



RESEARCH ARTICLE

GROWTH, YIELD AND QUALITY SEED PRODUCTION OF ONION RESPONSE TO MULCHING AND VARIETIES

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ABSTRACT

Onion (*Allium cepa* L.) belonging to the family Alliaceae, is one of the most important spice and vegetable crops in the world. In Bangladesh, onion is grown in winter when rainfall is scarce and plants face deficiency of water. The farmers cannot irrigate the land due to shortage of irrigation facilities or acute financial problem. In this situation soil moisture conservation through mulching may ensure sufficient supply to the growing crop. Mulches have various effects on plant growth and yield. There were significant variation exists on bulb, seed yield and seed quality performance among the genotypes. The experiment was conducted to study the effect of mulching and variety on growth, yield and seed production of onion. Two factors: Factor (A) four mulching treatments, no mulch, natural mulch, rice straw mulch and black polythene mulch; Factor (B) five onion variety Taherpuri, BARI piaz-2, Jhitka, BARI piaz- 4 and BARI piaz-1 were used in the study. The experiment was laid out in Randomized Complete Block Design with twenty treatment combinations and three replications. In the experiment it was revealed that black polythene mulch showed highest results on almost all plant, seed yield (1653.79kg/ha) and seed quality characters and lowest result in control treatment. The performance of the mulches was found in order of no mulch < natural mulch < rice straw mulch < black polythene mulch. In case of variety BARI piaz- 4 showed highest results almost on all vegetative, reproductive, seed yield (1476.04 kg/ha) and seed quality characters and lowest result in parameters and lowest result in Jhitka variety. The performance of the onion varieties was found in order of Jhitka < Taherpuri < BARI-1 < BARI-2 < BARI-4. Among the treatment combinations, black polythene mulch with BARI-4 variety produced the highest result and lowest in Jhitka variety with no mulch treatment. Further trial of this research work in different locations of the country is needed to recommend the result for use at farmer's level.

KEYWORDS

Onion, Variety, Mulching, Growth, Yield

1. INTRODUCTION

Onion (*Allium cepa* L.) belonging to the family Alliaceae is one of the most important spices as well as vegetable crops in the world including Bangladesh. In Bangladesh, onion ranks first in production and second in respect of area among spices crops (BBS, 2010). On an average, the total annual requirement of onion in Bangladesh is about 17-18 lakh metric tons for the requirement of 24-25 lakh ton (DAE, 2016). To meet this shortage Bangladesh has to import onion from abroad every year. Among many factors, the unavailability of good quality onion seeds is greatly responsible for low yield of onion in Bangladesh. The total production of onion seed in Bangladesh is about 410 metric tons per year, but the requirement is more than 640 metric tons (Uddin et al., 2011). Reasons for lower yield of quality onion seeds are lack of irrigation water in seed production season, use of local cultivars, short winter, limited seed production area etc. In winter rainfall occurs a little amount and ground water table goes down in long distance and for that frequent irrigation is not possible in many cases for quality onion seed production. Moreover, irrigation increases the cost of production.

Mulching is an important practice which decreases the evaporation loss of soil moisture. It reduces the irrigation requirements, increasing root development, promoting faster crop development, reducing weed attack and inducing earlier harvest of crop (Zaman and Mallick, 1991; Vavrina and Roka, 2000; Mahajan et al., 2007). Polythene mulch increases soil temperature, increases efficiency of applied N fertilizer by reducing leaching and evaporation loss of nutrients, reduces weed problems and certain insect pest (Rhu et al., 1990, Kashi et al., 2004). Black and white polythene mulch or organic mulch are a reasonable expense and conserve soil moisture (Mukherjee et al., 2004). Different types of mulches including rice straw and polythene significantly increased the growth and yield of onion (Islam et al., 2002).

