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Response of Leaf area index, Chlorophyll Content and Protein Concentration of Sorghum to Application Different Rate of Nitrogen Fertilizer and Vermicompost Affected Water Stress Condition

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ABSTRACT

BACKGROUND: In organic agriculture, the main goal is increasing and maintains soil quality with a high biological activity. Also for economic production keep equilibrium between fertilizer and biofertilizer is necessary in sustainable agriculture.

OBJECTIVES: Determine effect of different level of water deficit stress and combined effect of nitrogen fertilizer and vermicompost on quantitative and qualitative characteristics of Sorghum crop.

METHODS: Current study was done via split plot experiment based on randomized complete blocks design with four replications. The main factor consisted water deficit stress at three level (A_1: 70, A_2: 100 and A_3: 130 mm Class A evaporation pan) and combined effect of nitrogen fertilizer and vermicompost at five level (B_1: 100% Nitrogen; 100% pure nitrogen equivalent to 200 kg per hectare, B_2: 75% Nitrogen+25% Vermicompost, B_3: 50% Nitrogen+50% Vermicompost, B_4: 25% Nitrogen+75% Vermicompost, B_5: 100% Vermicompost) belonged to sub plot.

RESULT: Result of analysis of variance revealed effect of water deficit stress and combination nitrogen with vermicompost on all studied characteristics was significant but interaction effect of treatments was not significant (instead seed and biologic yield). Assessment mean comparison result indicated in different level of water deficit stress the maximum amount of leaf area index (4.15), number of seed per raceme (25.13), Chlorophyll index (53.04 Spad), Chlorophyll a (2.23 $mg.g^{-1}$), Chlorophyll b (1.38 $mg.g^{-1}$), Seed yield (4030.55 $kg.ha^{-1}$), Biologic yield (1161.52 $gr.m^{-2}$) and Harvest index (34.52%) was noted for 70 mm evaporation pan class A and minimum of that belonged to 130 mm evaporation pan class A treatment, but Protein percentage had reverse trend. Compare different level of combination nitrogen with vermicompost showed highest and lowest amount of mentioned traits belonged to 75% nitrogen+25% vermicompost and 100% vermicompost treatment.

CONCLUSION: Generally result of current research proved the treatment of 75% nitrogen+25% vermicompost treatment under 70 mm evaporation pan class A produced highest amount of crop production and it can advised to farmers.

KEYWORDS: *Crop Production, Mineral, Organic matter, Raceme, Water deficit.*

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1. BACKGROUND

Sorghum has potential uses such as: food (grain), feed (grain and biomass), fuel (ethanol production), fiber (paper), fermentation (methane production) and fertilizer (utilization of organic byproducts) (Roy *et al*., 2018). The limitation of water resources in arid and semi-arid areas was the main reason that we considered water as the most important material in the production lines, although people often do not obey the irrigation water consumption rules and regulations (Cakir, 2004). Innovations for saving water in irrigated agriculture and thereby improving water use efficiency are of paramount importance in water-scarce regions. Conventional deficit irrigation is one approach that can reduce water use without causing significant yield reduction (Kirda *et al*., 2005). Among the macro nutrients essential for crop growth, nitrogen (N) is a very mobile element in the soil, due to its susceptibility to leaching, de nitrification, and volatilization losses. Excessive use of N fertilizer can lead to pollution of water bodies and may lead to soil acidification. Balanced and efficient use of applied N is of paramount importance in the overall nutrient management system than any other plant nutrient in order to reduce its negative impact on the environment. Besides, even under the best management practices, 30%-50% of the applied nitrogen is lost through different routes and hence more fertilizer needs to be applied than actually needed by the crop to compensate for the loss. The transitory loss of N not only causes loss to the farmer but also causes irreversible damage to the environment. High rates of chemical fertilizer cause environmental pollution (Shamme *et al.,* 2016). Moghimi and Emam (2015) in order to evaluate the impact of different amounts of nitrogen fertilizer on yield of sorghum cultivars reported Pegah cultivar and application of 205 kg N ha^{-1} might be offered for producers (in similar climate). Nitrogen is an important nutrient for optimum crop growth and yield performance. Although its effect on the growth and yield of sweet sorghum has been demonstrated to be dependent on the factors of climate, soil type and genotype which also vary across seasons and locations, the application nitrogen generally results in increase in the biomass and yield of sweet sorghum until an optimum rate is reached. This optimum rate varies from one location to another and from one season to another. However, from this, the optimum rate can be said to lie within the range of 60 and 120 kg N ha^{-1} depending on the location, the soil type and the native N of the soil determined through soil test (Olugbemi, 2017).

