, a 36.6% increase from the previous season's average of 369.3 kg [6].

Fertilization practices, including the addition of nutrients to the soil as fertilizers, are critical factors in meeting plant nutrient requirements. The addition of nutrients, particularly micronutrients, is vital for growth and directly impacts yield quality and production due to their essential role in many biological processes within the plant [7].

The decline in wheat productivity is primarily due to soil fertility depletion and reduced fertilizer use, with some soil nutrients being lost due to erosion by water or wind. Consequently, mineral fertilizers, notably, those incorporating nitrogen, phosphorus, and potassium have been traditionally employed to enhance soil quality and fertility, as well as wheat and other crop production, given that these nutrients are the most limiting in almost all soils [8]. Foliar fertilization in wheat crops is also important for directly supplying nutrients to plants through their leaves, providing a quick and effective solution to compensate for nutrient loss and stimulate plant growth, especially during critical growth periods [9].

Materials and Methods

During 2021-2022 season, a field study was performed to assess the impact of specific foliar mineral and biofertilizers on the growth and yield of two bread wheat cultivars across two locations “Abbasiyya” in Tilkaif district and “Bartella”, both within Nineveh Governorate. The study comprised two factors: fertilizers at five levels (“NPK”, KINGLIFE + POLYAMIN, “ALGAREN TWIN + POLYAMIN”, “HASCON + POLYAMIN”, and “Control”), [all fertilizers details are show in Table 1], and two wheat Cultivars (“Babel 113” and “Ozkan”).

1. *Agricultural Operations*

Study field was prepared for cultivation, and sowing was carried out mechanically using a seed drill on November 28, 2021, at the “Abbasiyya” location and on November 29, 2021, at the “Bartella” location. Supplementary irrigation was utilized, and harvesting took place on May 29, 2022, at “Abbasiyya” and on May 30, 2022, at “Bartella”.

2. *Experimental Design*

The experiment followed a “split plot ” designwithin a randomized complete block design [RCBD] with three replications where the cultivars took into main plots, and fertilizers kinds took into sub-plot. Each replication contained ten experimental units, making a total of thirty treatments. The main plots were assigned to fertilizers, while the subplots were assigned to Cultivars. Data analysis was performed using the L.S.D method for mean comparison with the GenStat V12 program.[10]

Table (1) Fertilizer Installation Details:

Fertilizer Name	Dose	Fertilizer components
HASCON 32 [Mineral fertilizer]	6 - 10 L ha^{-1}	Total nitrogen 41.6% w/v, Nitrogen in the form of nitrate 10.4% w/v. Nitrogen in the form of ammonia 10.4% w/v. Nitrogen in the form of urea 20.8% w/v. B 0. 0.065% w/v. Cu "EDTA" 0.013% w/v. Mn "EDTA" 0.13% w/w. Mo 0.0013% w/v, Zn "EDTA" 0.013% w/v.
ALGAREN TWIN [Biofertilizer]	2 - 5 L ha^{-1}	Organic nitrogen 2.3% w/v., Organic carbon 16.1% w/v., Organic matter 34.5% w/v.
KINGLIFE [Mineral fertilizer]	4.5 - 5 kg ha^{-1}	N total 12%., Nitrogen in the form of nitrate N 2%., Nitrogen in the form of ammonia N 10%., p2o5 48%., Potassium oxide (k2o) 8%., Boron 0.05%., (Fe) "EDTA" %0.1., (Mn)" EDTA" %0.5., (Mo) "EDTA" %0.01., (Zn) "EDTA" 0.01%.
POLYAMIN [Organic fertilizer]	15–300 g. 100 L^{-1}	Organic Nitrogen 14.1%, Organic carbon 39.4%, Organic matter 78.8%, Amino Acids 90%.

Results and Discussion

1 - *Plant Height (cm)*:

The results from Table (2) for the results at the "Abbasiyya" location demonstrate a notable superiority of all fertilizer treatments compared to the control, which noted the bottom value of (26.53) cm. The "HASCON + POLYAMIN" treatment noted the top value of (85.14) cm, which was not significantly different of the other fertilizer treatments used in the study. At the "Bartella" location, all fertilizer treatments also achieved considerably better results than "Control" treatment, which noted the bottom value of (57.79) cm. The "KINGLIFE + POLYAMIN" treatment reached the greater plant height of (80.08) cm, which did not show a significant difference of the other fertilizer treatments used in the study. The observed increase may be attributed to the presence of polyamine, which provides good resistance to plants against various stresses, including drought. Additionally, the "HASCON" fertilizer contains numerous nutrients that contributed to the increase observed at the Abbasiyya location. At the Bartella location, a similar effect was noted with the "KINGLIFE" fertilizer, which contains chelated micronutrients that align with the function of polyamine. This observation is agreed with the findings of [11–15].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show no significant differences between the Cultivars, with "Babel 113" and "Bartella" recording 78.96 cm and 76.53 cm, respectively. These findings align with those of [16, 17], who confirmed that the variation in plant height among wheat Cultivars is primarily due to genetic factors, which are the main influence on this trait. At the "Bartella" location, the cultivar "Ozkan" noted the top value of (75.81) cm, while "Babel 113" noted the bottom value of (71.01) cm. The difference in plant height between the two varieties may be attributed to the variation in their gibberellin and auxin hormone content, which are responsible for cell elongation and expansion, thus affecting plant height. Genetic factors also play an effective role in influencing the height of wheat varieties. These results align with previous findings.[18]

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "HASCON + POLYAMIN" treatment with the "Babel 113" cultivar noted the top value of 88.85 cm, while the "Control" treatment with

the same cultivar noted the bottom value of (62.16) cm. At the "Bartella" location, the "KINGLIFE + POLYAMIN" treatment noted the top value of 83.44 cm, while the "Control" treatment with the "Babel 113" cultivar noted the bottom value of (56.28) cm.

2 - *Flag Leaf Area (cm²)*:

The data from Table (2) for the "Abbasiyya" location indicate a significant different of all fertilizer treatments greater than "Control" treatment, which reached the lowest mean (21.756) cm². The "NPK" treatment noted the top value of (33.10) cm², which was not significant difference from the "KINGLIFE + POLYAMIN" and "HASCON + POLYAMIN" treatments, recording (32.04) cm² and (32.17) cm², respectively. At the "Bartella" location, all fertilizer treatments also significant different than the "Control" treatment, which noted the bottom value of (20.06) cm². The treatment (KINGLIFE + POLYAMIN) was recording the highest flag leaf area of (31.14) cm², which was not significantly different from the "NPK" and "HASCON + POLYAMIN" treatments, which recorded (29.56) cm² and (29.92) cm², respectively. The increase in "flag leaf area" may be attributed to contribution of elements present in both "KINGLIFE" and "HASCON" fertilizers in enhancing cell division, these fertilizers contain micronutrients that are involved in the composition of division enzymes, particularly "Cytokinin", in which nitrogen is a key component. This aligns with the findings of [19].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show no significant differences between the Cultivars, with "Babel 113 "and "Bartella" recording (29.59 and 30.19) cm², respectively. At the "Bartella" location, the cultivar "Ozkan" noted the top value of (28.141) cm², while "Babel 113" noted the bottom value (26.78) cm². The reason may be attributed to competition for nutrients, and genetic factors also play a role. This trait is governed by quantitative genes, as confirmed by previous research. [20]

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (33.81) cm², while the "Control" treatment with the same cultivar reached (21.32) cm². At the "Bartella" location, the "KINGLIFE + POLYAMIN" noted the top value of (30.799) cm², while the "Control" treatment with the "Babel 113" cultivar noted the bottom value of (18.31) cm².

3- *Number of Tillers (tillers m²)*:

The results from Table (2) for the "Abbasiyya" location indicate a significant superiority of all fertilizer treatments over the "Control" treatment, which noted the bottom value of (329.48) tillers m². The "NPK" treatment noted the top value of (489.12) tillers m², which was not significantly different from the "KINGLIFE + POLYAMIN" treatment, which recorded (471.60) tillers m². At the "Bartella" location, all fertilizer treatments also significantly outperformed the "Control" treatment, which noted the bottom value of (331.06) tillers m². The "NPK" treatment noted the top value of (448.77) tillers m², which was not significantly different from the "KINGLIFE + POLYAMIN" treatment, which recorded (429.98) tillers m². The increase in the number of tillers can be attributed to the stimulation of plants by biofertilizers, which enhance cell division. Additionally, the presence of polyamine makes the plants more capable of undergoing these divisions effectively. This result is agreed with [21].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show no significant differences between the Cultivars, with "Babel 113 "and "Bartella" recording (423.45 and 435.45) tillers m², respectively. At the "Bartella" location, no significant differences between the cultivars, with "Babel 113" and "Bartella" recording (404.89 and 441.82) tillers m², respectively. Varieties may exhibit similar abilities to produce tillers due to genetic behavior similarity and inherent genetic nature. Their capacity to produce tillers and response to environmental factors aligns with the findings of [22].

