



RESEARCH PAPER

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Relative efficacy of different organic and inorganic fertilizers on the growth and bulb yield of onion (*Allium cepa*)

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Key words: Organic manure, Inorganic fertilizers, Onion cultivars

Abstract

In order to find out the impact of different fertilizers on the growth and bulb yield of Onion, an experiment was conducted at PARC-National Tea and High Value crops research Institute, Shinkiari, Mansehra, Pakistan during Rabi season 2017-18. The trial was laid out in randomized complete block design (RCBD) with split plot arrangement having three replications. It has two onion cultivars i.e Swat-1 and Sunset that was assigned to the main plot and four different type fertilizers i.e Poultry manure, Farm yard manure, DAP and NPK which were allotted to the sub-plot. The finding of the trials reveals significant variation among the studied parameter. Tallest plants (47.37cm), more number of leaves per plants (10.04), Leaves length (36.43cm), leaves width (7.71cm), bulb diameter (57.73mm), Bulb weight (83.04g) and bulb yield (7.46t/ha) was recorded from cultivar Swat-1 planted plots. In case of fertilizers, Maximum plant height (47.74cm), Number of leaves per plant (10.35), Leaves length (37.94cm), Leaves width (8.26cm), Bulb diameter (65.19mm), Bulb weight (103.30g) and Bulb yield (8.90t/ha) was obtained from plots which were fertilized with poultry manure. The results of the present study suggest poultry manure in combination with cultivar swat-1 should be used for better production of onion.

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Introduction

Onion (*Allium cepa* L.) is an imperative vegetable crop, belongs to the family of Amaryliadaceae. It is cultivated over the globe as food and consumed as cooked vegetable or fresh (Fritsch & Freissen. 2002, Patricia. 2006). It had numerous medicinal uses and effective in treating ailment cough, hair loss, snake bite and, insect repellent (Ken & Addy. 2013, Usपो. 2011). Worldwide 75977.21 thousand metric ton of onion are produced annually on an area of 3971.51 thousand hectare with average production of 19.1 tons per hectare (FAO, 2016). In Pakistan, it is grown at an area 130532 hectare with a production of 1671012 tons with a mean production of 12.80 tons per hectare (Agricultural statistic of Pakistan, 2016).

Onion is a high value cash crop due to high cost of production. Presently its prices are high and consumers cannot afford it and there are so many problems in its marketing and they do not have better profit from its cultivation. Normally excessive amount of chemical fertilizers are applied to the vegetable crops for better production (Young *et al.*, 2005). Whenever chemical fertilizers applied to soil it produces several harmful effects to human health and also to environmental condition such as environmental pollution. Soil structures are also more affected by excessive usage of inorganic fertilizers so organic manure is used as an alternative for chemical fertilizers for improving soil structure (Aisha *et al.*, 2007)

Organic manure do not easily leach down and release nutrient at a slower rate and improve soil fertility, develop soil structure and increases soil organic matter (Stolton, 1999 & Shaheen, 2007). Application of organic manure to the soil had beneficial effect on root growth by improving root rhizosphere and proliferations of microorganism population which results in better plant growth (Shaheen, 2007). Organic manures contain various macro and micro nutrients and on decomposition it releases organic acid which increases the benefit of plant nutrient uptake (Anonymous, 2010).

Many researchers such as Akanbi and Makinde (2007) had reported significant results regarding increase in yield of onion crops by the application of fertilizers. Organic manure increased yield and provide more nutrients to onion bulbs (Rumpel, 1998). Researchers concluded from experiments that onion crop which received organic manure gave more yield as compared to onion crop which were fertilized with inorganic fertilizer NPK. In organic farming less cost of production is required and it reduces the chance of environmental pollution. It also improve soil structure enhances different activity of soil organism which are helpful to the plants. Vegetable and fruits produced by organic farming are good for human health (Colla *et al.*, 2002).

Keeping the above points in mind research study was conducted at PARC- National Tea and High Value Crops Research Institute Shinkiari, Mansehra, Pakistan, in order to compare different organic and inorganic fertilizers for growth and bulb yield of onion.

Material and method

Study Area

An experiment entitle “Relative efficacy of different organic and inorganic fertilizers on the growth and bulb yield of onion (*Allium cepa*)” was conducted at National Tea and high value crops research institute Shinkiari, Mansehra during rabbi 2017-18.

