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Evaluation Effect of Different Level of Combination Chemical and Biological Fertilizer and Several Type of Application Fertilizer on Growth Indices of Bread Wheat

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ABSTRACT

BACKGROUND: Fertilizer management plays an important role for obtaining satisfactory yields and to increase crop productivity. Nutrient management may be achieved by the involvement of organic sources, bio fertilizers, and micro-nutrients.

OBJECTIVES: Current study was done to assess effect of different rate of combination fertilizer and biological fertilizer and type of application biofertilizer on physiological traits of Wheat crop.

METHODS: This research was carried out via factorial experiment based on randomized complete blocks design with three replications along 2020-2021 year. The treatments included different rate of combination Nitrogen fertilizer and Biofertilizer (Fla Wheat) (a_1: 100% nitrogen with nonuse of Fla Wheat as control or N_{100}/F_0, a_2: 70% Nitrogen with Fla Wheat or N_{70}/F_1, a_3: 40% Nitrogen with Fla Wheat or N_{40}/F_1) and several methods of applying biofertilizer (Fla Wheat) (b_1: 100% Seed treatment, b_2: 100% by irrigation, b_3: 50% seed treatment with 50% by irrigation).

RESULT: According result of analysis of variance effect of different level of fertilizer combination, method of application fertilizer and interaction effect of treatments on all measured traits (instead leaf area index, net assimilation rate and crop growth rate) was significant. Mean comparison result of different level of Fertilizer combination indicated that maximum total dry matter, leaf area index, net assimilation rate, crop growth rate and seed yield was noted for N_{100}/F_0 and minimum of that belonged to N_{40}/F_2 treatment (along all growth stages). As for Duncan classification made with respect to different level of Method of application fertilizer maximum and minimum amount of significant traits belonged to M_3 and M_2 treatment.

CONCLUSION: The use of 70% nitrogen treatment with Fla Wheat biofertilizer (despite a 28% reduction in grain yield and 23% grain protein compared to the control) leads to less chemical fertilizer consumption and a move towards sustainable agriculture and is recommended to farmers. Also apply of Fla Wheat 50% at seed treatment with 50% by irrigation lead to achieve maximum amount of measured traits.

KEYWORDS: *Dry Weight, Growth Curve, Leaf area, Nutrition, Yield.*

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1. BACKGROUND

Due to the adaptability of its genotypes to different environmental conditions and different aspects of its use, wheat with the scientific name of (*Triticum aestivum* L.) is one of the plants that is cultivated in large areas of the world with diverse climatic conditions (Saberi *et al*., 2013). Today, due to the prevailing conditions in dry areas (lack of organic matter, drought, salinity, and calcareous soils), increasing the wheat yield through increasing the area under cultivation is almost impossible. Iran is among the countries that will face physical water scarcity by 2025. This means that, even with the highest efficiency and productivity in water consumption, there will not be enough water to meet conventional needs (Zoski *et al*., 2013). Nitrogen (N) is essential for all biological process that occurs in the plant. A sub-optimal supply of N limits the expression of yield potentials of green bean varieties (Dauda *et al*., 2015). Chamani *et al*. (2012) reported that the interaction of seed inoculation with growth-promoting bacteria and humic acid intake during irrigation with saline water was significant on grain yield and spike yield. The highest grain and spike yield was obtained from seed inoculation treatment with Azotobacter and lack of humic acid consumption and salinity application of 75 mM. Selection of superior cultivars, attention to physiological characteristics, and use of these indices in the selection of compatible and high-yielding cultivars are the most essential indirect factors in the successful increase in wheat yield (Ahmadi *et al*., 2012). Chemical fertilizers have several negative impacts on environment and sustainable agriculture. Therefore, bio fertilizers are recommended in these conditions and growth prompting bacteria uses as a replacement of chemical fertilizers (Wu *et al*., 2005). The growth and yield of crop can be adversely affected by deficient or excessive supply of any one of the essential nutrients. However, in intensive agriculture nitrogen is the major nutrient which determining crop yield. Nitrogen as an essential constituent of cell components having direct effect on growth, yield and quality of crop. Plant growth is affected more due to deficiency of nitrogen than that of any other nutrient. Nitrogen fertilization influences dry matter yield by influencing leaf area index, leaf area duration and photosynthetic efficiency (Mohan *et al*., 2015).