2. OBJECTIVES

The main goals of this research determine effect of different level of water deficit stress and combined effect of nitrogen fertilizer and vermicompost on quantitative and qualitative characteristics of Sorghum crop.

3. MATERIALS AND METHODS

3.1. Field and Treatments Information

Current study was conducted according split plot experiment based on ran-

domized complete blocks design with four replications along 2017 year. Place of research was located in Hamideyeh city at longitude 48°10'E and latitude 31°33'N in Khuzestan province (Southwest of Iran). The main factor included water deficit stress at three level (A_1: 70, A_2: 100 and A_3: 130 mm Class A evaporation pan) and combined effect of nitrogen fertilizer and vermicompost at five level (B_1: 100% Nitrogen; 100% pure nitrogen equivalent to 200 kg per hectare, B_2: 75% Nitrogen + 25% Vermicompost, B_3: 50% Nitrogen+50% Vermicompost, B_4: 25% Nitrogen + 75% Vermicompost, B_5: 100% Vermicompost) belonged to sub plot. The amount of vermicompost used in the field in 100% vermicompost treatment was equal to 5 tons per hectare. This experiment had 60 plots. Each plot consisted of 6 lines with a distance of 75 cm and 5 meters length. Before performing the experiment, sampling was done from the farm soil and the physical and chemical properties of the soil and vermicompost were determined (Tables 1 and 2).

Table 1. Some physical and chemical properties of field's soil

Depth of soil sampling (cm)	SP	EC ($ds.m^{-1}$)	pH	OC (%)	N (ppm)	P (ppm)	K (ppm)	Soil texture
0-30	46	3.42	7.1	0.72	0.42	9.1	150	Clay loam
30-60	44	3.21	7	0.61	0.38	8.8	147	Clay loam

Table 2. Some physical and chemical properties of vermicompost

EC ($ds.m^{-1}$)	pH	Mn ($mg.kg^{-1}$)	Zn ($mg.kg^{-1}$)	Fe ($mg.kg^{-1}$)	Nitrogen (%)	Potassium (%)	Phosphorus (%)
2.9	6.9	21	33	44	4.96	3.19	0.61

3.2. Farm Management

The amount of fertilizer required in the field included 90 $kg.ha^{-1}$ of superphosphate triple and 100 $kg.ha^{-1}$ of potassium sulfate fertilizer. All vermicompost was applied to the soil in the mentioned treatments before planting. After fertilizing, the field soil was mixed with the soil by a light disk. Seed sowing was done manually on August 10, 2017 at a depth of four centimeters. The first irrigation was done immediately after planting. Up to the four-leaf stage of conventional irrigation, and after the four-leaf stage, according to the experimental treatments based on the Class A evaporation pan placed near the field and based on continuous evaporation from it, each of the stress treatments of irrigation water shortage stress (Nadimpour and Mojaddam, 2015). Sorghum seedlings were thinning at four-leaf stage and weed controlled manually without pesticides.

3.3. Measured Traits

In order to determine the yield and yield components, two side rows and a half meters from the beginning and end of the plot were removed as marginal effects. The final harvest was done on the 24th of October of 2017 in an area

equivalent to two square meters in each plot. In order to calculate the weight of 1000 seeds, two groups of 500 seeds were separated and if their difference was less than six percent, their total weight was determined as the weight of 1000 seeds. To determine the biological yield, an area of two square meters was taken from each plot and a section of about 500 grams was separated and after transferring the samples to the laboratory, they were placed in a oven dryer at 75 °C for 48 hours. And after drying, their weight was calculated. To determine the percentage of grain protein, the percentage of grain nitrogen was first measured by Kjeldahl method, which includes digestion, distillation and titration. To measure the amount of seed protein by multiplying the percentage of seed nitrogen by a factor of 6.25, the amount of protein in the seed was obtained. Then, by multiplying the percentage of protein in each treatment by its seed yield, the protein yield for each treatment was calculated (Keeney and Nelson, 1982). Harvest index (HI) was calculated according to formula of Gardner *et al*. (1985) as follows: **Equ.1.** HI= (Seed yield/Biologic yield) ×100. Chlorophyll content of five ear leaves in each plot was measured at anthesis stage by SPAD 502 device, accurately three points of leaf measured and the average of three numbers was considered. (SPAD 502, Minolta Co., Japan).