Experimental Treatments & Design

The experiment was laid out in RCBD design with split plot arrangement having three replications. The treatment comprises of different type fertilizers viz farm yard manure and poultry manure which were assigned to the sub-plot and different cultivars i.e. swat-1 and sunset were allotted to the main plot.

Cultural Practices

The nitrogen were applied in the form of Ammoumum sulphate in three split doses i.e. at planting stage, 2nd at leaf expansion stage and third at bulb initiation stage whereas phosphorous and potassium are applied at the time of planting in the form of super phosphate and

potassium sulphate. During the course of the experiment, weeds were removed by hand hoeing and irrigation was applied as and when required.

Data collection and Analysis

At the end of the trial, data were collected on growth and bulb yield of onion and parameter measured were: Plant height, number of leaves per plant, leaf length, leaf width, bulb weight, bulb diameter, number of clove per bulb and bulb yield. Data measured were statistically analyzed using analysis of variance (ANOVA) where the treatments means are separated by using Duncan Multiple Range test (DMRT) at 5% probability level.

Result and discussion

Plant Height (cm)

Plant height (cm) was significantly affected by different fertilizers, cultivars and their interaction (Table-1). In case of fertilizers, maximum plant height (47.74cm) was recorded from plots where poultry manure was applied whereas minimum plant height (41.34cm) was noted from plots where NPK was applied. Similar results were obtained by Paven *et al.* (2004), Prakash and Bhadoria (2004) and Dileep (2005) which obtained taller plants from plots where poultry manure was applied to the soil as a fertilizers. In case of cultivars, highest plant height (47.37cm) was obtained from plot where cultivar swat-1 was planted whereas lowest plant height (41.77cm) was recorded from plots where cultivar sunset was planted. These findings are in line with those of Khan *et al.* (2011) which reported that cultivars swat-1 produces tallest up to 55cm in height. In case of interaction between fertilizers x cultivars, application of poultry manure gave taller plant (50.35cm) in cultivar swat-1 whereas NPK resulted in shorter plants (38.13cm) in cultivar sunset.

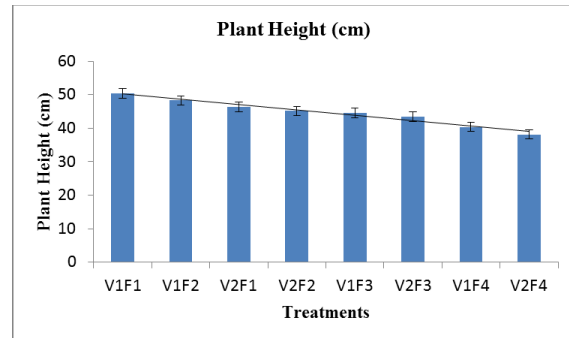


Fig. 1. Plant Height as effect by different fertilizers and cultivars.

No of leaves per plant

Analysis of the data indicated that different fertilizers, cultivar and their interaction had significant effect on no of leaves per plant (Table 1). In fertilizers, more leaves per plant (10.35) were noted from plots where poultry manure was applied whereas less leaves per plant (07.42) was obtained from plots where NPK was applied. Similar results were produced by Sekhon and Meelu, (1994) which obtained maximum number of leaves per plant from plants which were fertilized with poultry manure. In cultivars, maximum number of leaves per plant (10.04) was recorded from plot where cultivar swat-1 was planted whereas minimum number of leaves per plant (07.02) was observed from plot where cultivar sunset was planted. Interaction between fertilizers and cultivars indicated that no of leaves per plant (12.26) in cultivar swat-1 was higher when poultry manure was applied whereas where NPK applied plots produces shorter plants (5.95) in cultivar sunset.

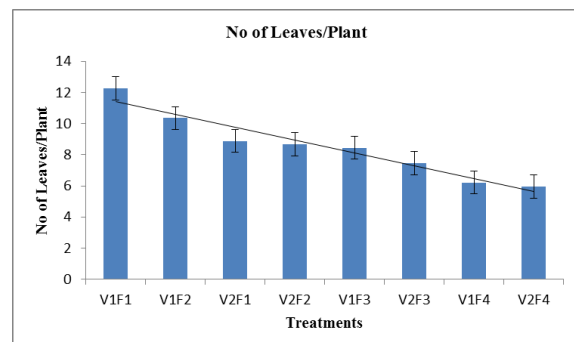


Fig. 2. No. of Leaves/Plant as effected by different fertilizers and cultivars.

