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Growth and yield of shallot (*Allium ascalonicum* L.) as influenced by soil application of liquid urea and cow urine

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Abstract

This experiment was carried to evaluate the effect of liquid urea and cow urine with cow dung on the economic yield of shallot (Allium ascalonicum L.) in the Eastern Province of Sri Lanka. The experiment was arranged in a Completely Randomized Design (CRD) with eight replicates and six treatments namely, T1: 20 g cow dung, T2: 20 g cow dung + 3% urea, T3: 20 g cow dung + 3% cow urine, T4: 30 g cow dung, T5: 30 g cow dung + 3% urea, and T6: 30 g cow dung + 3% cow urine. The soil applications of liquid urea and cow urine were done as top dressing at two weeks interval from 3rd week after planting (WAP). Data were collected at 3rd, 5th, 7th, and 9th WAP and at harvesting stage. The results revealed that there were significant (P<0.001) variations in plant height, number of bulbs, bulb diameter, fresh weight of single bulb, number of roots, root length, dry weight of leaves, dry weight of bulbs per plant and bulb yield per unit land among the treatments. Relatively higher yield (37.5 t/ha) was obtained from the plants treated with 30 g cow dung and 3% urea (T5) than other treatments whereas 20 g cow dung alone (T1) produced the lowest yield (8.4 t/ha). T6 (30 g cow dung and 3% cow urine) gave 32.6 t/ha bulb yield. It was also noted that there was no remarkable (P>0.05) difference in the bulb yields between T2 and T3. However, significant variation was observed between T5 and T6. The combined effect of cow dung and liquid urea fertilizer increased the onion yield. From this study, it could be stated that 30 g cow dung with 3% urea or 3% cow urine could give high bulb yield in the shallot cultivation at rural areas in Sri Lanka where farmers could easily collect the locally available materials for crop production in ecofriendly manner.

Keywords: *Bulb yield, cow dung, cow urine, shallot, urea*

Introduction

Shallot onion (*Allium ascalonicum* L.) is the herbaceous important bulb crop belonging to the family Alliaceae. It is a popularly consumed spice crop and it is widely cultivated in many parts of world, including the tropics (Derajew *et al*., 2017). Onion is an important crop in all continents and this crop is cultivated for the consumption in immature and mature stages of bulbs (Haque *et al*, 2011). It can be stored for a long period and can safely withstand the rough handling including long distance transport (Tripathi and Lawande, 2019).

Onion bulb is used as both vegetable and flavoring the food and it is rich in minerals like phosphorus and calcium. Further, it contains chemical compounds such as phenolic and flavonoids and also vitamin C (Michael and Smith, 2005). It is rich in any nutrients such as minerals like phosphorus and calcium and carbohydrates and it also contains protein and vitamin C (Asanga *et al*., 2015). This genus is widely known for its aromatic properties, and for its medicinal properties (Liguori *et al*., 2017).

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The colour of red onions is mainly due to anthocyanin present in the epidermal cells of the scale leaves of the bulbs (Kim *et al*., 2018).

Onions in the diet play a part in preventing heart diseases and other ailments (Lanzotti, 2006). Many tropical onions are grown in the river beds and valleys where irrigation is possible. Onion is classified as high valued cash crop because of high cost of production. In Sri Lanka, shallot (red onion) are grown and consumed. In Sri Lanka, the major red onion producing districts are Jaffna, Vavuniya, Kilinochchi, Trincomalee, Batticaloa and Monaragala. Red onion is grown as rain fed crop and an irrigated crop and it is normally propagated by bulbs. Production of onion is greatly influenced by agronomic practices such as planting time, planting density, age of seedling. Farmers spend greater portion of their capital for purchasing chemical fertilizers. Generally excessive amount of inorganic fertilizers is applied to vegetables in order to achieve a higher yield (Stewart *et al*., 2005).