2. OBJECTIVES

Current study was done to assess effect of different rate of combination fertilizer and biological fertilizer and type of application biofertilizer on physiological traits of Wheat crop.

3. MATERIALS AND METHODS

3.1. Field and Treatments Information

This research was carried out to evaluate Nitrogen fertilizer and Biofertilizer (Fla Wheat) on growth indices of Wheat crop via factorial experiment based on randomized complete blocks design with three replications along 2020-2021 year. Place of research was located in Hamidiyeh city at longitude 48°40'E and latitude 36°31'N in Khuzestan province (Southwest of

Iran). The treatments included different rate of combination Nitrogen fertilizer and Biofertilizer (Fla Wheat) (a_1: 100% nitrogen with nonuse of Fla Wheat as control or N_{100}/F_0, a_2: 70% Nitrogen with Fla Wheat or N_{70}/F_1, a_3: 40% Nitrogen with Fla Wheat or N_{40}/F_1) and several methods of applying biofertilizer (Fla Wheat) (M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation). This experiment had 36 plots. Each plot consisted of 9 lines with a distance of 20 cm and 5 meters length. Physical and chemical properties of studied field was mentioned in table 1.

Table 1. Physical and chemical properties of studied field

Soil texture	Clay (%)	Silt (%)	Sand (%)	K (ppm)	P (ppm)	N (%)	OC (%)	pH	EC ($ds.m^{-1}$)	SP (%)
Clay loam	52	27	21	168	9.1	0.039	0.6	7.2	3.5	48

3.2. Farm Management

According to the fertilizer recommendation of the soil and water department of the Agricultural and Natural Resources Research Center of Khuzestan Province, the rate of application urea fertilizer was 300 $kg.ha^{-1}$ (equivalent to 138 $kg.ha^{-1}$ pure nitrogen). Phosphorus fertilizer from triple superphosphate source at the rate of 90 $kg.ha^{-1}$ and potash fertilizer from potassium sulfate source at the rate of 50 $kg.ha^{-1}$ were applied as a base before planting. 1/3 of nitrogen fertilizer was applied as a base and the remaining 2/3 at tillering and steam elongation stage. Distilled water was used instead of Fla Wheat in the control treatment. It should be noted that according to the manufacturer's recommendation, for every 100 kg of seeds, one liter of Fla Wheat biofertilizer was used as seed treatment. Place the seeds in the shade on nylon or a clean surface and sprinkle the bio-inoculum gradually on the seeds after shaking and mix well so that all of them are evenly impregnated with fertilizer. Then, in the shortest time after drying the seeds in the shade, planting was done. In the method of inoculation with irrigation in two shifts (each stage in the amount of one liter per hectare and at intervals of 40 days) Fla Wheat biofertilizer was applied with irrigation water. The first stage was at the beginning of the stem and the second stage was at the time of pollination. Fla Wheat biofertilizer contains *Microbacterium sp*. This biofertilizer increases wheat yield in dry and irrigated conditions due to its growth-promoting bacteria (10^7-10^8 CFU per gram) and production of natural growth hormones.

3.3. Measured Traits

In order to determine the yield two planting lines from each plot harvested and after the removal of marginal effect were carried to the laboratory and were placed in the oven at 75°C for 48 hours and after ensuring that the samples were completely dry, they were weighed and finally the total dry matter was measured. By measuring three factors including leaf area, leaf dry weight and total dry matter, the physiological parameters

of growth including LAI, NAR, CGR and RGR were obtained using the following equations. To determine the leaf area of the linear relationship S= K. L.W was used in which S, L and W were the leaf area, L and W respectively, the maximum length and width of each leaf and K= 0.75 correction coefficient. The leaf area index was calculated from leaf area ratio to ground level. Crop growth rate and net assimilation rate were measured according fallowing formula (Buttery, 1970; Enyi, 1962):

