



The Effect of Organic Fertilizer on Yield and Some Yield Components of Durum Wheat

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Abstract

This study aimed to assess the effects of organic fertilizer applications on yield and some yield components of durum wheat (*Triticum durum* L.). Field trials were conducted under supplemental irrigation conditions in Harran Plain during the growing seasons of 2014-2015 and 2015-2016. In the experiment, Control+ 6 types of organic fertilizer treatments were tested (ie. 1. chicken manure, 2. vermicompost, 3. cattle manure, 4. chicken manure + liquid fertilizer, 5. vermicompost + liquid fertilizer, 6. cattle manure + liquid fertilizer). Combined Analysis of two consecutive years' data indicated that cattle manure+ liquid fertilizer treatment increased grain yield significantly. In the control application, grain yield was 386,381 kg/da while cattle manure+ liquid fertilizer treatment produced 605, 5476 kg / da grain yield.

Among all of the treatments 'cattle + liquid fertilizer' treatment produced the highest grain yield (605, 5476 kg/da), 94,13cm plant height, , 6,865 cm spike length, . and 55,41 g weight of thousand kernel . It was concluded that various organic fertilizer applications increased plant height, spike length and thousand kernel weight compared to control plants while the treatments increased grain yield 50 -56% based on the applied organic fertilizers .

Keywords: Durum wheat, yield, plant height, spike length

INTRODUCTION

Historical Background

Wheat is the most important grain in the world, one of the main sources of carbohydrates, containing significant amounts of protein, minerals and vitamins [1] The world population is growing rapidly. By the year 2050, it is predicted that the world population will reach 9.5 billion. Considering these factors, it shows the importance of increased agricultural and dairy food. Even today, we are in shortage of agricultural and dairy food [2]

In order to meet the needs arising from the rapid growth of the world population, it is needed to increase wheat yield per unit in the world. Suitable wheat variety and fertilization can help to increase wheat production but yield depends on the amount of sufficient nutrients and organic matter in the soil. Turkey's soil, with exception of some restricted areas, is generally poor in organic matter [3]

All kinds of herbal remnants, farm grains, poultry litter, garbage compost and organic wastes can be used for organic matter deficiency. These materials improve the physical, chemical and biological properties of soils and provide nutrients to the soil, thus positively affecting yield and quality in crop production ([4] [5], [6], [7] [8] [9]).

A research conducted to determine the use of compost and organic fertilizer at various levels on wheat development and yield found that organic fertilizer applications increased the grain yield by about 11.13 (105%) tons 13.53 (128%) g compared to control . The fact that the plant weight, number of siblings, spike length, straw yield, grain yield, grain weight in 1000 kernel weight was significantly different compared to untreated plants. They also found that various organic fertilizer applications for a long time would significantly improve the yield [10].

A research conducted a study in two developmental seasons to determine the effects of organic fertilizers on the growth, production and nutrient dynamics of winter wheat, and the concentration of trace elements in soil and in wheat

plants. They compared effects of 16, and 32 mg dry weight of ha⁻¹ yr⁻¹ poultry litter and 120 kg N ha⁻¹ yr⁻¹ + 80 kg P₂O₅ ha⁻¹ yr⁻¹, respectively with non-treated control plants. The results indicated that animal manure increases wheat development and yield depending on the application doses. It was determined that animal manure (32 mg dry weight ha⁻¹ yr⁻¹) increased the number of spikes in m² and yielded as much as of plants that treated with inorganic fertilizer [11].

Conducted a study at the Bakrajow Agricultural Research Center, which lies between 35 ° 32-36.8 "north latitude and 45 ° 21-09.6" east longitude under natural precipitation conditions during the 2013-2014 growing season to determine the influence of different organic fertilizers on Semito wheat vegetative development. The treatments were sheep, cows and poultry manures. Poultry manure produced the most significant results compared to the other manures. Chicken manure application yielded 6.750 t⁻¹ grain [12].