Application of inorganic fertilizers alone generate deleterious effects to the environment and human health as the synthetic N, P, K fertilizer is rapidly lost by either evaporation or by leaching in drainage water and it causes dangerous environmental pollution (Aisha *et al*., 2007). Continuous usage of inorganic fertilizer affects soil structure hence, organic manures can severe as alternative to mineral fertilizers (Naeem *et al*., 2006) for improving soil structure and microbial biomass (Dauda *et al*., 2008). Akoun (2004) confirmed that organic manure increases the nutrient status of a soil which leads to increase in onion yield. Generally, N, P and K uptake are remarkably higher in both organically and inorganically fertilized plants than their unfertilized plants (Seran, 2016). On the other hand, continuous use of inorganic fertilizers resulted in deficiency of micronutrients, imbalance in soil physiological properties and unsustainable crop production (Jeyathilake *et al*., 2006).

Organic farming is an environmentally friendly cultivation system and usage of organic fertilizers in crop cultivation enhances soil health. Cattle manure is the most common organic manure which is used in crop cultivation to improve the soil physical properties and nutrient availability to the crop. Urea fertilizers play a significant role in improving productivity of onion that has shallow and unbranched root system (Alajrami *et al*., 2018). Cow urine is very useful in agricultural operations as a biofertilizer and biopesticide (Dharma *et al*., 2005). It also improves the soil physical properties, increase the nutrient availability of the growing medium especially nitrogen to the crop because it contains 2.5% urea (Sadhukhan *et al*., 2019). Hence, this experiment was carried out with the objectives of assessing the effects of growth and yield of *Allium ascalonicum* L. (shallot) as influenced by liquid urea and cow urine as soil application.

Materials and Methods

This experiment was carried out at Kokkaddicholai in Eastern Province of Sri Lanka from May to September 2021 which is located at average elevation of 100 meters above sea level. The average annual temperature ranges from 28 to 32° C. The average yearly rainfall of the district ranges from 1800 mm to 2100 mm. Sandy loam is predominant soil type. The experiment was arranged in a completely randomized design (CRD) with six treatments (Table 1) and eight replications in open field. Each treatment had eight replications. Each replication consisted of two plants. A black polythene sheet having a thickness of 500 gauge was used to prepare the polybags (30 cm length and 15 cm diameter). Three holes were punched at the bottom and sides of the polybags for drainage of excess irrigation water. Soil was filled to each polybag and then cow dung was incorporated with the soil as basal application (Table 1). Thinnavely red (small onion) variety was used in this study. Uniform, healthy bulbs were obtained from Kaludavalai Agro-Farm Private Limited in the Eastern Province of Sri Lanka. Before planting, the bulbs were treated with a fungicide (captan 2.5 g/L) to avoid disease infections.

Table 1: Treatment codes and its description

Treatment codes	Basal application	*Top dressing (liquid form)	
	Cow dung (g/polybag)	Urea % (w/v)	Cow urine% (v/v)
T1	20	0	0
T2	20	3	0
T3	20	0	3
T4	30	0	0
T5	30	3	0
T6	30	0	3

The two onion bulbs were planted in each polybag at the spacing of 10 cm between plants. The application of fertilizers was done in accordance with the treatments as indicated in Table 1. Before planting the bulbs, cow dung (20 or 30 g per polybag) was applied evenly to the soil as basal application. The onion plants had a two-week interval of top-dressing treatments (15 ml per polybag) with or without 3% (v/v) cow urine as stated by Jandaik *et al*. (2015) or 3% (w/v) liquid urea (46% N in urea) starting from 3^{rd} week up to 9^{th} week. Until the first week, irrigation was done twice a day (morning and evening) with a watering can. After that, watering was done once a day, throughout the duration of the experiment. Irrigation was not done seven days before harvesting the bulbs. Hand weeding was done every week from the third week of planting.