Equ.1. CGR ($g.m^{-2}.day^{-1}$) = TDM_2-TDM_1/T_2-T_1

TDM_1= Primary dry weight (g), TDM_2= Secondary dry weight (g)

T_1= initial sampling time, T_2= Secondary sampling time

Equ.2. NAR ($g.m^{-2}.day^{-1}$) = CGR* $LnLA_2$-$LnLA_1/LA_2$-LA_1

CGR = Growth rate in grams per day per square meter

LA_1 = Initial leaf area,

LA_2 = Secondary leaf area

3.4. Statistical Analysis

Analysis of variance and mean comparisons were done via SAS (Ver.8) software and Duncan multiple range test at 5% probability level.

4. RESULT AND DISCUSSION

4.1. Total dry matter

According result of analysis of variance effect of Fertilizer combination and method of application fertilize on total dry matter was significant at 1% probability level, also interaction effect of treatments was significant at 5% probability level along all growth stages (Table 2). Mean comparison result of different level of Fertilizer combination indicated that maximum total dry matter was noted for N_{100}/F_0 (at booting: 1385.8 $gr.m^{-2}$, anthesis: 1565.1 $gr.m^{-2}$ and grain filling: 1531.5 $gr.m^{-2}$) and minimum of that belonged to N_{40}/F_2 treatment (at booting: 883.2 $gr.m^{-2}$, anthesis: 1027.1 $gr.m^{-2}$ and grain filling: 1001.8 $gr.m^{-2}$) (Table 3).

Table 2. Result of analysis of variance effect of treatment on total dry matter

S.O.V	df	Booting	Anthesis	Grain filing
Replication	2	520^{ns}	618^{ns}	643^{ns}
Fertilizer combination (F)	2	568552^{**}	651134^{**}	631352^{**}
Method of application fertilize (M)	2	13520^{**}	15323^{**}	14899^{**}
F×M	4	1847^{*}	2197^{*}	2075^{*}
Error	16	562	488	477
CV (%)	-	18.8	17.59	17.72

ns, * and **: no significant, significant at 5% and 1% of probability level, respectively.

Table 3. Effect of different method of Fertilizer combination on total dry matter along different growth stage

Treatment	Total dry matter (gr.m^{-2})		
Fertilizer combination	**Booting**	**Anthesis**	**Grain filing**
N_{100}/F_0	1385.8a*	1565.1a	1531.5a
N_{70}/F_1	1132.9b	1295.8b	1266.9b
N_{40}/F_2	883.2c	1027.1c	1001.8c

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat as control, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat.

As for Duncan classification made with respect to different level of Method of application fertilizer maximum and minimum amount of total dry matter belonged to M_3 (at booting: 1175.9 gr.m^{-2}, anthesis: 1340.5 gr.m^{-2} and grain filling: 1310.7 gr.m^{-2}) and M_2 treatment (at booting: 1099.5 gr.m^{-2}, anthesis: 1259.1 gr.m^{-2} and grain filling: 1230.4 gr.m^{-2}) (Table 4). Eydizadeh *et al*. (2010) stated that biological fertilizers increase the root contact with soil and ultimately increase the absorption of nutrients. Mentioed researchers also stated that the production of various acids by bacteria could lead to more organic solubility of the soil. It seems that the effect of bio-fertilizers provides up to 50% of the plant's nutritional requirements, and the rest of the plant's needs must be provided through the use of chemical fertilizers. Evaluation mean comparison result of interaction effect of treatments indicated maximum total dry matter was noted for N_{100}/F_0 and M_3 (at booting: 1404.1 gr.m^{-2}, anthesis: 1580.0 gr.m^{-2} and grain filling: 1546.8 gr.m^{-2}) and lowest one belonged to N_{40}/F_2 and M_2 treatment (at booting: 839.2 gr.m^{-2}, anthesis: 979.3 gr.m^{-2} and grain filling: 955.5 gr.m^{-2}) (Table 5). Hojattipor *et al*. (2014) reported that the maximum total dry weight was obtained in wheat with increasing nitrogen fertilizer up to 225 kg.ha^{-1}, along with biological nitrogen fertilizer of nitrokara.

