Published with Open Access at Journal BiNET
Vol. 14, Issue 01: 1190-1193
Journal of Bioscience and Agriculture Research
Journal Home: www.journalbinet.com/jbar-journal.html

Organic amendment and mulch on yield of onion

Ahmmed, M. M.[1] , Hossain, F.[1] and Quddus, A. F. M. R.[2]

[1] Soil Resource Development Institute (SRDI), Ministry of Agriculture, Bangladesh
[2] Bangladesh Agricultural Research Institute (BARI), Ministry of Agriculture, Bangladesh

✉ For any information: ask.author@journalbinet.com, Available online: 14 July 2017.

ABSTRACT

An experiment was conducted at a farmer field in Saltha upazilla of Faridpur district, Bangladesh to evaluate the influence of organic amendment and mulch on the growth and yield of onion (Allium cepa) cv. Taherpuri. The experiment was laid out in randomized complete block design (RCBD) with four replications. Treatments were no organic amendment and no mulch or control (T_0), mulch (T_1), organic amendment (T_2) and organic amendment + mulch (T_3). Results indicated that leaves per plant, plant height, diameter of bulb, single bulb weight and bulb yield were increased significantly with the application of organic amendment and mulch. Yield contributing characters and yield was found in ascending order ($T_0 < T_1 < T_2 < T_3$). The value of nitrogen, potassium and boron were increased without changing status where organic matter, phosphorous, sulpher and zinc amount reserved sharply.

Key Words: *Onion, Mulch, Organic amendment and Nutrients*

Cite Article: Ahmmed, M. M., Hossain, F. and Quddus, A. F. M. R. (2017). Organic amendment and mulch on yield of onion. Journal of Bioscience and Agriculture Research, 14(01), 1190-1193.
Crossref: https://doi.org/10.18801/jbar.140117.146

I. Introduction

Onion (*Allium cepa* L.) belongs to the family *Alliaceae* and is well known as the most important crop all over the world which is used as both vegetable and spice crop. As spice onion bulb is used, which is composed of carbohydrates (11.0 g), proteins (1.2 g), fiber (0.6 g), moisture (86.8 g) and several vitamins like vitamin A (0.012 mg), vitamin C (11 mg), thiamine (0.08 mg), riboflavin (0.01 mg) and niacin (0.2 mg) and also some minerals like phosphorus (39 mg), calcium (27 mg), sodium (1.0 mg), iron (0.7 mg) and potassium (157 mg) (Suresh, 2007). It was also reported that the average bulb yield of onion in Bangladesh is less than 10 t ha^{-1} whereas the world yield is 17.46 t ha^{-1} (FAO, 2003), which is much lower than the other onion producing countries in the world. Improper cultural management practices, lack of enough soil moisture and lack of improved varieties are attributed to this lower yield. Mulching is an important technology which decreases the loss of soil water through evaporation and conserve soil moisture thus reduces the irrigation requirements, increasing root development, promote faster crop development, reducing weed attack and induce earlier harvest of crop (Vavrina and Roka, 2000; Mahajan et al. 2007) but along with organic amendment resulted better yield performance. In soil management relationships, organic amendment and mulching has been reported

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to influence organic matter content, activity of microorganisms, availability of soil nutrients, control of erosion, soil compaction and regulating soil temperature (Stowell, 2000; Grigg et al. 2006). Organic amendment and mulching improves the soil environment for increasing crop growth, development and yield. Rhee et al. (1990) showed that organic amendment and mulching increases the efficiency of applied N fertilizer by reducing leaching and evaporation loss of nutrients. Different types of mulches including rice straw and polythene significantly increased the growth and yield of onion (Islam et al. 2002). The study was undertaken with three different levels of organic amendment and mulching to investigate the yield of onion.

II. Materials and Methods

Experiment was conducted at a farmer field in Saltha upazilla of Faridpur district, Bangladesh under the agro-ecological zone of Low Ganges Floodplain, AEZ 12 during the period from October 2013 to April 2014 to evaluate the influence of organic amendment and mulch on the growth and yield of onion (*Allium cepa*) cv. Taherpuri. The experiment was laid out in randomized complete block design with three replications. The following treatments were used:

T_0= No organic amendment and no mulch
T_1= Mulch (dried straw)
T_2= Organic amendment (well rotten cowdung)
T_3= Organic amendment + mulch

Nutrient status of initial soil and experimental plot soil was recorded by testing soils in SRDI Regional Soil Testing Laboratory, Faridpur, Bangladesh. Doses of fertilizers and manures were used following the Fertilizer Recommendation Guide (FRG, 2012). Different intercultural operations and protection measures were done as and when necessary. Plants in each plot were randomly selected and tagged for recording data on plant for yield and yield contributing characters. All the data were statistically analyzed using the computer package program MSTAT-C. The mean differences among the treatments were compared by least significant difference (LSD) test at 5% level of significance.

