International Journal of Botany
and Research (IJBR)
ISSN (P): 2277–4815; ISSN (E): 2319–4456
Vol. 11, Issue 1, Jun 2021, 89–96


TRANS STELLAR
•Journal Publications •Research Consultancy

# RESPONSE OF VARIOUS BIOFERTILIZER AND MULCHING ON GROWTH YIELD AND QUALITY OF ONION (*Allium cepa* L.) Cv. PRO-6

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***ABSTRACT***

***A field experiment was conducted during the Rabi season to seek out the response of varied biofertilizer and mulching on growth, yield and quality of onion cv. PRO-6.The experiment was laid in randomized block design together with three replications. The various treatments included a mixture of assorted biofertilizers and mulching. The study revealed that there have been significant effects of varied treatments on the growth, yield and quality attributes of onion. The plant height (49.78 cm), leaf length (46.31 cm), number of leaves plant-1 (8.78), stem diameter (12.84 mm) and dry weight of plant (80.65 g), yield (7.12 kg/plot and 395.82 q ha-1), length of bulb (6.67 cm), diameter of bulb (14.22 mm), number of scales per bulb (7.30), total soluble solids (12.91 ºBrix), acidity (0.43 %) and water-soluble vitamin (15.27 mg/100g) were recorded maximum in treatment T8 (Black polythene mulch + Azotobacter + PSB) whereas root length (6.50 cm), weight of bulb (44.53 g) and TSS:acid ratio (37.57) were found maximum in treatment T7 (Black polythene mulch + PSB) and T11 (Rice Straw mulch + PSB). However, the treatment T8 (Black polythene mulch + Azotobacter + PSB), T7 (Black polythene mulch + PSB) and T11 (Rice Straw mulch + PSB) were found best for better growth, yield and quality improvement in onion among all treatments under study.***

***KEYWORDS: Azotobacter, Biofertilizer, Black Polythene, Mulching & Onion***

**Received**: Feb19, 2021; **Accepted**: Mar 09, 2021; **Published**: Jun 11, 2021; **PaperId.**: IJBRJUN202112

Original Article

## 1. INTRODUCTION

Onion (*Allium cepa* L.), thought to be the queen of the kitchen, belongs to the Alliaceae, IJBRJUN202112and is widely grown as a herbaceous biennial vegetable crop with cross-pollinated and monocotyledonous behaviour with having diploid chromosomes2n=16 (Bassett, 1986). The onion crop is understood to have arisen in Central Asia. The word "Onion" comes from Latin and means "Large pearl". The Onion was compared with pearls for its highly valuable nutritional and medicinal quality and not just for its shape.

The onion bulb contains protein 6 g, fat 0.9 g, carbohydrates 44 g, calcium 137 mg, phosphorus 188 mg, iron 2.1 mg, thiamine 0.15 mg, riboflavin 0.1 mg, niacin 0.6 mg and water-soluble vitamin 38 mg (Thomson and Kelly, 1998). Its pungency is due to the presence of an essential oil allyl propyl disulphide (Kumar *et al.*, 2017).

In the present content of rapid civilization, heating, global climate change, indiscriminate use of synthetic fertilizers and pesticides, sustainable production of agricultural crops is the main intention of agricultural researchers and policymakers. Organic production and integrated use of benefits are the key issues of today's crop production. As onion is employed as fresh or for cooking, the cultivation of onion with judicial application of chemical fertilizers together with bio-fertilizers, mulching, organic manures, compost and micronutrients in an integrated way is ecofriendly while reducing health hazards. Organic farming provides several benefits to farmers. It reduces cost and it's an environmentally friendly method of cultivation. Addition of biofertilizers and mulching

improves soil structure and enhances activities of useful soil organism, to maintain the ecosystem. Biofertilizers are the inoculation of that microorganism, which is capable of preparing nutrient elements by converting them from unavailable form to available through biological processes (Jat *et al.*, 2018) and is alternate for chemical fertilizer. They improve the growth of crop and quality by giving plant hormones and help in sustainable crop production through sustaining soil productivity (Bhonde *et al.*,1997).

Mulching is that the practice of spreading plant residues or other material like straw on the soil surface to cut back water evaporation losses (Pervaize *et al.,* 2009). It's a vital soil management practice for enhancing and sustaining productivity of soil within the tropics e.g. use of shredded wood, chopped wood, pine bark, rice dust, groundnut shell, grasses and composted materials. Mulching at the soil surface functions as a barrier against moisture losses from the soil, reduce surface run-off, mitigate soil temperature and increase soil water content. It contributes to higher long-term growth by improving the organic matter content and releasing minerals into the soil.

