Response of Productivity Indicators of Cotton Variety "Aleppo 1-33" to Compost Rates

Mohamed Abd EL-Aziz[1], Hossam Eldeen Khalasy[2], Azzam Ali[3]
[1] Professor, Dep. of Field Crops, Faculty of Agriculture, Tishreen Univ., Syria
[2] Assistant Prof., Dep. of Field Crops, Faculty of Agriculture, Tishreen Univ., Syria
[3] PhD Student , Dep. of Field Crops, Faculty of Agriculture, Tishreen Univ., Syria

Abstract

The research was carried out during 2016 and 2018 seasons in the village of Al Mahrousa in Al-Ghab region to study the effect of three compost rates (10-15-20 ton.h^{-1}) on the following production indicators: Boll weight (g), Plant yield (g) , Seed index (g), Harvest index (%) Crop index (%) and ginning out rate (%) for the cotton Gossypium hirsutum L. variety Allepo 1-33 and compare The results with Control plants (without addition). The experiment was performed according to the Completely Randomized Design with three replicates per treatment.

Compost was added with basic tillage. Results were taken and the averages were calculated and statistically analyzed using the GenStat-12 program which showed the following: The increase in the compost rate resulted in a decrease in the boll weight and the ginning out rate, although all the rates exceeded the control. The rate 20 ton.h^{-1} gave the best results in the characteristics of plant yield (93.39 g and 106.45 g), the seed index (11.80 g and 12.90 g), the harvest index (34.72% and 35.74%) and the crop index (53.21% and 55.64 %). In the first and second seasons respectively. There were no significant differences between the rates 10 and 15 ton.h^{-1} in the harvest index. There were no significant differences between the three rates and the control plants in the boll weight during the two seasons of the study and in the ginning out rate during the 2016 season.

Keywords: *Cotton Compost, Boll weight, Plant yield, Seed index, Harvest index, Crop index.*

I. INTRODUCTION

Compost process is a biological decomposition of organic matter by the presence of oxygen in the waste under controlled conditions that allow the growth of aerobic microorganisms that transform it into a stable, decomposable, decomposable material that can be used without adverse environmental effects [1].

Re. [2] noted that the compost has two major effects on soil, particularly nutrient-poor soils: rejuvenating the soil content of organic matter and supplying plants with their needs. According to re. [3], compost has several advantages compared to plant residues when applied to soil as low volume, slower mineralization rates and recycling of municipal solid biomass. Other beneficial effects of the compost include increased water storage capacity in the soil, increased water availability of the plant [4], reduced nutrient inertia [5] and reduced erosion and evaporation [6]. And prevention of plant diseases [7]. Compost can therefore act as a slow-acting, long-lasting fertilizer.

In an experiment to determine the response of cotton to compost and risobacterin levels under different levels of nitrogen. Re. [8] indicated that the best treatment was the use of risobacetrine + compost at 4 ton.fed^{-1} and 75% N which gave the best result in plant height, Sympodial Branches Number and Opened Bolls Number , Boll Weight, the seed index, Plant Yield, Ginning Out Rate. The addition of compost significantly increased the soil content of the organic matter and increased the production of cotton, harvest and crop index, this increase was relative to the application rate and there was a slight cumulative effect from year to year [9].

Re. [10] noted that using compost organic fertilizer with four levels (10-20-30-40 ton.ha^{-1}) showed that the increase in organic fertilization increased cotton yield and that the best results were at 30 ton.ha^{-1} . Re. [11] confirmed that the application of compost at the rate of 2.5 ton.fed^{-1} plus bacterial strains gave the best results for cotton production indicators (Plant yield, Seed index and Ginning out rate) and fiber quality as well as chemical and biological soil properties.

Re. [12] confirmed that the organic fertilization at the rate of 20 ton.ha^{-1} bovine waest fertilizer gave an increase in the productivity of cotton seed compared to the lower rates.

The aim of this Research is to study the effect of compost on the productivity indicators of cotton plants in this agricultural area.

II. MATERIALS AND METHODS

A. Planted Cultivar:

"Aleppo 1-33" cotton seeds were planted, which obtained from "Al - Ghab Agricultural Research Center", a strain of individual selection of the American class Akalas C 4, which is more tolerant of the Wilt disease of Aleppo 40 and has the longer staple and better smoothness, Aleppo1-33 was distributed in 1991 instead of Aleppo 33 and Aleppo

40 in Homs, Hama and El Ghab because of its high resistance to wilt disease, its high productivity and excellent technological specifications. The average characteristics of the cotton cultivars are as follows: plant height (105 cm), Monopodial Branches Number (2 branches), First Fruitful Branch Height (6), Boll Weight (6.8 g), Ginning Out Rate (38.97%). Fiber Technological properties such as staple length (1.203 inches), Softness (4.84 Microner) and elongation (5.2%).