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (489.12) tillers m², while the "Control" with the same cultivar noted the bottom value of (318.0) tillers m². At the "Bartella" location, the "KINGLIFE + POLYAMIN" treatment noted the top value of (448.7) tillers m², while "Control" with the "Ozkan" cultivar noted the bottom value of (331.06) tillers m².

4 - *Number of Spikes (spikes m²)*:

The results from Table (2) for the "Abbasiyya" location indicate a high significant of all fertilizer treatments greater than "Control", which noted the bottom value of (310.02) spikes m². The "NPK" treatment noted the top value of (477.04) spikes m², which was not significantly different from the "KINGLIFE + POLYAMIN" treatment, which recorded (460.63) spikes m². At the "Bartella" location, all fertilizer treatments also significant different with "Control", which noted the bottom value of (326.01) spikes m². The "NPK" treatment noted the top value of (428.65) spikes m², which was not significantly different from the "KINGLIFE + POLYAMIN", which recorded (436.89) spikes m². This increase can be attributed to the enhanced branching at the previously mentioned levels, ultimately leading to the production of spikes [21].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show no significant differences between the Cultivars, with "Babel 113"and "Bartella" recording (414.78) and (425.07) spikes m², respectively. At the "Bartella" location, not significant differences between the cultivars, with "Babel 113"and "Bartella" recording (395.01 and 400.89) spikes m², respectively. This can be attributed to the lack of significant differences between the varieties in terms of tiller number, resulting in no recorded significant differences. These results are consistent with the findings of [23], which indicate a direct relationship between the two traits.

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (477.04) spikes m^{-2}, while the "Control" with the same cultivar noted the bottom value of (310.02) spikes m². At the "Bartella" location, the "NPK" noted the top value of (436.89) spikes m², while the "Control" with the "Ozkan" cultivar noted the bottom value of (322.45) spikes m^{-2}.

5 - *Number of Grains (grains spike $^{-1}$)*:

The results from Table (2) for the "Abbasiyya" location indicate a high significant of all fertilizer treatments greater than "Control", which noted the bottom value of (33.24) grains spike^{-1}. The "NPK" treatment noted the top value of (41.92) grains spike^{-1}, which was not significant different from the "HASCON + POLYAMIN", which recorded (40.95) grains spike^{-1}. At the "Bartella" location, all fertilizer treatments also high significant than the "Control", which noted the bottom value of (32.16) grains spike^{-1}. The "HASCON + POLYAMIN" treatment noted the top value of (41.70) grains spike^{-1}, which was not significantly different from the "NPK" and "KINGLIFE + POLYAMIN" treatments, both recording (39.48) grains spike^{-1}. The increase can be attributed to the presence of polyamine in the treatments, which enhances the colloidal content in plant cells and increases the leaf area of the same treatments, thereby improving photosynthetic efficiency. This, in turn, reflects in the higher grain yield per spike. [14, 19, 21, 24].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show no significant differences between the Cultivars, with "Babel 113"and "Bartella" recording (37.89 and 38.97) grains spike^{-1}, respectively. At the "Bartella" location, not significant were observed between the cultivars, with "Babel 113" and "Bartella" recording (36.78 and 38.99) grains spike^{-1}, respectively. The reason may be due to the similar performance of the two varieties and the different interactions of

genetic factors with environmental conditions [22].

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (42.26) grains spike^{-1}, while "Control" treatment with "Babel 113" cultivar noted the bottom value of (32.61) grains spike^{-1}. At the "Bartella" location, the "NPK" treatment noted the top value of (40.25) grains spike^{-1}, while the "Control" with the "Babel 113" cultivar noted the bottom value of (31.93) grains spike^{-1}.

6 - *Weight of 1000 Grains (g)*:

The results from Table (2) for the "Abbasiyya" location indicate a significant superiority of all fertilizer treatments over the "Control" treatment, which noted the bottom value of (31.14) g. The "KINGLIFE + POLYAMIN" treatment noted the top value of (39.36) g, which was non-significant different from the "NPK", "ALGAREN TWIN + POLYAMIN", and "HASCON + POLYAMIN" treatments, which recorded (38.66, 36.77, and 39.31) g, respectively. At the "Bartella" location, all fertilizer treatments also high significant than "Control" treatment, which noted the bottom value of (29.93) g. The "NPK" treatment noted the top value of 40.65 g, which was non-significant different of all "KINGLIFE + POLYAMIN", "ALGAREN TWIN + POLYAMIN", and "HASCON + POLYAMIN" treatments, which recorded (38.72, 36.73, and 38.94) g, respectively. The observed increase may be due to the enhanced photosynthetic efficiency of the plants treated with the mentioned treatments, which resulted from the increased leaf area. This enhancement led to better grain filling and, consequently, an increase in grain weight. [25].