So, artificial soil moisture conservation techniques e.g., rice straw mulch, black polythene mulch, natural mulch etc. can be helpful for onion seed production. Borgo *et al.*, reported that water stress during bulb sprouting and beginning of the anthesis reduces the number of umbels and flower/plant. Onion seed producers are used local cultivar (Taherpuri, Jhitka, Faridpuri Bhati, Kalantari, Salta etc.) which have low potentiality in

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bulb and seed production. But there are some improved onion varieties (Winter: BARI piaz-1, BARI piaz-4 and summer BARI piaz-2) which have high potentiality for bulb and seed production. So, the present study was undertaken in preserving soil moisture by using different mulching techniques and to find out suitable variety for higher yield and quality seed production of onion crop.

2. MATERIALS AND METHODS

The experiment was carried out at Achrahali village in Natore Sadar Upazilla of Natore District during the period from October, 2013 to April 2015 to study the effect of bulb size and variety on the growth, yield and quality seed production of onion. Four mulching techniques, no mulch, natural mulch, rice straw mulch and black polythene mulch and five onion variety, Taherpuri, BARI piaz-1, BARI piaz-2, BARI piaz-4 and Jhitka were used in the study. The experiment was laid out at Randomized Complete Block Design with three replications maintaining a distance of 1m between rows and 0.5m within rows. The unit plot was 1m×1m. The plots were fertilized with recommended doses of 10 t well decomposed cow dung, 200 kg Urea, 160 kg TSP, 150 kg MOP, 10kg zinc sulfate and 10kg boric acid per hectare. The entire quantity of cow dung, $\frac{1}{4}$ urea, $\frac{1}{3}$ MOP, TSP, zinc sulfate and boric acid was applied as basal dose before final land preparation.

The rest urea fertilizer was applied as top dressing in three equal splits at 35, 55 and 80 DAP. The rest MOP fertilizer was applied in two equal splits at 35 and 55 DAP. The onion bulbs were planted at 10th November maintained spacing at 25×20 cm². Medium sizes bulb of five onion varieties were planted in the experiment plot after final land preparation. Light irrigation was given to the crop prior to laying down the mulches in the plots immediately after transplanting and hand hoeing was done periodically in the natural mulch plot. Intercultural operations (Irrigation, gap filling, weeding and staking) were done depending on the requirement of crop growth.

To control thrips 'Admire' @ 10ml/ 10 litres of water was sprayed at 10 days intervals at 25 DAP. Similarly, to control purple blotch disease, the crop was sprayed with 'Rovral' @ 20g/10 litres of water at 10 days interval at 40, 50, 60 and 70 DAP. The spray remained stopped after initiation of first blooming. The crop was harvested through 30 April to 10th May, depending on maturity. Data on plant height, number of leaf, number of tiller, number and length of flowering stalk, days to 50% flowering, number of umbel, number of flower, number of fruit seed weight per umbel, per plant, per plot and per hectare, thousand seed weight and germination percentage of seed were recorded. The collected data were analyzed, and mean values were adjusted by DMRT following MSTAT package program.

3. RESULTS AND DISCUSSION

3.1 Effect of Mulches on Plant Growth, Seed Yield and Seed Quality Characteristics of Onion Crop

Significant differences of plant height (Figure 1), number of leaf (Figure 2), number of flowering stalks, days to emergence 50% flowering, number of umbels plant⁻¹, number of flower plant⁻¹, number of seeded fruits, percentage fruit set, seed weight umbel⁻¹, seed weight plant⁻¹, seed yield hectare⁻¹, and germination percentage of seeds were observed in respect of different mulches (Table 1). The maximum plant height (82.54cm) was obtained from black polythene mulch followed by rice straw mulch (82.35cm), natural mulch (81.40cm) and control (77.59cm) respectively. This finding was supported by who reported that with mulch, plant received more soil moisture for longer period which might have promoted the vegetative growth resulting in the maximum plant height (Mia, 1996). The result revealed that the maximum number of leaves per plant (16.44) were produced with black polythene mulch in comparison with other mulch treatments.