B. The Research Execution Location

These experiments were carried out in Al - Ghab area (Al-Mahrousa) village, at 225 m height. A soil sample was taken and (physically and chemically) analyzed and obtained the results shown in Table 1:

Table (1): Physical and chemical analysis of the soil sample from the research location

	Sand%	Selt%	Clay%	PH	EC Millemose / cm	Organic matter %	potassium PPM	phosphor PPM	Nitrogen %
General values				6.5-7.5	Less than 4	4-6	240-360	6-12	0.15-0.2
2016 Sample	36	12	52	7.49	0.65	1.55	94.5	8.97	0.09
2018 Sample	35.5	13.5	51	7.57	0.67	2.07	102	9.01	0.12

The results of the soil sample analysis show that the soil in which the experiment was conducted has a clay content, the pH level is moderate, it is low salinity with good phosphorus content, and is low in organic matter and mineral nitrogen content. Mineral fertilizers were added with basic tillage according to soil analysis according to equation 190 + 74 + 350 kg / e (K2O + P2O5 + N), respectively.

Generally, this region is characterized by a hot and dry summer with cold and rainy winter with two transitional seasons which weather is unstable. Table 2 shows some climatic data (Temperature and precipitation) during the two seasons of the study.

Table (2) Mean temperatures and precipitation during the 2016 and 2018 seasons.

	Season 2016			Season 2018		
	Maximum Temperature	Minimum Temperature	Precipitation	Maximum Temperature	Minimum Temperature	Precipitation
April	23.2	5.6	9	26	8.8	90
May	26.7	11.6	56	31	16	68
June	34.8	18.6	0	32	20.8	2
July	37.8	23.2	0	34.5	21.6	0
August	38.6	23.5	0	33.9	21.6	0
September	33.1	18.8	0	34.8	20.2	0
October	30.2	14	37	27.9	14.5	55
Total precipitation			548.5	Total precipitation		557.5

C. Planting Date:

Planting was done manually in the first season on 20/04/2016 and in the second season on 22/04/2018

D. Experiment Design

This experiment was designed according to the design of the complete randomization by three replicates per rate of compost rates in addition to the control treatment as in Table (3):

Table (3): Applicated compost rates and its used symbol.

Applicated rate	(Control) 0 ton.h^{-1}	10 ton.h^{-1}	15 ton.h^{-1}	20 ton.h^{-1}
Used symbol	C0	C1	C2	C3

(The source of the compost is the solid waste recycling manufactory / Wadi El-Hada / Tartous), where the three rates were added once at the main tillage and at a depth of 25-30 cm. Table 4 shows the analysis of the used compost sample.

Table (4): Chemical analysis of the compost sample.

PH	EC Millemose / cm	Organic matter %	organic carbon %	Nitrogen %	Humidity %
8.16	2.08	65	32.5	2.1	42

The analysis shows that the used compost in the study has good organic matter and organic carbon content. It is also rich in nitrogen. Its pH level is slightly high and its salinity is also slightly high.

The ground plan dimensions of 75 cm between lines and 20 cm between the plants at rate of one plant / hole to achieve a density of 66667 plants.ha^{-1}, divided into experimental plots with dimensions (2.5x2.5 m), the plot area is 6.25 m^2. The sections separated by a one meter width service corridors and the irrigation channels and the range of the experiment with a width of one meter from each direction is added to the total area of the experiment.

Basic tillage was done in the autumn at a depth of 25-30 cm using a disk cultivator. The weeding, seedlings separating and hoeing was done manually. No chemical control operations were carried out. The traditional irrigation method was carried out according to the cotton crop irrigation program in the area and according to the plants needs at a rate of Watering every 12 day .

E. Readings and Studied Indicators

1) Boll Weight (g): 50 boll were Harvested from each plot to represent the first boll of the fruit branches 3,6,9 for all treatments with the three replicates and then weighed by a sensitive balance and estimated averages.

2) Plant Yield (g): The whole bolls of 20 plants were harvested from each plot and weighed individually for each plant and then the average Calculated.

3) Seed Index (g): 100 seeds of each plot with its three replicates were weighed using a sensitive electronic balance.