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. Leaf area index (LAI)

Result of analysis of variance showed effect of water deficit stress and combination nitrogen with vermicompost on leaf area index was significant at 1% probability level but interaction effect of treatments was not significant (Table 3). Assessment mean comparison result indicated in different level of water deficit stress the maximum leaf area index (4.15) was noted for 70 mm evaporation pan class A and minimum of that (3.29) belonged to 130 mm evaporation pan class A treatment (Table 4). Compare different level of combination nitrogen with vermicompost showed that the maximum and the minimum amount of leaf area index belonged to 75% nitrogen+25% vermicompost (4.42) and 100% vermicompost (3.08) treatments (Table 5). In another study conducted by Garg *et al.* (2005) increasing nitrogen to soil increased the plant photosynthetic efficiency and ultimately increased the seed yield and growth rate. So, since the rate of light absorption by leaves and converting it into photosynthetic materials are the other factors affecting the plant growth and production, the increase of leaf area in the farm leads to the increase of light absorption and ultimately leads to the increase of seed yield.

4.2. Number of seed per raceme

According result of ANOVA effect of water deficit stress and combination nitrogen with vermicompost was significant at 1% probability level but interaction effect of treatments was not significant (Table 3).

Table 3. Result analysis of variance of studied traits

S.O.V	df	Leaf area index	No. seed per raceme	Chlorophyll index	Chlorophyll a	Chlorophyll b
Replication	3	0.057^{ns}	0.48^{ns}	4.08^{ns}	0.041^{ns}	0.178^{ns}
Water deficit stress (A)	2	3.49^{**}	71.03^{**}	97.54^{**}	1.52^{*}	1.35^{*}
Error I	6	0.18	4.18	8.34	0.004	0.164
Combination nitrogen with vermicompost (B)	4	2.24^{**}	35.14^{**}	75.03^{**}	0.954^{*}	0.991^{*}
A × B	8	0.07^{ns}	0.25^{ns}	1.57^{ns}	0.001^{ns}	0.003^{ns}
Error II	36	0.13	2.24	7.87	0.007	0.015
CV (%)	-	9.77	6.41	5.48	5.36	12

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

Continue table 3.

S.O.V	df	Seed yield	Biologic yield	Harvest index	Protein percentage
Replication	3	378.24^{ns}	1248.54^{ns}	0.93^{ns}	1.764^{ns}
Water deficit stress (A)	2	651742^{*}	102442^{**}	287.32^{**}	8.15^{*}
Error I	6	39547	4571.1	6.267	2.249
Combination nitrogen with vermicompost (B)	4	532638^{*}	98631^{**}	87.12^{**}	6.021^{*}
A × B	8	209366^{*}	60467^{**}	0.07^{ns}	0.05^{ns}
Error II	36	3514.30	4012	4.34	0.841
CV (%)	-	5.61	5.83	6.86	9.08

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

Mean comparison result of different level of water deficit stress indicated that maximum number of seed per raceme (25.13) was noted for 70 mm evaporation pan class A and minimum of that (21.27) belonged to 130 mm evaporation pan class A (Table 4). As for Duncan classification made with respect to different level of combination nitrogen with vermicompost maximum and minimum amount of number of seed per raceme belonged to 75% nitrogen+25% vermicompost (26.66) and 100% vermicompost treatment (20.11) (Table 5). Application of biological fertilizers significantly increased the number of seeds per spikelet and these results were already reported by (Kumar *et al.,* 2009). Results of Hammad *et al*. (2011) revealed that maximum plant growth, number of kernels per ear and grain yield of maize was found in 250 kg N ha^{-1} treatment and the highest days to maturity and biological yield were recorded from 300 kg N ha^{-1} application. It has been clearly shown in the literature that applying optimum rate of N at proper time is crucial in improving crop productivity. Farmers usually apply high rates of nitrogen fertilizer to ensure the fulfillment of the crop needs, while they are using both water and nitrogen in an inefficient way by increasing leaching potential of nutrients into the ground water (Ramos *et al*., 2012).