In this experiment, some growth measurements were obtained every two weeks starting from third week after planting, while yield measurements were taken after harvesting. The randomly selected plants from each replication were selected from the third week to the final harvest. The plant height (cm) of the selected plants was measured using the meter scale from the soil surface to the tip of the longest leaf. The number of leaves was carefully counted at two weeks interval. At harvest (75 days after planting), the number of onion bulbs and number of roots were manually counted and subsequently the diameter (cm) of the bulbs per plant and root length were measured for each treatment in each replication. For each treatment, fresh weights (g) of leaves, bulbs and roots per plant in each replication were measured separately by using an electronic balance. After measuring the fresh weights of leaves, bulbs and roots per plant from each replication in each treatment were sundried for three days until they reached constant dry weights. Bulb weight per plant was calculated based on airdry weight of bulbs per plant subsequently the total average bulb yield of onion was calculated for each treatment. Analysis of variance (ANOVA) procedure was used to determine the significant level of the treatments. The analysis was carried out using the statistical analysis system (SAS 9.4 version) to determine significant differences among the treatments. Treatment means were compared using the Duncan's Multiple Range Test at the 5% significant level.

Results and Discussion

Plant height

There were significant differences ($P<0.001$) in plant height at 3rd, 5th, 7th, and 9th weeks after planting (WAP) as shown in Table 2. Tallest onion plant was recorded in T6 (14.2 cm), followed by T5 (14.2 cm) while the lowest plant height was recorded in T1 (8.1 cm) at 3rd WAP. At 5th WAP, significantly maximum plant height ($P<0.05$) was observed in T5 (30.6 cm) than that of the other treatments. Further, it was noted that significantly lowest plant height was observed in T1 (22.3 cm) compared with the other treatments except T4. Similar patterns were showed at 7th and 9th WAP too. At 9th WAP, the tallest plant was observed in T5 (37.1 cm), followed by T2 (34.7 cm) and T6 (34.3 cm) while shortest plant was observed in T1 (27.6 cm). At 7th and 9th WAP, no significant differences ($P>0.05$) were found in plant height between T2, T3, and T6 and also between T1 and T4. The results are in agreement with Aisha *et al*. (2007) stated that canopy height in tomato plant was increased in the combined application of cow dung and inorganic fertilizer as compared with cow dung and organic fertilizer combination. Research studies showed that inorganic fertilizers enhanced the plant height in wheat (Khan *et al*., 2017).

Table 2: Effect of liquid urea and cow urine application on plant height of onion plant at different weeks

Treatments	Plant height (cm)			
	3rd week	5th week	7th week	9th week
T1	$08.1±0.4^b$	$22.3±0.4^c$	$26.5±0.4^c$	$27.6±0.4^c$
T2	$12.6±0.5^a$	$28.8±0.6^b$	$33.6±1.0^b$	$34.7±1.0^b$
T3	$13.4±0.9^a$	$27.6±0.6^b$	$32.6±0.7^b$	$33.3±0.7^b$
T4	$09.0±0.5^b$	$22.4±0.5^c$	$28.0±0.7^c$	$28.8±0.6^c$
T5	$14.2±1.1^a$	$30.6±0.5^a$	$36.1±0.9^a$	$37.1±0.9^a$
T6	$14.2±0.7^a$	$28.0±0.6^b$	$33.5±0.9^b$	$34.3±0.9^b$
F test	***	***	***	***

Value represents mean ± standard error of 8 replicates. F test: - ***: $P<0.001$. Means followed by the same letter in each column are not significantly different according to Duncan's Multiple Range Test at 5% level.

Number of leaves per plant

Significant differences ($P<0.05$) in average number of leaves per plant were noted at 3rd, 5th, and7th week after planting (WAP) (Table 3). Maximum number of leaves was recorded in T6 (6.8) while the lowest number of leaves was recorded in T1 (5.3) at 3rd WAP. At 5th WAP, the increase number of leaves was observed in T5 (11.1) followed by T6 (11.0) but lowest number of leaves in plant was observed in T4 (8.0). At 7th WAP, the maximum number of leaves was observed in T5 (13.1) followed by T6 (12.4) and T2 (12.1) while lowest number of leaves was observed in T4 (10.0). At 9th week, remarkable difference ($P<0.001$) in number of leaves was noted among the treatments and the maximum number of leaves was observed in T5 (13.1) while lowest number of leaves was observed T4 (10.0).