4) Harvest Index (%): Calculated as follows:

Harvest Index = (Economical Crop Weight / Biological yield) x 100. from [13].

Crop Index (%): Calculated as follows:

Crop yield = (Economical crop Weight / straw Crop weight) x 100 .from [13].

Ginning Out Rate (%): Calculated as:

Intermediate rate = 100 x (Ginning Out cotton weight) / (cottonseed weight)

F. Statistical Analysis

Excel 2007 was Used to tabulate and schedule data and the GenStat-12 software was used to analyze data statistically by examining the variance in differences (variance analysis) and then calculating the values of the least significant difference L.S.D. at a level of 5%.

III. RESULTS AND DISCUSSION

The readings were taken from three replicates for each applied rate and we calculated the averages. We obtained the results in Table (5) which shows the effect of compost rates on the cotton studied characteristics.

Table (5): Effect of compost rates on the cotton studied characteristics and L.S.D (5%) values for each.

Character	C0=0 ton/h		C1=10 ton/h		C2=15 ton/h		C3=20 ton/h		LSD (5%)	
	2016	2018	2016	2018	2016	2018	2016	2018	2016	2018
Boll Weight (g	5.65	5.75	6.04	6.47	5.97	6.39	5.94	6.35	n.s.	n.s.
Plant Yield (g)	64.33	71.33	80.84	90.44	85.95	97.82	93.39	106.45	4.155	4.566
Harvest Index (%)	31.13	32.03	33.83	34.29	34.05	34.76	34.72	35.74	0.457	0.476
Crop Index (%)	45.21	47.11	51.16	52.22	51.67	53.29	53.21	55.64	0.332	0.273
Seed Index (%)	10.59	11.84	11.60	12.75	11.69	12.85	11.80	12.90	n.s.	n.s.
Ginning out Rate (%)	38.97	39.10	39.43	39.90	39.30	39.75	39.19	39.59	n.s.	0.141

The differences between the mean values were examined by means of the LSD(5%) test. The results were as follows:

A. Boll Weight (g)

One of the most important characteristics of the productivity of cotton plant is affected by environmental and agricultural factors and other plant-related causes such as Kind and Cultivar [13].

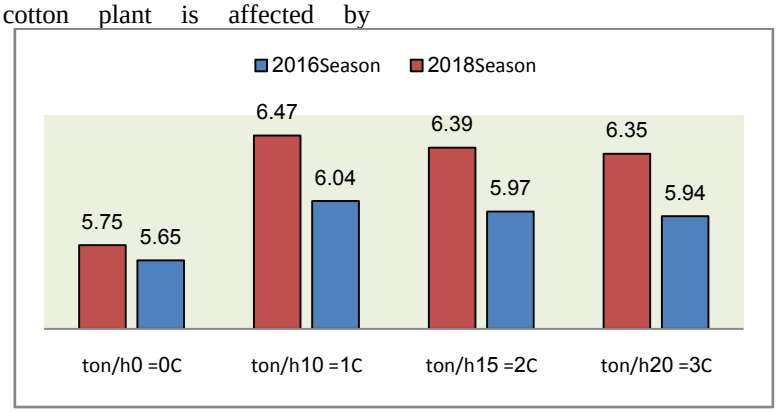

Figure 1: Compost Effect on Boll Weight (g)

The figure (1) results show that the average boll weight decreased slightly with increase in the compost rate, which was the highest value (6.04 g) at the rate (K1 = 10 ton.h^{-1}) and the lowest value (5.94 g) at the rate (K3 = 20 ton.h^{-1}) in the first season and in the second season the highest value was (6.47 g) at the rate (K1 = 10 ton.h^{-1}) and the lowest value (6.35 g) at the rate (K3 = 20 ton.h^{-1}). The statistical analysis of the study seasons showed that there were no significant difference between boll weight at the three compost rates. all of which were significantly higher than the control plant (5.65 g) in the first season and (5.75 g) in the second season

The increase than the control is due to the role of compost as organic fertilizer in improving growth and paper surface, which increases the ability of the plant to manufacture and store food. These results are consistent with [8]. The slight decrease by the increase in the rate was caused by the increase in the boll number/plant and therefore the distribution of food on a larger number of storage units.

B. Plant Yield (g)

The productivity of the cotton plant is the main objective of its cultivation and productivity is different due to the impact of many characteristics (number of fruit branches, number of open boll and boll weight).