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show not significant differences between the cultivars, with "Babel 113" and "Ozkan" recording (36.15 and 37.95) g, respectively. At the "Bartella" location, no significant differences were observed between the Cultivars, with "Babel 113" and "Ozkan" recording (36.70 and 37.28) g, respectively. The variation between varieties can be attributed to the role of the flag leaf in providing the developing florets with their growth requirements and storing manufactured food due to its expanded area. Additionally, the grain-filling duration has an impact. Moreover, an increase in the number of spikes per unit area and the number of grains per spike directly affects the weight of a thousand grains [20].

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (41.88) g, while the "Control" treatment with the "Babel 113" cultivar noted the bottom value of (30.46) g. At the "Bartella" location, the "NPK" treatment with the "Ozkan" cultivar noted the top value of (40.98) g, while the "Control" with the same cultivar noted the bottom value of (29.83) g.

7 - *Grain Yield (g m^{-2})*:

The data from table (2) for the "Abbasiyya" location indicate a high significant of all fertilizer treatments grater than "Control", which noted the bottom value of (333.53) g m^{-2}. The "NPK" treatment noted the top value of (843.92) g m^{-2}, which was non-significant differences from the "KINGLIFE + POLYAMIN" and "HASCON + POLYAMIN" treatments, which recorded (710.40 and 710.52) g m^{-2}, respectively. At the "Bartella" location, all fertilizer treatments also high significant than "Control" treatment, which noted the bottom value of (317.92) g m^{-2}. The "NPK" treatment noted the top value of (692.26) g m^{-2}, which was no significant different from the both "KINGLIFE + POLYAMIN" and "HASCON + POLYAMIN", which recorded (654.41 and 663.04) g m^{-2}, respectively. The increase in grain yield can be attributed to the enhanced leaf area, which represents improved photosynthetic efficiency. Additionally, the increase in the number of spikes per square meter and the weight of 1000 grains positively

influenced the grain yield trait. [7, 12, 14, 21, 25]

Table (3) results for the effect of Cultivars at the "Abbasiyya" location show a significant different of the "Ozkan" cultivar, which noted the top value of (647.44) g m^{-2}, while the "Babel 113" cultivar noted the bottom value of (578.98) g m^{-2}. At the "Bartella" location, not significant different were showed between the cultivars, with "Babel 113" and "Ozkan" recording (546.23, and 601.59) g m^{-2}, respectively. The reason could be that grain yield depends on the number of spikes per unit area, the number of grains per spike, and the weight of 1000 grains. These results align with [20],[16] and [26], who indicated that the difference in wheat varieties' grain yield is due to the variation in yield components.

The interaction effects between fertilizers and Cultivars at the "Abbasiyya" location, shown in Table (4), indicate that the "NPK" treatment with the "Ozkan" cultivar noted the top value of (843.92) g m^{-2}, while the "Control" treatment with the "Babel 113 "cultivar noted the bottom value of (332.19) g m^{-2}. At the "Bartella" location, the "NPK" treatment with the "Ozkan" cultivar noted the top value of (715.89) g m^{-2}, while the "Control" treatment with the same cultivar noted the bottom value of (316.93) g m^{-2}.

Conclusions:

The data of study referred the variability in the performance of fertilizers which used. The "NPK" treatment had the significant influence on increasing yield and its components. However, due to the high cost of these fertilizers compared to foliar fertilizers, which did not significantly differ in enhancing wheat productivity, the use of foliar fertilizers is more economically beneficial and provides a better net profit than soil-applied fertilizers.

Table (2) Effect of Fertilizers on traits growth and yield of wheat for both "Abbasiyya" and "Bartella" Locations.