Found that organic fertilizers significantly increased the dry weight, nitrogen, phosphorus and potassium intake and soil properties of wheat during a study to determine the effect of mineral fertilizer and organic fertilizer on the growth and soil characteristics of wheat. They determined that animal manure decreased weight per volume by 13% and increased in organic matter content by 51% relative to the control plants [13].

Conducted a study to determine the effect of non-chemical weed control and the effectiveness of organic fertilizers on wheat at the experimental field of Agricultural Research Center of Ataturk University, Faculty of Agriculture in 2006-07, 2007-08 and 2008-09. The study was conducted in the factorial design of randomized blocks, three types of weed control methods (weed control, manual picking and frequent sowing) and seven fertilizer sources (unfertilized, mineral NP, Bio, Bio SR, Leonardite, organic fertilizer and animal manure) Applied to two baking wheat cultivars Doğu 88 and Kırık. A breeding cultivar, Doğu 88, has a higher

leaf area index, grain filling time, number of spikes per m², number of spikes per grain, grain yield and harvest index compared to a local cultivar Kırık. Animal manure produced the highest yield followed by the organic fertilizers. Animal manure increased yield by 25.6% and 23.2% by organic fertilizer compared to untreated plants. Yield increase was mainly related to the increase in number of spikes in m² [14].

MATERYALS AND METODS

The study was conducted at Harran University Akçakale Experimental Station in 2014-2015, 2015-2016.. In the study animal manure, pigeon manure, compost and microbial fertilizers were applied to Şölen wheat cultivars in.

Random Blocks” with three replications and each of the plots had size of 5 x 1.2 m. In the study, six plots were treated with organic fertilizer during sowing while three plots were

treated with microbial fertilizer during tillering stage. Seeds were planted with 20 cm row spacing and 4-5 cm depth based on 475 seeds / m² [15]. In organic agriculture, 2-3 tonnes of processed animal manure per ha. were applied to organic agriculture plots (Tan and Serin, 1995). Organic treatments received no chemical fertilizer and weed management applications research plots were harvest with combine when wheat reached harvesting stage.

RESULTS AND DISCUSSION

Results; wheat yield, plant height, spike length and the results of one thousand kernels of the experiment carried out in 2014-2015 and 2015-2016 are discusses.

Table 1. Combined variance analysis of different organic fertilizers applied to Şölen wheat on plant length, grain yield, and thousand kernel weight and spike length in 2014-2015, 2016.

Source of variation		Table of Analyse of Variance			
		Plant Height(cm)	Yield kg/da	Spike Height(cm)	Thousand Kernel weight(g)
Year	1	0.259	84.545	0.659	1.252
Replication	4	2.811	290.202	0.430	7.537
Variety	6	11.414**	35442.455**	1.492**	24.548**
Year x Cultivar	6	0.138	72.242	0.068	0.474
Error	24	2.112	247.30	0.240	4.093
General	41				
CV		1.56	2.83	7.65	3.80

* Significant at 0.05. **: Significant at 0.01

Grain Yield

As it is indicated in the Fig. 1, organic fertilizers significantly ($P= 0.05$) increased grain yield.