## 2. MATERIAL AND METHODS

The Experiment was conducted at the Agriculture Farm, School of Agricultural Sciences and Technology, RIMT University, MandiGobindgarh, Punjab (India) during Rabi season of 2019-2020 to find out the response of various biofertilizer and mulching on growth yield and quality of onion (*Allium cepa* L.) cv. PRO-6. A total of 12 treatments *i.e.*$T_1$ ( No mulch + No biofertilizer), $T_2$ (No mulch + *Azotobacter*), $T_3$ (No mulch + PSB), $T_4$ (No mulch + *Azotobacter* + PSB), $T_5$ (Black polythene mulch + No biofertilizer), $T_6$ (Black polythene mulch + *Azotobacter*), $T_7$ ( Black polythene mulch + PSB) $T_8$ (Black polythene mulch + *Azotobacter* + PSB), $T_9$ ( Rice Straw mulch + No biofertilizer), $T_{10}$ : (Rice Straw mulch + *Azotobacter*), $T_{11}$ (Rice Straw mulch + PSB) and $T_{12}$ (Rice Straw mulch + *Azotobacter* + PSB) and experiment was laid out in randomized block design (RBD) with three replication. The observations were recorded on plant height (cm), leaf length (cm), number of leaves per plant, root length (cm), stem diameter (mm), bulb length (cm), bulb diameter(cm), number of scales per bulb, dry weight of plant at the time of harvesting(g), average weight of bulb (g), yield per plot (kg), bulb yield per hectare (q), total soluble solids (°Brix), Acidity (%), TSS:acid ratio and Ascorbic Acid (mg/100g).The laboratory analysis was done according to the standard procedure as mentioned by A.O.A.C, 2000). The recorded data were statistically analyzed and treatment effects were compared at 5 per cent level of significance (Panse and Sukhatme, 1985).

## 3. RESULTS AND DISCUSSIONS

### 3.1. Effect Biofertilizers and Mulching on Growth Parameters

The result of this study indicated that the growth parameters of plant such as plant height (cm), leaf length (cm), number of leaves per plant, root length (cm), stem diameter (mm), root length (cm) and dry weight of plant (g) were significantly influenced by different biofertilizers and mulching materials and their combinations.

Among the treatments, the utmost plant height (49.78 cm), leaf length (46.31 cm), number of leaves per plant (8.78), stem diameter (12.84 mm) and dry weight of plant (80.65 g) were recorded within the treatment $T_8$ with Black polythene mulch + *Azotobacter* + PSB, whereas minimum plant height (39.34 cm), leaf length (35.53 cm), number of leaves per plant (6.00), stem diameter (10.97 mm) and dry weight of plant (45.33 g) were found in treatment $T_1$( No mulch + No biofertilizer). However, the most root length (6.50 cm) was observed in the treatment $T_7$( Black polythene mulch + PSB) while the bottom root length (4.23 cm) was produced by treatment $T_1$ ( No mulch + No biofertilizer). These findings

are similar to Singh *et al.* (2015) in cabbage and Nkansah*et al*. (2003) in tomato. Additionally, paddy straw mulching with *Azotobacter* also manifests a productive effect on growth parameters. The possible reasons for inflated growth parameter with *Azotobacter* inoculation could also be due to increased biological process which eventually shows a positive effect on vegetative growth of plant (Sharma *et al.*,2002). Besides this, the PSB (Phosphorus Solbulizing Bacteria) increases the dry matter of curd which is because of the assembly of some growth encourage substances that are involved in increasing accumulation of food in plant (Singh *et al.*,2013). The results of Bahadur *et al.*(2006) strongly confirm this study who reported significantly higher dry matter in Chinese cabbage from the treatment during which PSB was supplied.

Mulching helps in improving the microclimatic condition of the soil which could have given an acceptable condition for better plant growth (Kumar *et al.*,1990). Similar consequences also recorded by Rachel *et al*. (2018), they found that higher plant height, leaf length and number of leaves number by the applying of polythene mulches rather than opposite natural mulches. The tallest plants in black polythene compared to other mulches could be disturbed with conservation of high soil moisture and temperature. Plastic mulches directly influence the microclimate around the plant by modifying the radiation budget of the surface and reducing the soil water loss leading to more uniform soil moisture. The soil temperature within the planting bed increased, promoting faster crop development and earlier harvest (Inusah *et al*., 2013).