Table 4. Mean comparison effect of different level of water deficit stress on studied traits

Treatments	LAI	No. seed per raceme	Chlorophyll index (Spad)	Chlorophyll a ($mg.g^{-1}$)	Chlorophyll b ($mg.g^{-1}$)
70 (mm)	4.15a	25.13a	53.04a	2.23a	1.38a
100 (mm)	3.64b	23.60b	51.55b	1.48b	1.09b
130 (mm)	3.29c	21.27c	48.91c	0.99c	0.60c

*Means with similar letters in each column are not significantly different by Duncan's test at 5% probability level.

Continue Table 4.

Treatments	Seed yield ($kg.ha^{-1}$)	Biologic yield ($gr.m^{-2}$)	Harvest index (%)	Protein percentage (%)
70 (mm)	4030.55a	1161.52a	34.52a	8.66c
100 (mm)	3270.55b	1094b	29.76b	10.03b
130 (mm)	2710.07c	998.98c	26.78c	11.60a

*Means with similar letters in each column are not significantly different by Duncan's test at 5% probability level.

4.3. Chlorophyll index

Result of analysis of variance showed effect of water deficit stress and combination nitrogen with vermicompost on chlorophyll index was significant at 1% probability level but interaction effect of treatments was not significant (Table 3). According result of mean comparison maximum of chlorophyll index (53.04 Spad) was obtained for 70 mm evaporation pan class A and minimum of that (48.91 Spad) was for 130 mm evaporation pan class A treatment (Table 4). Evaluation mean comparison result indicated in different level of combination nitrogen with vermicompost the maximum chlorophyll index (53.81 Spad) was noted for 75% nitrogen+25% vermicompost and minimum of that (48.75 Spad) belonged to 100% vermicompost treatment (Table 5). Rahi (2013) reported that increase in Nitroxin also increased fresh and dry weights of leaf, stem, chlorophylls a, b, total carotenoids, and anthocyanin content of the plants linearly. Sorghum it is the fifth most important cereal crop in the world and it is the dietary staple of more than 500 million people in more than 30 countries, and it ranking the fourth food grains of the world (El Naim *et al*., 2012).

4.4. Chlorophyll a

According result of analysis of variance effect of water deficit stress and combination nitrogen with vermicompost on chlorophyll a was significant at 5% probability level but interaction effect of treatments was not significant (Table 3). Assessment mean comparison result indicated in different level of water deficit stress the maximum chlorophyll a (2.23 $mg.g^{-1}$) was noted for 70 mm evaporation pan class A and minimum of that (0.99 $mg.g^{-1}$) belonged to 130 mm evaporation pan class A treatment (Table 4). Compare different level

of combination nitrogen with vermicompost showed that the maximum and the minimum amount of chlorophyll a belonged to 75% nitrogen + 25% vermicompost (2.28 $mg.g^{-1}$) and 100% vermicompost (0.89 $mg.g^{-1}$) treatments (Table 5). The highest amount of vegetative growth, oil yield, chlorophyll content and NPK percentages were recorded by the treatment of bio-fertilizer plus two third of recommended dose of nitrogen fertilizer (Ahmed *et al*., 2013).

4.5. Chlorophyll b

Result of analysis of variance showed effect of water deficit stress and combination nitrogen with vermicompost on chlorophyll b was significant at 5% probability level but interaction effect of treatments was not significant (Table 3). Evaluation mean comparison result showed in different level of water deficit stress the maximum chlorophyll b (1.38 $mg.g^{-1}$) was noted for 70 mm evaporation pan class A and minimum of that (0.60 $mg.g^{-1}$) belonged to 130 mm evaporation pan class A treatment (Table 4). Between different levels of combination nitrogen with vermicompost the maximum chlorophyll b (1.44 $mg.g^{-1}$) was observed in 75% nitrogen+25% vermicompost and the lowest one (0.61 $mg.g^{-1}$) was found in 100% vermicompost treatment (Table 5). Combined application of organic fertilizer and urea fertilizer or combination urea fertilizer and polyamines significantly increased yield, vegetative growth and chlorophyll index (Zeid, 2008).