More number of leaves per plant obtained by black polythene mulch may be due to more soil moisture conservation which caused rapid vegetative growth. This finding also corroborated with the result (Mondol et al., 2000b). The plants grown with black polythene mulch was given maximum (5.13) number of flowering stalk and the minimum (3.49) were in no mulch treatments. This result is also supported by who stated that mulch had significant and positive influence on number of flowering stalks per plant. Mulching reduced mean time to 50% flowering (Mia, 1996; Boby, 20011). Among the mulch treatments, the plants grown with the black polythene mulch took shortest time (58.13 days), which was identically

followed by rice straw mulch (59.67 days) and the natural mulch (61.92 days) and the longest period (62.60 days) was required for control treatment. The analyzed data proved that the highest number of umbels per plant (4.21) was observed from the application of black polythene mulch which was statistically different from rice straw mulch (3.30) and natural mulch (2.88), whereas the lowest (2.37) from no mulch used plot.

Among the treatments of mulches, black polythene mulch produced the highest (434.20) number of flowers per umbel, whereas the control treatments gave the lowest (360.77) number of flowers per umbel. This finding also supported by (Boby, 2011; Hamma, 2014; Mia, 1996). This might have happened because of prevailing favorable moisture and suitable temperature condition of soil that helped in higher vegetative growth and subsequently greater number of flowers per umbel. It was found that the maximum number of seeded fruits per umbel (338.30) was found in black polythene mulching, followed by rice straw mulching (314.49) and natural mulch (296.79), whereas the lowest (260.90) was observed from the control treatment. The increase in the number of seeded fruits per umbel in mulched treatment was probably associated with conservation of soil moisture and improved micro-climate both beneath and above the soil surface.

This suitable condition was conducive for viable and healthy pollens to carry out the normal fertilization of the normal fertilization of the mulched plant. The percentage of fruit set was recorded highest (77.17) with black polythene mulch which was statistically similar to rice straw mulch (77.04%) and intermediate fruit set (74.69%) from natural mulch, and minimum (72.05) was found from non-mulch. The analyzed data revealed that highest seed yield per plant (6.62g) was obtained from black polythene mulch treatment and the lowest (3.24g) was found from the control treatment. This might have happened because of prevailing favorable moisture and suitable temperature condition of soil that helped in higher vegetative and reproductive growth and subsequently higher seed yield. The result indicated that highest seed yield hectare⁻¹ (1653.79kg) was observed from black polythene mulch and lowest (804.89kg) from no mulch treatment.

Availability of optimum growing condition provided through conservation of adequate soil moisture; efficient use of nutrients due to mulching treatment may be attributed to good seed yield. The influence of mulching on thousand seed weight was non-significant. However, the maximum thousand seed weight (3.64g) was obtained from black polythene mulch followed by natural mulch and rice straw mulch and lowest thousand seed weight (3.45g) was in control treatment. The results revealed that effect of mulches on germination of onion seed was found statistically significant. Seed germination ranged from 77.87% to 93.46% among the mulch's treatment. Seed germination percentage observed highest (93.46) in black polythene and the lowest (77.87%) was found from non-mulch treatment.

A group researcher reported that plants grown with straw mulch gave higher bulb yield (10.89 t/ ha) which showed 13.79% increase over non-mulch (Islam et al., 2010; Rashid, 2010). stated that application of sulphur helps in vegetative growth in onion plant e.g., plant height, number of leaves, bulb diameter etc. a group researchers reported that growth and seed production was accelerated by black polythene (Anisuzzaman et al., 2009). Seed yield (460.81 kg/ha) was highest in the plots planted on 21 November. Seed yield was 529.06 kg /ha where black polythene mulch was used. A group researchers reported that mulching and bulb size showed significant effect on plant height and leaf number (Islam et al., 2002). The interaction effect of bulb size and mulch was significant in plant height but it was non-significant in leaf number.