### 3.2 Effect Biofertilizers and Mulching on Yield and Yield Attributing Traits

The various treatments were influenced significantly on yield and yield attributing traits. Among the assorted treatments, the most yield (7.12 kg/plot and 395.82 q/ha$^{-1}$), length of bulb (6.67 cm), diameter of bulb (14.22 mm) and number of scale per bulb(7.30) were recorded within the treatment $T_8$ (Black polythene mulch + *Azotobacter* + PSB), whereas the minimum yield (4.73 kg/plot and 262.87 q/ha$^{-1}$), length of bulb (5.04 cm), diameter of bulb (cm) (11.72) and number of scale per bulb (5.57) were found within the treatment $T_1$ (No mulch + No biofertilizer). However, the most weight of bulb (44.57 g) were recorded under treatment $T_7$ (Black polythene mulch + PSB) while the minimum weight of bulb (g) (29.57 g) was observed within the treatment $T_1$ (No mulch + No biofertilizer). Increased effect of yield attributes were measured with the application of PSB because it not only enhanced the uptake of phosphorus but also mediated solubilization of insoluble phosphates through the release of organic acid, metabolites which control soil born phyto-pathogens and increment of pathogen that suppressing metabolites mainly siderphores, phytohormones and lytic enzyme (Vassilev*et al.*, 2006). Similar results were observed by Kachari and Korla (2009). Moreover, mulching also shows positive effect on yield attributes which can ensue to the efficient use of present soil moisture, inhibition of weed growth, protection of surface dirt erosion, nutrient loss from soil by crop reduced (Belel, 2012). These results are in line with the findings of Jamil *et al.* (2005) and Kabir*et al.* (2016). Hence consequence of the study showed that mulching had positive effect on enchancing the fruit yield of onion. The yield under black polyethylene was quite double in contrast to no mulch. Favourably modified hydrothermal condition improved nutrients availability and under the black polyethylene supported the higher plant growth and the mulch was well changed in kind of highest fruit yield per plant. Enhancement in availability of nutrients and weeds were suppressed highly as a reason for improved yield has been reported by Sharma and Nagalakshmi*et al.* (2002) in strawberry. Some results were got by Pandey *et al.* (2016) and Bakshi *et al.* (2014).

### 3.3 Effect Biofertilizers and Mulching on Quality Parameters of Onion

The result of the current experiment showed a significant effect of as sortedbiofertilizer and mulching on quality parameters of onion bulb. The utmost total soluble solids (12.91 ºBrix), acidity (0.43 %) and ascorbic acid (15.27 mg/100g)

were found in treatment $T_8$ (Black polythene mulch + *Azotobacter* + PSB), whereas minimum total soluble solids (10.95 $^oBrix$), acidity (0.30%) and water-soluble vitamin (ascorbic acid) (8.14 mg/100g) were recorded in treatment $T_1$ (No mulch+ No biofertilizer). However, the most TSS:acid ratio(37.57) were recorded under treatment $T_{11}$ (Rice straw mulch + PSB) and minimum TSS:acid ratio (36.56) was observed within the treatment $T_1$(No mulch+ No biofertilizer). Increased antioxidant because of the implementations of *Azotobacter* because it's positive effect on the enzyme reaction and formation of metabolites for carbohydrates and increment in vitamin C content which is lead by proteins synthesis (Bahadur *et al.*,2003). Similar, consequences were found by Narayanamma *et al.* (2005) and Sable and Bhamare (2007) who reported that *Azotobacter* helps in increasing the antioxidant content. Besides this, increase in antioxidant is shown by Paddy straw mulching and supply the best result than other treatments when applied together with PSB. The results of the present study are in accordance with the observations of Najafabadi *et al.* (2012) in garlic and Kamal and El-Shazly (2013) in tomato. On the opposite hand, improvement in TSS with the appliance of biofertilizers over control could also be because of high nutrient uptake and increase photosynthesis rate besides, physiological and biochemical activities were also affected (Thilakavathy and Ramaswamy, 1999).

## CONCLUSIONS

The experiment indicated the effects of different treatment combination of various biofertilizers and mulching on the growth yield and quality attributing of onion. Among the treatments, the treatment $T_8$ (Black polythene mulch + *Azotobacter* + PSB) significantly improved the plant height (cm), leaf length (cm), number of leaves per plant, stem diameter (mm), bulb length (cm), bulb diameter(cm), number of scales per bulb, dry weight of plant at the time of harvesting (g), yield (kg/plot and q/ha), total soluble solids (°Brix), acidity (%) and ascorbic acid (mg/100g), whereas the treatment $T_7$ (Black polythene mulch + PSB) best for root length (cm) and weight of bulb (g). However, treatment $T_{11}$ (Rice Straw Mulch + PSB) produced the highest TSS:acid ratio.