III. Results and Discussion

Leaves per plant and plant height

Organic amendment + mulch (T_3) treatment significantly increased leaves number of onion. Maximum numbers of leaves were 14.9 and minimum (11.1) numbers of leaves were produced at the control (T_0) treatment. Maximum numbers of leaves were obtained possibly due to higher nutrient availability reinforced by mulching, this phenomenon also well established in case of garlic as reported by Baten et al. (1995). While organic amendment and mulch had significant effect on plant height (Table 01). Highest plant height (49.4 cm) was noted from the T_3 treatment. The lowest 40.3 cm plant height was obtained from the control (T_0) treatment.

Table 01. Effect of organic amendment and Mulch on onion plant characteristics and yield

Treatments	Leaves plant^{-1}	Plant height (cm)	Diameter of bulb (cm)	Single bulb wt. (g)	Bulb yield (t ha^{-1})
T_0= No organic amendment and no mulch	11.1c	40.3	4.1	35.3	15.1cd
T_1= Mulch (dried straw)	11.2bc	42.2	4.2	41.2	16.7c
T_2= Organic amendment	12.3b	45.6	4.4	46.1	17.1b
T_3= Organic amendment + mulch	14.9a	49.4	4.8	46.4	18.4a
LSD 0.05	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
CV	*4.44*	*4.14*	*3.01*	*6.22*	*5.44*

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Bulb diameter and single bulb weight

Results showed that T_3 had significant effect on diameter of onion bulb (Table 01). These result also found by Jamil et al. (2005). The highest bulb diameter (4.8 cm) was recorded in T_3 treatment followed by T_3 and T_2 treatment. Whereas the lowest bulb diameter (4.1 cm) was obtain from control plots. Sumi et al. (1986) reported that organic amendment and mulch produced higher bulb diameter compare to unmulched condition. In case of garlic, Baten et al. (1995) and Mia (1996) also reported similar results of higher bulb diameter with organic amendment and mulch. Covering the soil with mulch material assures better water retention, improves its aggregation and protects from sudden temperature changes which positively influence yield component resulting increased bulb weight (Zaongo et al., 1997). T_3 treatment had significant effect on single bulb weight of onion (Table 01). The highest bulb weight (46.4 g) was observed with organic amendment and mulch (T_3), whereas the lowest (35.3 gm) was observed at control (T_0) plots. Results of this present study were supported by the findings of Hossain (1996); Rekowska (1997). Similar observation also found in garlic observed by Jamil et al. (2005) who concluded that the highest fresh weight garlic was obtained from those plants which were grown under mulch. Organic amendment and mulch increases bulb fresh weight of onion bulb. Bulb fresh weight might increase as mulching conserved adequate soil moisture which increased chlorophyll content of plant (El-oksh et al., 1993). Rate of photosynthesis increased with the increase level of chlorophyll content. Thus higher amount of dry matter was accumulated in onion bulb.

Table 02. The effect of Organic Amendment and Mulch on Plant nutrients in soil

Name of Nutrients	OM (%)	N (Total)	P (microgram /g soil	K (miliequ. /100g soil	S (microgram /g soil	Zn (microgram /g soil	B (microgram /g soil
Initial soil status	1.33 Low	0.124 Low	21.511 Medium	0.140 Low	11.350 Low	0.272 Very low	0.251 Low
T_0	1.04 Low	0.902 Low	16.211 Medium	0.092 Low	12.512 Low	0.311 Very low	0.141 Low
T_1	1.66 Low	0.141 Low	21.582 Medium	0.110 Low	13.011 Low	0.443 Very low	0.224 Low
T_2	1.91 Medium	0.175 Low	21.651 Medium	0.1622 Low	14.527 Low	0.512 Low	0.243 Low
T_3	2.60 Medium	0.191 Low	22.101 Medium	0.1653 Low	16.343 Medium	0.880 Low	0.271 Low

Bulb yield of onion

Significant difference in bulb yield was obtained due to the effect of T_3. The highest bulb yield (18.4 t/ha) was recorded fromT_3 treatment whereas the lowest yield (15.1 t/ha) was obtain from control plot (T_0) . This result is consistent with values of leaves per plant, plant height, bulb diameter and single bulb weight with T_3 of this study (Table 01). These results were agreed with the findings of Adetunji (1994); Mia (1996) and Hossain (1996), they reported that organic amendment and mulch gave higher bulb yield compare to unmulched condition. Organic amendment and mulching (T_3) favors the reduction of evaporation leading to higher soil moisture content, a reduction in weed growth and the decomposition of added mulches might have also contributed to increase the supply of nutrients and moisture for overall increase in crop yields.

Post-harvest soil nutrients status

It is evident from Table 02 that initial plant nutrients statuses were lower in amounts except the phosphorus. But plant nutrients status found relatively improved in case of organic amendment and mulch treatment compared to initial soil fertility statuses, i.e., OM and Sulphur statuses were found medium, Zn status raised from very low to low and P status remain similar. However, further repeated study is suggested following contribution and management of other crops in the season/years to conclude on soil fertility conditions. Fertilizer recommendation would follow existing guidelines; methodology developed and or suggested techniques (FRG, 2012; Sultana et al. 2015).

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Acknowledgement

The author acknowledges contribution of the officers and staffs of Soil Resource Development Institute, Regional Soil Testing Laboratory, Faridpur for testing initial and post-harvest soil samples.

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