Leaf length (cm)

It is evident from table-1 that fertilizers, cultivars and their interaction had significant effect on leaf length (cm). In case of fertilizers, lengthy leaves (37.94cm) were recorded from plots where poultry manure was applied whereas shorter leaves (32.02cm) were obtained from plot where NPK was applied. This is in conformity with the findings of Amujoyegbe *et al.*, (2007), Brady & weils (1999), Sharpley & Smith (1999) which states that application of poultry manure enhances leaf length, water holding capacity and chlorophyll content of the leaf. In cultivars, highest leaf length (36.43cm) was obtained from plots where cultivar swat-1 was planted whereas lowest leaf length (33.30cm) was noted from plots where cultivars sunset were planted. These finding are in line with those of Flore and Layne, (1999) reported variation in leaf length in different cultivars of onion due to genetic variation in onion cultivars. In case of interaction between cultivars and fertilizers, maximum leaf length (39.51cm) was recorded from cultivar swat-1 when plants were fertilized with poultry manure whereas minimum leaf length (30.26cm) was obtained from plant which were fertilized with NPK in cultivars sunset plots.

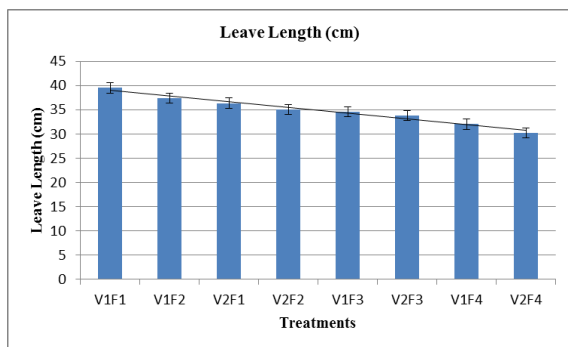


Fig. 3. Leaf Length (cm) as effected by different fertilizers and cultivars.

Leave Width(mm)

Leaf width was significantly effected by different fertilizers, cultivars and their interaction (Table 1). In case of fertilizers, maximum leaf width (8.26mm) was recorded from plots where poultry manure was applied as fertilizers whereas minimum leaf width (6.91mm) was noted from plots where NPK was applied as fertilizer. These result are similar to that of Schjegel, (1992) and Bendfeldt, (2002) where wider

leaves were produced from plot which were fertilized with poultry manure. In case of cultivars, wider leaves (7.71mm) were produced by plots where cultivar swat-1 was planted whereas narrow leaves (7.40mm) were produced in plots where cultivar sunset was planted. These findings are in line with those of Mohanty (2001), Tripathy *et al.*, (2013), Kushal *et al.*, (2015) and Sarkar *et al.*, (2015) who reported difference in leaf width due to variation in genetic makeup of variety and its suitability under different climatic condition. In case of interaction between fertilizers and cultivars, wider leaves (8.30mm) were produced when plants are fertilized with poultry manure in cultivar swat-1 plots whereas narrow leaves (6.66mm) were obtained from cultivars sunset plots when it is fertilized with inorganic fertilizers NPK.

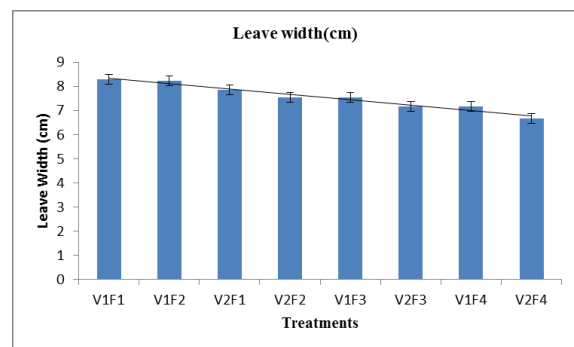


Fig. 4. Leaf Width (cm) as effected by different fertilizers and cultivars.

Table 1. Plant height (cm), No of leaves per plant, leave length (cm) and leave width (mm) as effected by different fertilizers and varieties.