"Abbasiyya"							
Fertilizers	*Plant Height*	*Flag leaf Area*	*Number of Tiller's*	*Number of Spikes*	*Number of grains*	*Weight of 1000 Grains*	*Grain Yield*
"NPK"	83.203	33.10	484.02	472.76	41.92	38.66	764.98
KIN. +POL.	80.45	32.04	471.60	460.63	39.16	39.36	710.40
ALG.+POL.	77.42	30.40	411.3	403.11	36.89	36.77	546.59
HAS. +POL.	85.14	32.178	452.55	441.17	40.95	39.31	710.52
"Control"	62.53	21.75	329.48	321.96	33.24	31.14	333.53
L.S.D (5%)	*10.93*	*2.157*	*25.82*	*25.78*	*1.476*	*4.173*	*81.2*
"Bartella"							
"NPK"	78.79	29.564	440.38	428.65	39.48	40.659	692.26
KIN. +POL.	80.08	31.145	429.98	418.44	39.48	38.722	654.41
ALG.+POL.	74.62	26.639	416.12	404.99	36.61	36.733	541.91
HAS. +POL.	75.78	29.929	422.93	411.68	41.7	38.942	663.04
"Control"	57.79	20.063	332.38	326.01	32.16	29.931	317.92
L.S.D (5%)	*6.187*	*2.085*	*17.19*	*16.07*	*2.548*	*4.142*	*66.8*

Table (3) Effect of Cultivars on traits growth and yield of wheat for both "Abbasiyya" and "Bartella" Locations.

"Abbasiyya"							
6Cultivars	*Plant Height*	*Flag leaf Area*	*Number of Tiller's*	*Number of Spikes*	*Number of grains*	*Weight of 1000 Grains*	*Grain Yield*
Babel 113	78.96	29.59	424.13	414.78	37.89	36.15	578.97
"Ozkan"	76.53	30.19	435.45	425.07	38.97	37.95	647.44
L.S.D (5%)	*6.33n.s*	*1.758n.s*	*15.89n.s*	*15.08 n.s*	*1.032*	*3.005 n.s*	*48.3*
"Bartella"							
Babel 113	71.01	26.789	404.89	395.01	36.78	36.708	546.23
"Ozkan"	75.81	28.147	411.82	400.89	38.99	37.287	601.59
L.S.D (5%)	*4.059*	*1.286*	*7.47 n.s*	*7.05 n.s*	*2.305 n.s*	*2.529 n.s*	*59.9 n.s*

Table (4) Effect of interaction between Fertilizers and Cultivars on traits growth and yield of wheat for both "Abbasiyya" and "Bartella" Locations.

"Abbasiyya"								
Cultivars	**Fertilizers**	*Plant Height*	*Flag leaf Area*	*Number of Tiller's*	*Number of Spikes*	*Number of grains*	*Weight of 1000 Grains*	*Grain Yield*
Babel 113	**"NPK"**	84.50	32.38	478.93	468.49	41.57	35.44	686.04
	KIN. + POL.	80.36	31.90	462.76	453.02	38.26	38.91	674.15
	ALG.+ POL.	78.96	30.23	394.78	386.59	36.87	36.85	525.12
	HAS. + POL.	88.85	32.14	443.23	431.91	40.13	39.09	677.35
	"Control"	62.16	21.32	340.97	333.91	32.61	30.46	332.19
"Ozkan"	**"NPK"**	81.9	33.81	489.12	477.04	42.26	41.88	843.92
	KIN. + POL.	80.54	32.17	480.45	468.23	40.06	39.80	746.64
	ALG.+ POL.	75.88	30.58	427.81	419.64	36.91	36.68	568.07
	HAS. + POL.	81.43	32.21	461.86	450.43	41.78	39.54	743.68
	"Control"	62.90	22.18	318.00	310.02	33.87	31.83	334.88
L.S.D.5%	***Fer. × Cul.***	***13.74***	***3.282***	***33.41***	***32.58***	***2.044***	***5.877***	***103.4***
"Bartella"								
Babel 113	**"NPK"**	76.58	29.144	431.98	420.41	38.7	40.335	668.63
	KIN. + POL.	76.72	31.49	426.8	415.27	37.65	38.786	613.76
	ALG.+ POL.	73.82	25.487	407.62	396.74	35.96	36.124	514.27
	HAS. + POL.	71.68	29.512	424.34	413.07	39.64	38.266	615.58
	"Control"	56.28	18.314	333.7	329.58	31.93	30.028	318.91
"Ozkan"	**"NPK"**	81.01	29.985	448.77	436.89	40.25	40.983	
	KIN. + POL.	83.44	30.799	433.17	421.62	41.3	38.659	715.89
	ALG.+ POL.	75.41	27.792	424.61	413.24	37.25	37.341	710.49
	HAS. + POL.	79.89	30.347	421.52	410.28	43.77	39.617	316.93
	"Control"	59.31	21.812	331.06	322.45	32.39	29.834	695.07
L.S.D.5%	***Fer. × Cul.***	***8.271***	***2.701***	***19.49***	***18.27***	***4.167***	***5.34***	***108.6***

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