4.6. Seed yield

Result of analysis of variance showed effect of water deficit stress, combination nitrogen with vermicompost and interaction effect of treatments on seed yield was significant at 5% probability level (Table 3). Mean comparison result of different level of water deficit stress indicated the maximum and the minimum amount of seed yield belonged to 70 mm evaporation pan class A (4030.55 $kg.ha^{-1}$) and 130 mm evaporation pan class A treatment (2710.07 $kg.ha^{-1}$) (Table 4). Among different level of combination nitrogen with vermicompost maximum seed yield (4050.56 $kg.ha^{-1}$) was obtained for 75% nitrogen + 25% vermicompost and minimum of that (2380.86 $kg.ha^{-1}$) was for 100% vermicompost treatment (Table 5). Evaluation mean comparison result of interaction effect of treatments indicated maximum seed yield (4720.64 $kg.ha^{-1}$) was noted for 70 mm evaporation pan class A and 75% Nitrogen+25% Vermicompost and lowest one (1640.90 $kg.ha^{-1}$) belonged to 130 mm evaporation pan class A and 100% Vermicompost treatment (Table 6). Riahinia *et al*. (2013) reported sorghum the highest seed yield was obtained in full irrigation treatment and application of 60 kg N ha^{-1}, which was consistent with the results of this study. Zare *et al*. (2016) reported that application of vermicompost under dehydration at 60 and 80% of field capacity, increase seed yield compared to control treatment. Research results of other researchers such as Amyanpoori *et al*. (2015); Assefa *et al*. (2010) confirm the results of this study.

Table 5. Mean comparison effect of combination nitrogen with vermicompost on studied traits

Treatments	LAI	No. seed per raceme	Chlorophyll index (Spad)	Chlorophyll a ($mg.g^{-1}$)	Chlorophyll b ($mg.g^{-1}$)
100% Nitrogen	3.75b	23.11b	50.40b	1.71b	1.07b
75% Nitrogen+25% Vermicompost	4.42a	26.66a	53.81a	2.28a	1.44a
50% Nitrogen+50% Vermicompost	4.03ab	24.80ab	52.07ab	1.83b	1.16ab
25% Nitrogen+75% Vermicompost	3.20c	21.89c	50.81b	1.17c	0.84bc
100% Vermicompost	3.08d	20.11d	48.75c	0.89d	0.61c

*Means with similar letters in each column are not significantly different by Duncan's test at 5% probability level.

Continue Table 5.

Treatments	Seed yield ($kg.ha^{-1}$)	Biologic yield ($gr.m^{-2}$)	Harvest index (%)	Protein percentage (%)
100% Nitrogen	3540.41b	1109.76b	31.85b	10.55b
75% Nitrogen+25% Vermicompost	4050.56a	1186.04a	33.94a	8.82d
50% Nitrogen+50% Vermicompost	3780.96ab	1136ab	33.21ab	9.37c
25% Nitrogen+75% Vermicompost	2920.49c	1027.72c	28.38c	10.59ab
100% Vermicompost	2380.86d	965.06d	24.39d	11.15a

*Means with similar letters in each column are not significantly different by Duncan's test at 5% probability level.

4.7. Biologic yield

According result of analysis of variance effect of water deficit stress, combination nitrogen with vermicompost and interaction effect of treatments on biologic yield was significant at 1% probability level (Table 3). Assessment mean comparison result indicated in different level of water deficit stress the maximum biologic yield (1161.52 $gr.m^{-2}$) was noted for 70 mm evaporation pan class A and minimum of that (998.98 $gr.m^{-2}$) belonged to 130 mm evaporation pan class A treatment (Table 4). Compare different level of combination nitrogen with vermicompost showed that the maximum and the minimum amount of biologic yield belonged to 75% nitrogen+25% vermicompost (1186.04 $gr.m^{-2}$) and 100% vermicompost (965.06 $gr.m^{-2}$) treatments (Table 5). Assessment mean comparison result of interaction effect of treatments indicated maximum biologic yield (1265.06 $gr.m^{-2}$) was noted for 70 mm evaporation pan class A and 75% Nitrogen + 25% Vermicompost and lowest one (790.58 $gr.m^{-2}$) belonged to 130 mm evaporation pan class A and 100% Vermicompost treatment (Table 6). Joorabi *et al*. (2015) reported that nitrogen fertilizer (150 $kg.ha^{-1}$) could increase qualitative and quantitative traits such as seed yield (9.82 $t.ha^{-1}$) of sorghum forage in Speed feed variety.