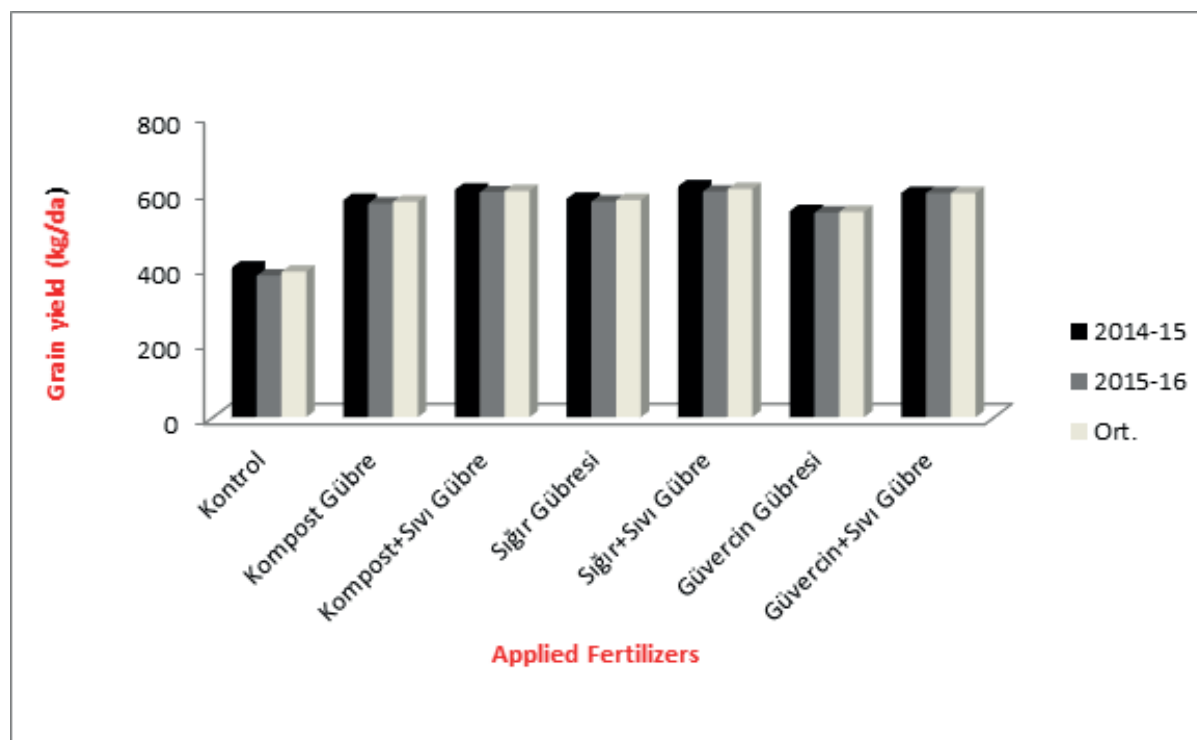
It has been determined that the use of organic fertilizers and organic fertilizers + microbial fertilizers in grain varieties of wheat in 2014-2015 and 2015-2016 increased grain yield (Table 2), while grain yield values ranged from 605.55 (compost + liquid fertilizer) to 386.38 (control) in the average of two years. The highest grain yield values were obtained from compost + liquid fertilizer, cattle + liquid fertilizer and pigeon + liquid fertilizer applications (Fig. 1). In both years, microbial fertilizer application and grain yield values increased.

The fertilizer types used in the experiment seem to increase grain yield when compared to untreated plants which is in agreement with some previous studies that organic fertilizer use improves grain yield ([10], [13] [14]).

Based on combined analysis of two years results, organic fertilizers significantly increased plant height (Fig. 1)

In the years of 2014-2015 and 2015-2016, the use of organic fertilizers and organic fertilizers + microbial fertilizers increased plant height of Şölen wheat cultivar (Fig. 2). In the average of two years, the value of plant height varied from 94.1 cm (cattle fertilizer + liquid fertilizer) and 90.4 cm (control). The highest plant height values were from compost + liquid fertilizer, cattle fertilizer, cattle + liquid fertilizer application. In both years, plant height values were increased with microbial fertilizer applications.

The fertilizer types used in the experiment seem to increase the plant height when compared to the untreated plants. It has also been reported by some researchers that use organic fertilizers would increase plant height ([10], [13], [4], [5], [6]).

Figure 1. Effect of different organic fertilizers applied to Şölen wheat plant length and grain yield in Şanlıurfa**Table 3.** Effect of different organic fertilizers applied to Şölen wheat on Plant Height(cm) and grain yield and formed LSD values.