Table 4. Effect of different method of application Fertilizer on total dry matter along different growth stage

Treatment	Total dry matter (gr.m^{-2})		
Method of application fertilizer	**Booting**	**Anthesis**	**Grain filing**
M_1	1126.5b	1288.60b	1259.1b
M_2	1099.5c	1259.1c	1230.4c
M_3	1175.9a	1340.5a	1310.7a

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

Table 5. Mean comparison interaction effects of treatments on TDM along growth stages

Treatment		Total dry matter (gr.m^{-2})		
Fertilizer combination	**Method of application fertilizer**	**Booting**	**Anthesis**	**Grain filing**
N_{100}/F_0	**M_1**	1382.2ab	1561.1ab	1527.5ab
	M_2	1374.2ab	1554.2ab	1520.3ab
	M_3	1404.1a	1580.0a	1546.8a
N_{70}/F_1	**M_1**	1112.4bc	1275.9bc	1247.0bc
	M_2	1085.0c	1243.6bc	1215.4bc
	M_3	1201.2b	1368.0b	1338.1b
N_{40}/F_2	**M_1**	884.8e	1028.6e	1002.8e
	M_2	839.2f	979.3f	955.5f
	M_3	925.5d	1073.5d	1047.2d

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat as control, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat. M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

Nouraki *et al*. (2017) reported that the spraying of biological fertilizers containing amino acids along with nitrogen fertilizers increases the growth and production of dry matter. Application of fertilizer of triple super phosphate 50% with bio-phosphate had a significant effect on increasing total dry weight of corn.

4.2. Leaf area index

Result of analysis of variance revealed effect of fertilizer combination and method of application fertilize on leaf area index was significant at 5% probability level, but interaction effect of treatments was not significant along all growth stages (Table 6).

Table 6. Result of analysis of variance effect of treatment on leaf area index

S.O.V	df	Booting	Anthesis	Grain filing
Replication	2	0.01249*	0.00968*	0.001526^{ns}
Fertilizer combination (F)	2	0.68295*	0.67954*	0.242626*
Method of application fertilizer (M)	2	0.00538*	0.00614*	0.006181*
F×M	4	0.00055^{ns}	0.00077^{ns}	0.000504^{ns}
Error	16	0.00040	0.00050	0.000722
CV (%)	-	6.59	5.23	6.10

$^{ns, *}$ and **: no significant, significant at 5% and 1% of probability level, respectively.

According result of mean comparison of the fertilizer combination the maximum of leaf area index was obtained for N_{100}/F_0 (at booting: 3.79, anthesis: 4.70 and grain filling: 2.46) and minimum of that was for N_{40}/F_2 treatment (at booting: 3.24, anthesis: 4.15 and grain filling: 2.13) (Table 7).

Shamoradi and Marashi (2018) reported among different level of bioferti-

lizer maximum leaf area index in tassel emergence, silk emergence and grain filling stage were 4.28, 3.40 and 2.33, respectively, due to application of Nitrokara and *Azotobacter* biological fertilizer and lowest one (4.13, 3.21 and 2.18) belonged to non-bio fertilized treatment.

Table 7. Effect of different method of Fertilizer combination on leaf area index along different growth stage

Treatment	Leaf area index		
Fertilizer combination	**Booting**	**Anthesis**	**Grain filing**
N_{100}/F_0	3.79a	4.70a	2.46a
N_{70}/F_1	3.56b	4.46b	2.31b
N_{40}/F_2	3.24c	4.15c	2.13c

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat as control, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat.

Sprent and Sprent (1990) reported that *Azospirillum*, Pseudomonas and *Azotobacter* bacteria, through the roots of plants, increase the moisture absorption and this extensive network through the absorption of water and nutrients and their transfer to the plant increases plant height, leaf area and dry weight. Evaluation mean comparison result indicated in different level of method of application fertilizer the maximum amount of leaf area index was noted for M_3 (at booting: 3.55, anthesis: 4.46 and grain filling: 2.33) and minimum of that belonged to M_2 treatment (at booting: 3.51, anthesis: 4.41 and grain filling: 2.27) (Table 8).