Table 6. Mean comparison interaction effect of treatment on seed and biologic yield

Water deficit stress × combination nitrogen and vermicompost	Seed yield (kg.ha^{-1})	Biological yield (gr.m^{-2})
70 (mm evaporation from class A evaporation)× 100% Nitrogen	4230.92b*	1067.87b
70 (mm evaporation from class A evaporation)× 75% Nitrogen+25% Vermicompost	4720.64a	1265.06a
70 (mm evaporation from class A evaporation)×50%Nitrogen+50% Vermicompost	4660.31ab	1251.44ab
70 (mm evaporation from class A evaporation)× 25% Nitrogen+75% Vermicompost	3420.31d	1118.26c
70 (mm evaporation from class A evaporation)× 100%Vermicompost	3160.54ef	1069.99d
100 (mm evaporation from class A evaporation)× 100% Nitrogen	3430.15d	1103.45c
100 (mm evaporation from class A evaporation)× 75% Nitrogen+25% Vermicompost	4600.85a	1199.29ab
100 (mm evaporation from class A evaporation)×50%Nitrogen+50% Vermicompost	3580.33cd	1126.45c
100 (mm evaporation from class A evaporation)× 25% Nitrogen+75% Vermicompost	2500.3g	1041.22d
100 (mm evaporation from class A evaporation)× 100%Vermicompost	2470.14g	1024.63d
130 (mm evaporation from class A evaporation)× 100% Nitrogen	3000.18f	1067.97d
130 (mm evaporation from class A evaporation)× 75% Nitrogen+25% Vermicompost	3250.17e	1101.76c
130 (mm evaporation from class A evaporation)×50%Nitrogen+50% Vermicompost	3030.23ef	1090.96d
130 (mm evaporation from class A evaporation)× 25% Nitrogen+75% Vermicompost	2350.86g	923.68e
130 (mm evaporation from class A evaporation)× 100%Vermicompost	1640.90h	790.58f

*Means with similar letters in each column are not significantly different by Duncan's test at 5% probability.

Tarang *et al*. (2013) reported applications of Nitroxin bio-fertilizer and chemical fertilizer (400 kg.ha^{-1} urea with 300 kg.ha^{-1} ammonium phosphate) had a significant effect on traits of root dry weight, number of seed per row (36.5), number of seeds per ear (458.56), 1000-grain weight, seed (13.23 t.ha^{-1}) and biological yield (26.4 t.ha^{-1}), and harvest index (53.88%).

4.8. Harvest index

Harvest index shows the way of dividing the nutritional materials between the growing structures of grain and plant. As one of the components for calculating the HI is grain yield, the changes in HI depend very much on the changes of grain yield. Based on the formula of HI, every factor can change the harvest index when the grain yield is influenced more than total dry weight (Sinclair *et al*., 1990). Result of analysis of variance showed effect of water deficit stress and combination nitrogen with vermicompost on harvest index was significant at 1% probability level but interaction effect of treatments was not significant (Table 3). Mean comparison result of different level of water deficit

stress indicated that maximum harvest index (34.52%) was noted for 70 mm evaporation pan class A and minimum of that (26.78%) belonged to 130 mm evaporation pan class A (Table 4). As for Duncan classification made with respect to different level of combination nitrogen with vermicompost maximum and minimum amount of harvest index belonged to 75% nitrogen+25% vermicompost (33.94%) and 100% vermicompost treatment (24.39%) (Table 5).

4.9. Protein percentage

According result of analysis of variance effect of water deficit stress and combination nitrogen with vermicompost on protein percentage was significant at 5% probability level but interaction effect of treatments was not significant (Table 3). Assessment mean comparison result indicated in different level of water deficit stress the maximum protein percentage (11.60%) was noted for 130 mm evaporation pan class A and minimum of that (8.66%) belonged to 70 mm evaporation pan class A treatment (Table 4). Compare different level of combination nitrogen with vermicompost showed that maximum and the minimum amount of protein percentage belonged to 100% vermicompost (11.15%) and 75% nitrogen+25% vermicompost (8.82%) treatments (Table 5). Brown (2010) reported that, triticale seed protein content increased up to 54% by using 120 $kg.ha^{-1}$ nitrogen fertilizer in compare to no nitrogen application treatment. Nasseri *et al*. (2009) reported the protein yield increased with increasing in nitrogen application rates so the highest protein yield (701 $kg.ha^{-1}$) produced by nitrogen rate of 90 $kg.ha^{-1}$. The results of various experiments have proved greater amount of protein in Durum genotypes than that of bread (Ayadi *et al*., 2014).

5. CONCLUSION

Generally result of current research proved the treatment of 75% nitrogen+25% vermicompost treatment under 70 mm evaporation pan class A produced highest amount of crop production and it can advised to farmers.

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FOOTNOTES

AUTHORS' CONTRIBUTION: All authors are equally involved.

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