At 7th and 9th WAP, number of leaves in T5 was considerably varied ($P<0.05$) from T1 treatment but there was no remarkable difference ($P>0.05$) in number of leaves between T5 and T6. Molla *et al.* (2020) stated that application of nitrogen in the form of urea increased number of leaves thus enhanced vegetative growth of onion. The increase in number of leaves per plant in response to the increase in fertilizer application might be due to the role of the nitrogen, phosphorus and other nutrient elements (Bagali *et al.*, 2012). Shabazi (2005) also reported that number of leaves was increased by the application of amino acid and nutrients. Leaves are responsible for the photosynthesis in plants. Hence, increase in number of leaves per plant leads for the high productivity of the plants.

Table 3: Effect of liquid urea and cow urine application on number of leaves of onion at different weeks

Treatments	Number of leaves per plant at different weeks			
	3rd week	5th week	7th week	9th week
T1	5.3±0.4^{b}	09.4±0.5^{ab}	10.6±0.4^{bc}	10.6±1.1^{bc}
T2	6.4±0.3^{ab}	10.5±1.0^{a}	12.1±0.7^{ab}	12.3±0.7^{ab}
T3	6.0±0.3^{ab}	10.0±0.6^{ab}	11.5±0.6^{abc}	11.4±0.6^{abc}
T4	5.3±0.3^{b}	08.0±0.7^{b}	10.0±0.5^{c}	10.0±0.5^{c}
T5	6.1±0.4^{ab}	11.1±0.6^{a}	13.1±0.7^{a}	13.1±0.5^{a}
T6	6.8±0.4^{a}	11.0±0.8^{a}	12.4±0.8^{ab}	12.4±0.7^{ab}
F test	**	**	**	***

Value represents mean ± standard error of 8 replicates. F test: - **: $P<0.05$; ***: $P<0.001$. Means followed by the same letter in each column are not significantly different according to Duncan's Multiple Range Test at 5% level.

Number of bulbs per plant

Substantial difference ($P<0.001$) was observed in bulb number per plant among the treatments at harvest (Table 4). Increase mean number of bulbs (4.3) per plant was produced by T5 meanwhile lowest number of bulbs were recorded by T1 and T4 (2.1) per plant. It was further noticed that there was no significant deviation in bulb number between T1 and T4, T2 and T3 and also between T5 and T6. Suthamathy and Seran (2009) stated that the additional nitrogen application after planting can increase the bulb size and number of bulblets in onion. Brewster (1983) mentioned that onion is a heavy feeder plant which provides good response to organic manures. In the present study, application of cow urine enhances the bulb formation in onion than the control treatment. Further, it was noted that cow dung (30 g) and urea applied treatment (T5) had produced a greater number of bulbs per plants (4.3) than cow dung (30 g) and cow urine applied plants (4.1) however statically similarity (P>0.05) was noted in number of bulb formation. It may be due to the influence of soil properties at the time of bulb initiation in order to enhance a greater number of bulbs per plant.

Table 4: Effect of liquid urea and cow urine application on number of bulbs per plant, bulb diameter and fresh weight of single bulb of onion

Treatments	Number of bulbs per plant	Diameter of bulbs (cm)	Fresh weight of single bulb (g)
T1	2.1 ± 0.2^{c}	1.9 ± 0.2^{b}	04.4 ± 0.6^{c}
T2	3.5 ± 0.2^{b}	2.7 ± 0.2^{a}	09.3 ± 0.2^{ab}
T3	3.1 ± 0.2^{b}	2.7 ± 0.1^{a}	10.2 ± 0.3^{a}
T4	2.1 ± 0.2^{c}	2.8 ± 0.2^{a}	08.3 ± 0.6^{b}
T5	4.3 ± 0.2^{a}	2.9 ± 0.1^{a}	10.2 ± 0.4^{a}
T6	4.1 ± 0.1^{a}	2.9 ± 0.1^{a}	09.2 ± 0.3^{ab}
F test	***	***	***

Value represents mean ± standard error of 8 replicates. F test: - ***: P<0.001. Means followed by the same letter in each column are not significantly different according to Duncan's Multiple Range Test at 5% level.