Table 8. Effect of different method of application Fertilizer on LAI along different growth stage

Treatment	Leaf area index		
Method of application fertilizer	**Booting**	**Anthesis**	**Grain filing**
M_1	3.53ab	4.44ab	2.30ab
M_2	3.51b	4.41b	2.27b
M_3	3.55a	4.46a	2.33a

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

Jahan *et al*. (2013) reported applying 80 $kg.ha^{-1}$ super absorbent polymer led to increase corn LAI by 11% compared with control. Mozzene Qamsari *et al*. (2009) reported increasing the leaf area index of maize affected super absorbent consumption in different irrigation periods may be due to the continuation of the necessary compressive potential for leaf growth and reduction of the effect of drought stress in the plant.

4.3. Net assimilation rate

Result of analysis of variance showed effect of fertilizer combination on net assimilation rate was significant at 5% probability level, but effect of method of application fertilize and interaction effect of treatments was not significant along all growth stages (Table 9). Assessment mean comparison result indicated in different level of fertilizer combination (from Booting until anthesis stage) the maximum net assimilation rate was noted for N_{100}/F_0 (2.1 $gr.m^{-2}.day^{-1}$) and minimum of that (1.94 $gr.m^{-2}.day^{-1}$) belonged to N_{40}/F_2 treatment (Table 10).

Table 9. Result of analysis of variance effect of treatments on crop growth rate and net assimilation rate along booting until anthesis stage

S.O.V	df	Net assimilation rate	Crop growth rate
Replication	2	0.006293^{ns}	0.0097^{ns}
Fertilizer combination (F)	2	0.061693^{*}	7.0263^{*}
Method of application fertilizer (M)	2	0.003804^{ns}	0.1457^{ns}
F×M	4	0.002459^{ns}	0.0555^{ns}
Error	16	0.002976	0.0528
CV (%)	-	4.35	9.51

ns, * and **: no significant, significant at 5% and 1% of probability level, respectively.

Table 10. Effect of different method of Fertilizer combination on crop growth rate and net assimilation rate along booting until anthesis stage

Treatment	Booting until anthesis stage	
Fertilizer combination	**Net assimilation rate ($gr.m^{-2}.day^{-1}$)**	**Crop growth rate ($gr.m^{-2}.day^{-1}$)**
N_{100}/F_0	2.1a	8.96a
N_{70}/F_1	2.02b	8.14ab
N_{40}/F_2	1.94c	7.19b

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)

N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat as control, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat.

4.4. Crop growth rate

According result of analysis of variance effect of fertilizer combination on crop growth rate was significant at 5% probability level, but effect of method of application fertilize and interaction effect of treatments was not significant along all growth stages (Table 9). Compare different level of fertilizer combination (from Booting until anthesis stage) showed that the maximum and the minimum amount of crop growth rate belonged to N_{100}/F_0 (8.96 $gr.m^{-2}.day^{-1}$) and N_{40}/F_2 (7.19 $gr.m^{-2}.day^{-1}$)

treatments (Table 10). Hokm Alipour and Hamele Darbandi (2011) reported negative values of crop growth rate and relative growth rate are due to loss of leaves at the end of the growing season. So with increasing nitrogen levels at all of the corn cultivars plant height was significantly increased. Between different levels of method of application fertilizer the maximum crop growth rate (8.22 $gr.m^{-2}.day^{-1}$) was observed in M_3 and the lowest one (7.97 $gr.m^{-2}.day^{-1}$) was found in M_2 treatment (Table 11). Wu *et al*. (2005) reported inoculation of corn grains with biological fertilizers increased growth rate of crops. The researchers reasoned this by increasing the availability of nutrients and improving absorption of nutrients by the plant.