The results shown in **Figure (2)** indicate that the average plant yield increased with the compost rate, the lowest value (80.84 g) at the rate (K1 = 10 ton.h^{-1}) and the highest value (93.39 g) at the highest rate (K3 = 20 ton.h^{-1}) in the first season. In the second season, the lowest value was (90.44 g) at the rate (K1 = 10 ton.h^{-1}) and the highest value (106.45 g) at the highest rate (K3 = 20 ton.h^{-1}).

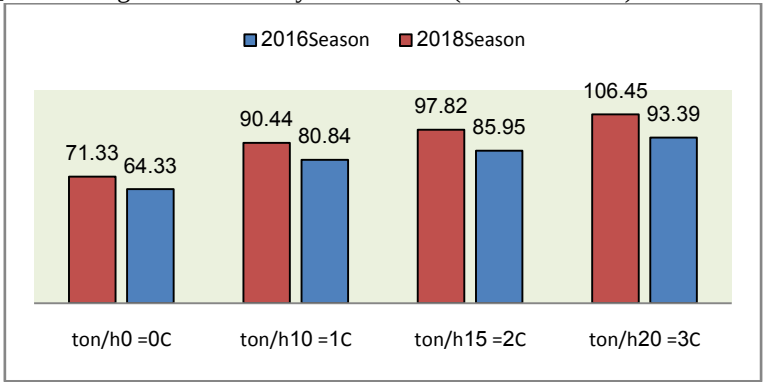

Figure 2: Compost Effect on Plant Yield (g)

The statistical analysis of the study seasons showed that there were only a few significant differences between the three rates, all of which were significantly higher than the control plant (64.5 g) in the first season and (71.33 g) in the second season. This increase is due to the role of compost as organic fertilizer in the improvement of yield components. These results are consistent with [8], [10].

C. Seed Index (g):

The results of the Figure (3) show that the weight of 100 seeds increased by increasing the compost rate. The values was (11.60 - 11.69 - 11.80 g) in the first season and (12.75 - 12.85 - 12.90 g) In the second season at the rates (10 - 15 - 20 ton.h^{-1}) respectively.

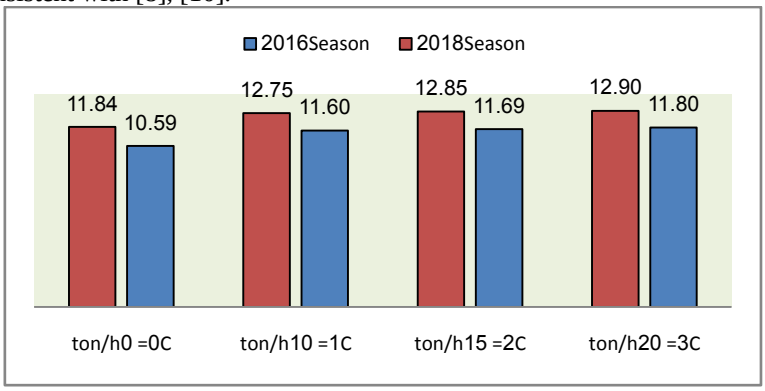

Figure 3: Compost Effect on Seed Index (g)

The statistical analysis of the results of the seasons didn't show any significant differences between the three rates. However, all rates showed better results than the control plant (10.99 g) in the first season and (11.84 g) in the second season. These results are consistent with [8].

D. Harvest Index (%)

The Figure (4) results show that the harvest index increased by the increase of the compost rate. The values were (33.83 - 34.05 - 34.72%) in the first season and (34.29 - 34.76 - 35.74%) In the second season at the rates (10 - 15 - 20 ton.h^{-1}) respectively.

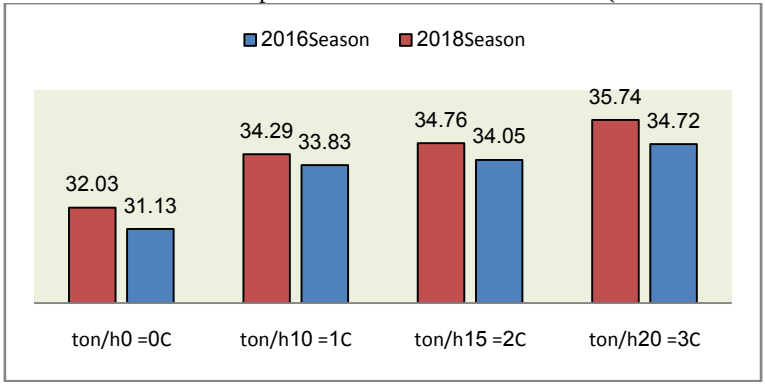

Figure 4: Compost Effect on Harvest Index (%)

The statistical analysis of the results of the seasons showed that the higher rate K3 plants was superior to the other rates, while the difference between K2 and K1 was no significant. The three rates were significantly higher than control plant (31.13% in the first season and 32.03% in the second season). This increase is due to the role of compost in increasing plant productivity of cottonseed. These results are consistent with [8] and experiences [9].