Treatments	Plant height (cm)	No of leaves plant ⁻¹	Leave length (cm)	Leave Width (mm)
Varieties				
Swat-1	47.37 A	10.04 A	36.43 A	7.71 A
Sunset	41.77 B	07.02 B	33.30 B	7.40 B
LSD	0.1348	0.6573	0.0610	0.1996
Fertilizers				
Poultry manure	47.74 A	10.35 A	37.94 A	8.26 A
Farm Yard manure	45.85 B	08.90 B	35.95 B	07.70 B
DAP	43.35 C	07.45 C	33.55 C	07.35 C
NPK	41.34 D	07.42 C	32.02 D	06.91 D
LSD	0.0871	0.5025	0.0446	0.0926
Interaction				
VxF	Fig-1	Fig-2	Fig-3	Fig-4

Bulb Diameter (mm)

Analysis of the data indicated that fertilizer, cultivars and interaction between fertilizer and cultivars had

significant effect on bulb diameter (Table 2). In case of fertilizers, larger bulbs (65.19mm) was recorded from plants which were fertilized with poultry manure whereas small bulbs (46.26mm) were obtained from plants which were fertilized with inorganic fertilizer NPK. Poultry manure improve bulb diameter by providing more nutrients to the plants. These results are similar to those of (Metwally & Abdel-Bary, 1999) which reported that poultry manure improve bulb diameter by enhancing the soil properties and overcome leaching of nutrients from root zone and also similar results were obtained by (Ali *et al.*, 2007) who stated that poultry manure enhances physical and chemical properties of onion and hence improve bulb diameter In cultivars, maximum bulb diameter (57.73mm) was noted from cultivars swat-1 plots whereas minimum bulb diameter (54.20mm) was obtained from cultivars sunset plants. A variation in bulb diameter of different cultivars might be due to genetic variation among cultivars or better adoptability of some cultivars in specific environment as compared to others (Shah *et al.*, 2012). smaller bulb produced by cultivars sunset might be due to inability of this cultivars to absorb nutrient and water from the soil (Khan *et al.*, 2011) In case of interaction between cultivars and fertilizers, more bulb diameter (68.26mm) was observed from cultivar swat-1 plot when fertilized with poultry manure whereas less bulb diameter (44.81mm) was obtained from plants which were fertilized by inorganic fertilizers in cultivars sunset plots.

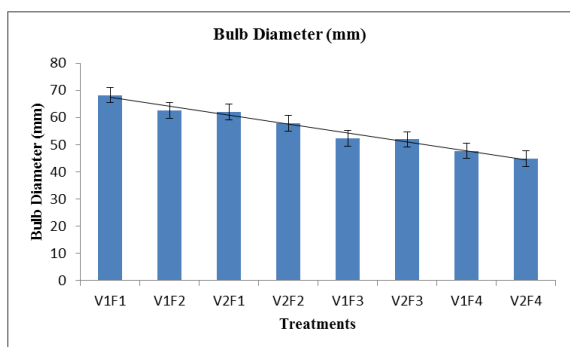


Fig. 5. Bulb Diameter (mm) as effected by different fertilizers and cultivars.

Bulb weight (g)

Fertilizer, cultivars and interaction between cultivars and fertilizers had significant effect on bulb weight (Table 2). In case of fertilizers, highest bulb weight (103.30g) was recorded from plants which were fertilized with poultry manure whereas lowest bulb weight (52.80g) was obtained from plants where inorganic fertilizers NPK was applied to the plots. The increase in bulb weight of onion might be due to the fact that poultry manure provides more nutrients to the plants, soil structure become fertile and more organic matter is available to the crop which enhances the uptake of nutrients and increases cell division and rate of photosynthesis so the bulb weight is increased by metabolism of organic matter. These results are in line with those with those of (Ewais *et al.*, 2010 & EL-Shatanofy & Manar, 2011) which reported that by application of poultry manure bulb weight of onion is increased significantly. In cultivars, maximum bulb weight (83.04g) was recorded from plots where cultivars swat-1 was planted whereas minimum bulb weight (72.10g) was noted from plots when cultivar sunset was planted. Better performance of swat-1 cultivar in term bulb weight might be due to genetic potential of this cultivars. In case of interaction between cultivar and fertilizers, bigger bulbs (108.31g) was obtained from cultivars swat-1 plants when it is fertilized with poultry manure whereas smaller bulbs (47.61g) was recorded from plants which were fertilized with inorganic fertilizer NPK