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**Table 1: Effect of Various Biofertilizers and Mulching on Growth of Onion Plant (*Allium cepa*L) cv. PRO-6**

| Treatment | Plant Height (cm) | Leave Length (cm) | Number of Leafs per Plant | Stem Diameter (mm) | Root Length (cm) | Dry Weight of Plant (g) |
|---|---|---|---|---|---|---|
| $T_1$ | 39.34 | 35.53 | 6.00 | 10.97 | 4.23 | 45.33 |
| $T_2$ | 46.04 | 42.24 | 6.11 | 11.33 | 5.46 | 58.40 |
| $T_3$ | 44.39 | 40.80 | 7.11 | 11.95 | 4.37 | 67.13 |
| $T_4$ | 45.59 | 43.18 | 8.11 | 12.27 | 5.91 | 63.96 |
| $T_5$ | 42.81 | 38.66 | 6.78 | 11.46 | 4.54 | 73.40 |
| $T_6$ | 46.21 | 42.46 | 7.78 | 12.08 | 6.09 | 71.42 |
| $T_7$ | 45.95 | 42.22 | 7.33 | 12.26 | 6.50 | 63.67 |
| $T_8$ | 49.78 | 46.31 | 8.78 | 12.84 | 4.85 | 80.65 |
| $T_9$ | 41.90 | 38.51 | 7.22 | 11.32 | 4.55 | 51.46 |
| $T_{10}$ | 42.64 | 37.90 | 6.89 | 11.35 | 5.33 | 48.41 |
| $T_{11}$ | 40.97 | 37.30 | 7.55 | 11.56 | 4.53 | 56.99 |
| $T_{12}$ | 42.82 | 38.05 | 7.00 | 11.45 | 5.69 | 62.11 |
| **CD at 5%** | **2.86** | **3.05** | **1.15** | **0.61** | **1.48** | **1.27** |

**Table 2: Influence of Biofertilizer and Mulching on yield and yield Attributing Traits of Onion (*Allium cepa* L.) cv. PRO-6**

| Treatments | Yield (kg/plot) | Yield ($q/ha^{-1}$) | Weight of Bulb (g) | Length of Bulb (cm) | Diameter of Bulb (mm) | Number of Scale per Bulb |
|---|---|---|---|---|---|---|
| $T_1$ | 4.73 | 262.87 | 29.57 | 5.04 | 11.72 | 5.57 |
| $T_2$ | 6.61 | 367.23 | 41.31 | 5.68 | 13.04 | 6.97 |
| $T_3$ | 5.78 | 320.92 | 36.10 | 5.84 | 12.39 | 6.83 |
| $T_4$ | 5.41 | 300.68 | 33.83 | 5.44 | 11.97 | 6.00 |
| $T_5$ | 5.06 | 281.16 | 31.63 | 5.31 | 12.55 | 6.40 |
| $T_6$ | 5.31 | 294.81 | 33.17 | 5.18 | 12.24 | 6.33 |
| $T_7$ | 6.53 | 362.88 | 44.53 | 5.56 | 13.27 | 7.00 |
| $T_8$ | 7.12 | 395.82 | 40.82 | 6.67 | 14.22 | 7.30 |
| $T_9$ | 6.76 | 375.53 | 42.25 | 6.23 | 13.28 | 6.50 |
| $T_{10}$ | 6.22 | 345.90 | 38.91 | 5.39 | 12.56 | 7.10 |
| $T_{11}$ | 6.00 | 333.22 | 37.49 | 5.56 | 13.03 | 6.47 |
| $T_{12}$ | 5.15 | 286.07 | 32.18 | 5.89 | 12.88 | 6.60 |
| **CD at 5%** | **0.41** | **23.01** | **2.59** | **0.86** | **1.28** | **1.14** |

**Table 3: Influence of Biofertilizer and Mulching on Quality Traits of Onion (*Allium cepa*L.) cv. PRO-6**

| Treatments | Total Soluble Solids (TSS) ºBrix | Acidity (%) | TSS: Acid Ratio | Ascorbic Acid (mg/100g) |
|---|---|---|---|---|
| $T_1$ | 10.95 | 0.30 | 36.56 | 8.14 |
| $T_2$ | 12.32 | 0.35 | 35.77 | 10.17 |
| $T_3$ | 11.79 | 0.41 | 29.07 | 9.97 |
| $T_4$ | 12.52 | 0.40 | 31.29 | 11.97 |
| $T_5$ | 11.52 | 0.38 | 30.33 | 11.07 |
| $T_6$ | 12.20 | 0.40 | 30.23 | 11.77 |
| $T_7$ | 12.31 | 0.35 | 35.27 | 12.53 |
| $T_8$ | 12.91 | 0.43 | 29.81 | 15.27 |
| $T_9$ | 11.63 | 0.32 | 36.37 | 13.83 |
| $T_{10}$ | 11.89 | 0.34 | 35.31 | 12.97 |
| $T_{11}$ | 12.12 | 0.32 | 37.57 | 10.30 |
| $T_{12}$ | 11.78 | 0.38 | 31.35 | 10.20 |
| **CD at 5%** | **1.39** | **0.03** | **5.07** | **1.29** |