4.5. Seed yield

Result of analysis of variance showed effect of fertilizer combination and method of application fertilize on seed yield was significant at 1% probability level, also interaction effect of treatments was significant at 5% probability level (Table 12). Mean comparison result of different level of Fertilizer combination indicated that maximum amount of seed yield was noted for N_{100}/F_0 (7032.1 $kg.ha^{-1}$) and minimum of that belonged to N_{40}/F_2 (2791.4 $kg.ha^{-1}$) treatment (Table 13). As for Duncan classification made with respect to different level of Method of application fertilizer maximum and minimum amount of seed yield belonged to M_3 (5462.1 $kg.ha^{-1}$) and M_2 treatment (4469.3 $kg.ha^{-1}$) (Table 13). Jafari Haghighi and Yarmahmodi (2011) stated biological fertilizer cannot sufficient but integrated application of fertilizers became causes significant increase in yield. Evaluation mean comparison result of interaction effect of treatments indicated maximum seed yield was noted for N_{100}/F_0 and M_3 (7389.7 $kg.ha^{-1}$) and lowest one belonged to N_{40}/F_2 and M_2 treatment (2366.4 $kg.ha^{-1}$) (Table 14). Use of bio-fertilizers offers agronomic and environmental benefits to intensive farming systems in Egypt, and the data showed that using *Azospirillum brasilense* or commercial bio fertilizers in cereals with a half N rate (144 $kgN.ha^{-1}$) caused a significant increase in yield. So seed inoculation with Rhizobium, phosphorus solubilizing bacteria and organic amendment increased seed production (Panwar *et al*., 2006).

5. CONCLUSION

Different levels of fertilizer combination and method of application fertilizer were effective on TDM, LAI, NAR (only fertilizer combination), crop growth rate (only fertilizer combination) and seed yield. Compared to control, Fla Wheat biofertilizer could not compensate lack of sufficient amounts of pure nitrogen. So, by reducing percentage of nitrogen, measured traits were reduced. Use of 70% nitrogen treatment with Fla Wheat biofertilizer (despite a 28% reduction in grain yield and 23% seed protein compared to control) lead to less chemical fertilizer consumption and move towards sustainable agriculture and is recommended to farmers. Also apply of Fla Wheat 50% at seed treatment with 50% by irrigation lead to achieve maximum amount of measured traits.

Table 11. Effect of different method of application Fertilizer on crop growth rate and net assimilation rate along booting until anthesis stage

Treatment	Booting until anthesis stage	
Method of application fertilizer	**Net assimilation rate ($gr.m^{-2}.day^{-1}$)**	**Crop growth rate ($gr.m^{-2}.day^{-1}$)**
M_1	2.02a	8.10ab
M_2	2.00a	7.97b
M_3	2.04a	8.22a

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

Table 12. Result of analysis of variance effect of treatments on seed yield

S.O.V	df	Seed yield
Replication	2	2421*
Fertilizer combination (F)	2	404948**
Method of application fertilizer (M)	2	22273**
F×M	4	1644*
Error	16	435
CV (%)	-	9.04

ns, * and **: no significant, significant at 5% and 1% of probability level, respectively.

Table 13. Effect of different method of Fertilizer combination and method of application Fertilizer on seed yield

Fertilizer combination	Seed yield ($kg.ha^{-1}$)	Method of application fertilizer	Seed yield ($kg.ha^{-1}$)
N_{100}/F_0	7032.1a	**M_1**	4908.8b
N_{70}/F_1	5016.5b	**M_2**	4469.3c
N_{40}/F_2	2791.4c	**M_3**	5462.1a

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat. M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

Table 14. Mean comparison interaction effects of treatments seed yield

Fertilizer combination	Method of application fertilizer	Seed yield ($kg.ha^{-1}$)
N_{100}/F_0	**M_1**	6947.1ab
	M_2	6759.4b
	M_3	7389.7a
N_{70}/F_1	**M_1**	4974.9d
	M_2	4281.9e
	M_3	5792.8c
N_{40}/F_2	**M_1**	2804.4fg
	M_2	2366.4g
	M_3	3203.6f

*Mean which have at least once common letter are nit significant different at the 5% level using (DMRT)
N_{100}/F_0: 100% nitrogen with nonuse of Fla Wheat, N_{70}/F_1: 70% Nitrogen with Fla Wheat or, N_{40}/F_1: 40% Nitrogen with Fla Wheat. M_1: 100% Seed treatment, M_2: 100% by irrigation, M_3: 50% seed treatment with 50% by irrigation.

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