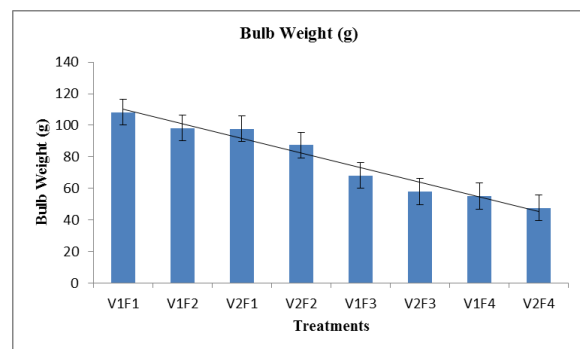


Fig. 6. Bulb weight (g) as effected by different by different fertilizers and cultivars.

Bulb Yield (t/ha)

Fertilizers, cultivars and their interaction had significant effect on Bulb Yield (t/ha) (Table 2). In case of fertilizers, maximum bulb yield (8.90t/ha)

was recorded from plots which were fertilized with poultry manure whereas minimum bulb yield (5.24t/ha) was obtained from plots which were fertilized with NPK inorganic fertilizer. The improvement in bulb yield by application of poultry manure might be due to the fact that it improves water holding capacity and provides ample nutrients for longer duration due to less leaching of nutrients as compared to inorganic fertilizers where there is greater problem of leaching (Carol *et al.*, 1999). In cultivars, more bulb yield (7.46t/ha) was noted from cultivars swat-1 planted plots whereas less bulb yield (6.69t/ha) was obtained from sunset planted plots. Better performance of Swat-1 cultivars in term of Bulb yield might be due to genetic potential of this cultivar (Khan *et al.*, 2011). In case of interaction between fertilizers and cultivars, maximum bulb yield (9.36t/ha) was recorded where cultivar swat-1 was planted in combination with poultry manure whereas minimum bulb yield (4.94t/ha) was noted from plots which fertilized by inorganic fertilizer NPK in combination with cultivar sunset

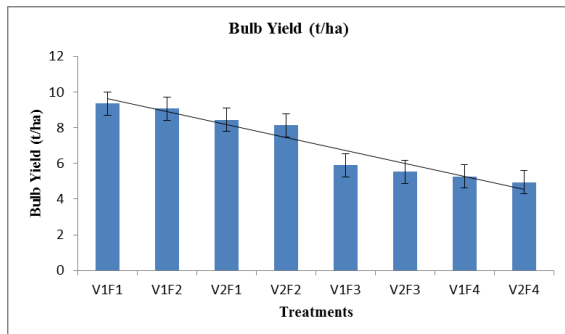


Fig. 7. Bulb Yield as effected by different fertilizers and cultivars of onion.

Table 2. Bulb Diameter (mm), Bulb weight (g), Plot yield (Kg) and Bulb Yield (t ha⁻¹) as effected by different fertilizers and cultivars.

Treatments	Bulb Diameter (mm)	Bulb Weight (g)	Bulb Yield (t ha ⁻¹)
Varieties			
Swat-1	57.73 A	83.04 A	7.46 A
Sunset	54.20 B	72.10 B	6.69 B
LSD	0.2538	0.1597	0.0285
Fertilizers			
Poultry manure	65.19 A	103.30 A	8.90 A
Farm Yard manure	60.25 B	92.57 B	8.60 B
DAP	52.16 C	61.63 C	5.58 C

NPK	46.26 D	52.80 D	5.24 D
LSD	0.8148	1.0334	0.0411
Interaction			
VxF	Fig-5	Fig-6	Fig-7

Conclusion

From this experiment it is concluded that application of organic manure and cultivars of onion effect growth and bulb yield of onion. Organic manure (poultry manure) improves Plant height (cm), No of leaves per plant, leave length (cm), leave width (cm), Bulb diameter, bulb weight and bulb yield of onion. In case of cultivars, swat-1 gave more yield and response to organic manure. On the basis of above conclusion, it is recommended that that poultry manure should be applied to the soil before transplanting while onion cultivar swat-1 should be planted with poultry manure for better production of onion crop .

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