E. Crop index (%):

The results of the **Figure (5)** show that the crop index increased by the increase in the compost rate. The values were (51.16 - 51.67 - 53.21%) in the first season and (52.22 - 53.29 - 55.64%) in the second season at the rates (10 - 15 - 20 ton.h^{-1}) respectively.

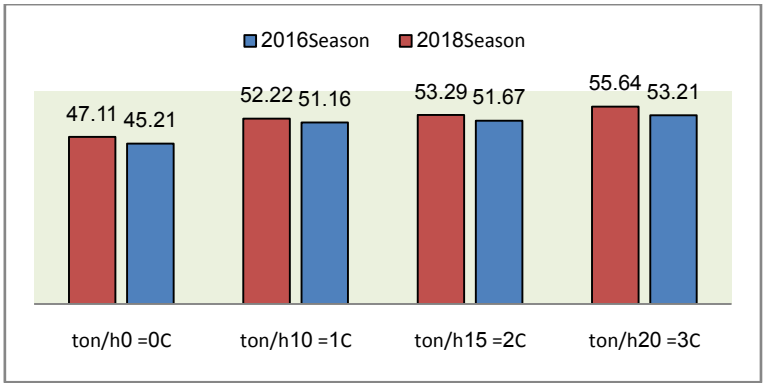

Figure 5: Compost Effect on Crop Index (%)

The statistical analysis of the results of the seasons showed significant differences between the three rates, all significantly higher than the control plant (45.21% in the first season and 47.11% in the second season). This increase is due to the role of compost in increasing the plant productivity of the cottonseed. These results are consistent with [8], [9].

F. Ginning Out Rate (%):

The results of the Figure (6) show that the addition of compost caused an increase in the ginning out rate compared to the control. We notice a slight decrease in the ginning out rate by increasing the compost rate. The values were (39.43 - 39.30 - 39.19%) in the first season and (39.90-39.75-39.59%) In the second season at the rates (10 - 15 - 20 ton.h^{-1}) respectively.

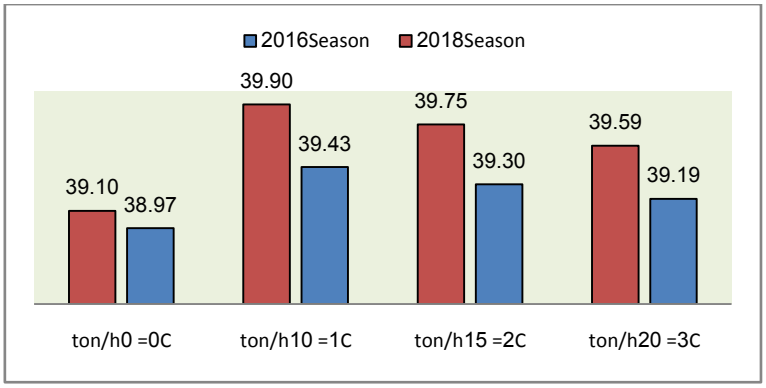

Figure 6: Compost Effect on Ginning Out Rate (%)

The statistical analysis of the results of the first season did not show any significant differences between the three rates. However, all of them showed better results than the control (38.97%). In the second season, the differences were significant among the three rates, all significantly higher than the control plant (39.10%). These results are consistent with [11], and [8]) findings

IV. CONCLUSIONS

1. The increase in the compost rate resulted in a decrease in the boll weight and the ginning out rate, although all the rates exceeded the control.
2. The rate 20 ton.h^{-1} gave the best results in the characteristics of plant yield (93.39 g and 106.45 g), the seed index (11.80 g and 12.90 g), the harvest index (34.72% and 35.74%) and the crop index (53.21% and 55.64 %) In the first and second seasons respectively. There were no significant differences between the rates 10 and 15 ton.h^{-1} in the harvest index.
3. There were no significant differences between the three rates and the control plants in the boll weight during the two seasons of the study and in the ginning out rate during the 2016 season.

We propose using the compost rate of 20 ton.h^{-1} to obtain the best results for the production indicators of cotton cultiver Aleppo 1-33.

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