Diameter of bulbs

It was found that there was considerable difference (P<0.001) in average diameter of bulbs among the treatments (Table 4). Average bulb diameter ranged from 1.9 cm to 2.9 cm. Higher diameter of bulbs was observed in T5 (2.9 cm) followed by T6 (2.9 cm). Lowest diameter was observed by T1 (1.9 cm). It was also observed that there were no significant variations (P>0.05) in bulb diameter between urea and cow urine treated plants (T2, T3, T4 and T6). This finding was in accordance with result of Tekeste *et al*. (2017) who stated that application of cow dung and urea increased bulb diameter of onion. The increase in bulb diameter because of urea fertilizer is ascribed to the increase in growth performance with respect to plant height, number of leaves per plant and leaf area per plant (Bagali *et al*., 2012). Yohannes *et al*. (2019) stated that the organic and inorganic nitrogen fertilizers can increase onion bulb diameter. Increasing major nutrient elements particularly N level through organic fertilizer might accelerate translocation of photosynthesis from leaves to bulb thereby it causes to enhance bulb weight and diameter in onion (Shedeed *et al*., 2014). In the present study, addition of cow dung at 30 g per polybag increased bulb diameter of onion plant than 20 g cow dung application.

Fresh weight of single bulb

Significant (P<0.001) differences were observed in fresh weight of single bulb among the different treatments (Table 4). Maximum fresh weight of single bulb was observed by T5 (10.2 g) followed by T3 (10.2 g) while lowest weight of single bulb was measured T1 (4.4 g). It was further noticed that there were no considerable variations in fresh weight of single bulb between T2, T3, T5 and T6. Urea and cow urine applied treatments resulted significantly high fresh weight (>9 g) of single bulb in this study. Urea and cow urine are the nitrogen containing fertilizers, but urea is the inorganic fertilizer and cow urine is the one of the organic fertilizers. Both fertilizers had influenced in single bulb weight.

This result is in line with the findings of Kisetu and Joseph (2013) stated that inorganic fertilizer applied treatment gave higher single bulb weight than the organic fertilizer applied treatment in garlic.

Number of roots per plant

It was found that there was significant (P<0.001) divergence observed in the number of roots per plant among thetreatments (Table 5). Maximum number of roots (23.2) per plant was observed in T5 meanwhile T4 treatment produced low number of roots (18.2) per plant. Roots are important plant part for crop growth and their growth has effect on shoot growth and crop yield (Vamerali *et al*., 2003). Fertilizers containing nitrogen increase number of roots for cotton plant (Wang *et al*, 2012). Urea and cow urine are N containing fertilizers. Urea applied T5 treatments (23.2) produced slightly high number of roots than cow urine applied T6 treatments (22.7) but there was no remarkable difference between them. It is confirmed with the findings of Reetha *et al*. (2014) stated that urea for continuous supply of nutrients increase number of roots as compared to organic fertilizer in onion.

Table 5: Effect of liquid urea and cow urine application on number of roots per plant, root length and dry weight of leaves per plant in onion plant at harvest

Treatments	Number of roots per plant	Root length (cm)	Dry weight of leaves per plant (g)
T1	18.4±2.3^{b}	5.0±0.3^{b}	3.7±0.3^{d}
T2	22.0±1.1^{a}	5.9±0.2^{b}	7.2±0.3^{a}
T3	21.5±0.7^{a}	5.4±0.2^{b}	6.1±0.4^{b}
T4	18.2±0.7^{b}	5.1±0.2^{b}	4.9±0.2^{c}
T5	23.2±0.4^{a}	7.1±0.2^{a}	7.7±0.2^{a}
T6	22.7±0.4^{a}	6.7±0.2^{a}	7.1±0.2^{a}
F test	***	***	***

Value represents mean ± standard error of 8 replicates. F test: - ***: P<0.001. Means followed by the same letter in each column are not significantly different according to Duncan’s Multiple Range Test at 5% level.