Fertilizer types	Plant Height (cm)			Grain Yield (kg/da)		
	2014-15**	2015-16	Ort. Ave.**	2014-15**	2015-16**	Ort. Ave.**
Untreated	90.3 d	90.5	90.4 c	397.10 d	375.66 e	386.38 d
Compost	91.9 cd	92.0	92.0 bc	576.14 bc	567.14 c	571.64 b
Compost + Liquid Fertilizer	94.2 a	93.7	93.9 a	603.71 ab	597.10 a	600.41 a
Animal Manure	93.9 ab	93.9	93.9 a	579.62 b	572.10 bc	575.86 b
Animal manure+ liquid Fertilizer	94.3 a	94.0	94.1 a	612.52 a	598.57 a	605.55 a
Pigeon manure	92.2 bc	91.6	91.9 bc	547.09 c	542.86	544.98 c
Pigeon manure Liquid Fertilizer	92.7 abc	92.5	92.6	594.85 ab	594.76 ab	594.81 a
LSD	1.80	23.78	1.70	31.39	23.78	18.68

* Columns followed by the same later are not significantly different (P=0.05)

Spike Height(cm)

Combined analysis of this study showed that application of organic fertilizers significantly (P=0.005) increased spike length.

Table 3. Effect of different organic fertilizers applied to Şölen wheat on Spike Height(cm) and Thousand Kernel Weight and formed LSD values.

Gübre Çeşitleri	Spike Height (cm)			Thousand Kernel weight(g)		
	2014-15	2015-16	Ort.**	2014-15	2015-16	Ort.**
Untreated	5.7	5.3	5.5 c	50.1	49.6	49.8 d
Kompost GÜBRE	6.4	6.1	6.3 b	52.7	52.7	52.7 c
Compost	7.1	6.8	6.9 a	56.0	54.8	55.4 ab
Compost + Liquid Fertilizer	6.7	6.2	6.5 ab	53.7	52.8	53.3 bc
Animal Manure	6.9	6.9	6.9 a	55.4	55.9	55.7 a
Animal manure+ liquid Fertilizer	6.3	6.0	6.2 b	52.0	51.6	51.8 cd
Pigeon manure	6.7	6.7	6.7 ab	53.1	53.1	53.1 bc
Pigeon manure Liquid Fertilizer			0.57			2.38

* Columns followed by the same later are not significantly different (P=0.05)

The fertilizer types applied in this experiment increased the spike length when compared to the control which is in agreement with results of previously reported studies ([4], [5] [6] [10], [13]).

Weight of Thousand Kernel (g)

Combined analysis of this study showed that application of organic fertilizers significantly ($P=0.005$) increased thousand kernel weight.

It has been determined that the use of organic fertilizers and organic fertilizers + microbial fertilizers in the Şölen wheat variety during 2014-2015 and 2015-2016 increased the weight of thousand kernel (Table 3). In the average of two years, the value of one thousand kernel weight varied between 49.8 g (control) and 55.7 g (cattle + liquid fertilizer). In both years, thousand kernel weights increased with the application of organic fertilizer and organic fertilizer + microbial fertilizer.

Compared to the untreated plants, the fertilizer types used in the experiment increased the value of thousand kernel weight. It has also been reported by some researchers that organic fertilizer use increases the weight of a thousand grains studies ([4], [5] [6] [10], [13]).

EXPERIMENTAL RESULTS

The average of two years indicated that average grain yield was 605.55 kg da⁻¹ (compost + liquid fertilizer) and 386.38 kg da⁻¹ (control), while plant height varied from 94.1 cm (animal manure + liquid fertilizer) to 90.4 cm (control). Spike length was 5.5cm for control plants and 6.9 cm for plants treated with compost + liquid fertilizer and animal manure + liquid fertilizer. Thousand kernel weight varied from 49.8 g (control) to 55.7 g (cattle + liquid fertilizer). In particular, the microbial used in this study increased the effectiveness of organic fertilizers.

CONCLUSION

We should prefer organic fertilizer that maintain balance in the environment, provide balance in soil fertility, help to control diseases and pests, create continuity of life, and provide quality products.

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