Root length

There was noteworthy ($P<0.001$) difference noted in root length among the treatments (Table 5). The lowest root length was noted in T1 (5.0 cm) and highest root length was recorded in T5 (7.1 cm), followed by T6 (6.7 cm). Insignificant difference ($P>0.05$) was observed in root length between T5 and T6, but substantial difference was noted from the control treatment. The result obtained was agreed with Misal *et al*. (2019) who affirmed that the effect of foliar application had significantly influence on root length of crops at harvesting time and the fertilizer application increased root length significantly over its no application of crops.

Dry weight of leaves per plant

Significant variation ($P<0.001$) was found in the dry weight of leaves among the treatments (Table 5). Maximum weight (7.7g) was obtained from T5 followed by T2 (7.2 g). Lowest weight was obtained by T1 (3.7 g). It was also observed that there were no remarkable differences between T2, T6 and T5. Amin *et al*. (2013) and Khandaker *et al*. (2011) indicated that application of nitrogen fertilizer enhanced the dry weights of leaves of marjoram plant.

Fresh weight of root per plant

There was substantial ($P<0.05$) difference in number of roots per plants among the treatment (Table 6). Higher root weight per plant was produced by T5 (5.9 g), followed by T6 (5.7 g) while the lowest weight of roots was recorded in T1 (5.0 g). It was further noticed that there were significant similarities between T1, T2, T3 and T4. Singh *et al*. (2002) proved the highest fresh weight of roots in *Gardenia lucida* treated with urea. Urea and cow urine releases nitrogen nutrient which in turn increased the number of the root and root length. All urea and cow urine treated plants gave better results in fresh weight of plant parts compared to control treatment. Merward (2017) also reported that spraying urea considerably increased fresh and dry weight of roots compared with the control plant.

Dry weight of roots per plant

It was found that there was significant variation ($P<0.05$) in the dry weight of roots per plant among the treatments (Table 6). T6 treatment had high airdry weight (3.0 g) of roots followed by T5 (2.9 g). The lowest weight was recorded in T1 (2.3 g). Application of liquid fertilizer at regular interval to plant increased the production of growth regulators in the cell system (Team *et al*., 2006).

Fresh weight of bulbs per plant

It was found that there was significant difference ($P<0.001$) in the fresh weight of bulbs per plant among the treatments (Table 6). Increase in number of bulbs per plant and increase in both diameter and length of bulb contributed to increase in weight of bulbs per plant. Average weight of bulbs per plant ranges from 10.6 g to 43.4 g. The highest weight of bulbs per plant was obtained in T5 (43.4 g) while treatment T1 (10.6 g) showed lowest weight of bulbs per plant. The result is supported with the findings of Kisetu and Joseph (2013) who stated that effect of nitrogen remarkably affected bulb weight of onion. Moreover, combined use of organic and inorganic fertilizers increased bulb weight (Jayathilake *et al*., 2002). The increase in bulb weight could be attributed to the increase in number of leaves produced and leaf length in response to the higher application of nitrogen fertilizer (Shedeed *et al*., 2014). Yohannes *et al*. (2019) showed that nitrogen fertilizer and organic fertilizer increased bulb weight. Inorganic and organic fertilizer provides nutrients to the plants for increasing growth and yield of onion. Nitrogen is an essential element to increase bulb fresh weight and plant growth of onion (Hayashi and Uchiyama, 2018).

Table 6: Effect of liquid urea and cow urine application on fresh and dry weights of roots and bulbs of onion plant after harvest

Treatments	Fresh weight of roots per plant (g)	Dry weight of roots per plant (g)	Fresh weight of bulbs per plant (g)	Dry weight of bulbs per plant (g)
T1	5.0±0.3^{c}	2.3±0.2^{b}	10.6±1.3^{e}	08.4±1.0^{e}
T2	5.5±0.2^{abc}	2.9±0.2^{a}	32.6±1.8^{bc}	27.5±1.5^{c}
T3	5.1±0.2^{bc}	2.7±0.2^{ab}	30.2±2.2^{c}	25.9±2.0^{c}
T4	5.1±0.2^{bc}	2.6±0.2^{ab}	16.9±1.9^{d}	14.2±1.7^{d}
T5	5.9±0.2^{a}	2.9±0.1^{a}	43.4±2.1^{a}	37.5±1.7^{a}
T6	5.7±0.2^{ab}	3.0±0.2^{a}	37.7±1.4^{b}	32.6±1.2^{b}
F test	**	**	***	***

Value represents mean ± standard error of 8 replicates. F test: - **: P<0.05. Means followed by the same letter in each column are not significantly different according to Duncan's Multiple Range Test at 5% level.

Dry weight of bulbs per plant

Considerable difference (P<0.001) in the sundried weight of bulbs per plant between the treatments (Table 6). The maximum weight (37.5 g) was obtained from T5 followed by T6 (32.6 g) and T2 (27.5 g). Lowest weight was observed by T1 (8.4 g). It was also observed that there was no significant difference between T2 and T3 and also between T5 and T6. Application of urea fertilizer increased airdry weight of bulbs in onion. These findings are in conformity with Ariyama and Yasui (2006). Urea applied plants had higher dry bulb weight than cow urine applied plants. The increased airdry weight was the result of better plant growth of onion.

Yield

It was found that there was significant difference (P<0.001) in the calculated yield among the treatments (Figure 1). High yield (37.5 t/ha) was obtained from T5 followed by T6 (32.6 t/ha). Lowest yield was produced by T1 (8.4 t/ha). Insignificant difference was noted between T2 and T3 treatments. Liquid urea fertilizer in concentrated forms of soil nutrients provides readily available nitrate ions to plants than cow urine. This may be the reason for the higher yield produced by the urea applied onion.

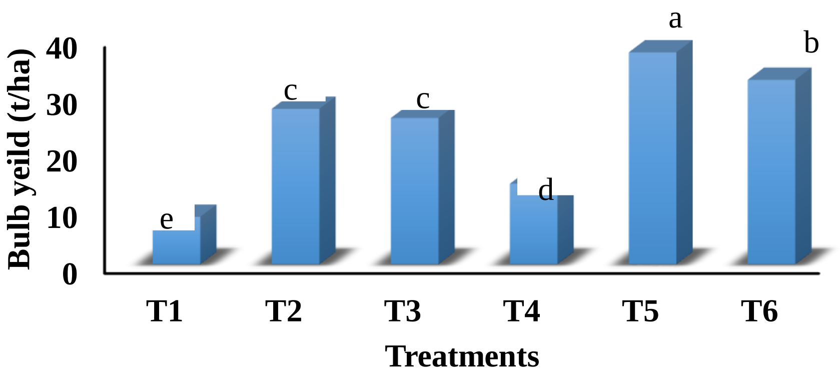

Figure 1: Effect of liquid urea and cow urine application on bulb yield of onion

Means followed by the same letter in each bar are not significantly different according to Duncan's Multiple Range Test at 5% level.

Conclusions

The results revealed that liquid application of urea and cow urine had significant differences ($P<0.001$) on most of the measured parameters on the growth and yield of *Allium ascalonicum* L. variety 'Thinnavely red'. The application of 3% urea or 3% cow urine with 30 g cow dung increased the number of leaves, number of bulbs, diameter of bulbs, fresh weight of single bulb, number of roots, root length and weights of leaves, roots per plant. In this experiment, all these parameters measured in 3% urea with 30 g cow dung treatment (T5) were statistically par with those in 3% cow urine with 30 g cow dung treatment (T6). However, bulb weight per plant and bulb yield of onion were significantly varied ($P<0.05$) between T5 and T6. According to total bulb yield, the highest bulb yield was obtained in T5 (37.5 t/ha) followed by T6 (32.6 t/ha) while lowest yield was recorded in T1 (8.4 t/ha). Application of urea or cow urine increased growth and yield of shallot compared to the control treatments. The present study suggested that 30 g cow dung as basal with 3% urea or 3% cow urine as top dressing would give higher yield of onion in sandy regosol soil.

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