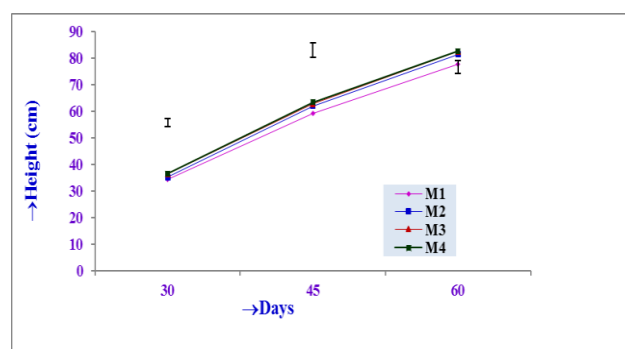


Figure 1: Effect of mulching on the plant height of onion, Vertical bars represent LSD at 5% level of probability.

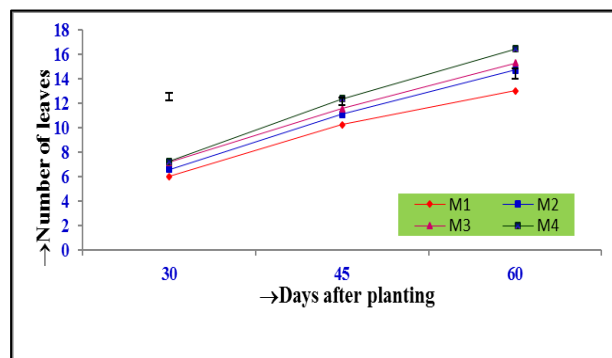


Figure 2: Effect of mulching on the number of leaves of onion. vertical bars represent LSD at 5% level of significance.

Table 1: Main Effect of Mulches on The Seed Yield and Seed Quality Characters of Onion Seed

| Treatment (Mulching) | Days to emergence 50% flowering stalk | No. of umbels plant ⁻¹ | No. of flowering stalks plant ⁻¹ | No. of flowers umbel ⁻¹ | No. of seeded fruits umbel ⁻¹ | Percentage of fruit set | Seed yield plant ⁻¹ | Seed yield hectare ⁻¹ | 1000 seed weight | Germination percentage |
|----------------------|---------------------------------------|-----------------------------------|---|------------------------------------|--|-------------------------|--------------------------------|----------------------------------|------------------|------------------------|
| M1 | 62.60c | 2.37d | 3.49c | 360.77d | 260.90d | 72.05c | 3.24d | 804.89d | 3.45 | 77.87d |
| M2 | 61.93a | 2.88c | 4.53b | 396.93c | 296.76c | 74.69b | 4.38c | 1094.51c | 3.64 | 87.02c |
| M3 | 59.67b | 3.30b | 4.59b | 407.45b | 314.49b | 77.04a | 5.06b | 1265.01b | 3.57 | 89.58b |
| M4 | 58.13b | 4.21a | 5.13a | 434.20a | 338.30a | 77.71a | 6.62a | 1653.79a | 3.59 | 93.46a |
| CV (%) | 4.85 | 7.11 | 4.25 | 5.47 | 5.96 | 5.58 | 4.5 | 5.47 | 6.31 | 4.58 |
| Level of sig | ** | ** | ** | ** | ** | ** | ** | ** | NS | ** |
| LSD at 5% level | 0.767 | 0.068 | 0.125 | 0.714 | 0.808 | 0.263 | 0.048 | 11.973 | 0.045 | 0.315 |

M₁= No mulch, M₂=Natural mulch, M₃= Straw mulch, M₄= Plastic mulch

* = Significant at 5% level of probability

** = Significant at 1% level of probability

NS = Not significant

In a column figure with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).

3.2 Effect of Varieties on Plant Growth, Seed Yield and Seed Quality Characteristics of Onion Crop

Significant differences of plant height (Figure 3), number of leaf (Figure 4), number of flowering stalks, days to emergence 50% flowering, number of umbels plant⁻¹, number of flower plant⁻¹, number of seeded fruit, percentage fruit set, seed weight umbel⁻¹, seed weight plant⁻¹, seed yield hectare⁻¹, and germination percentage of seeds were observed in respect of different mulches (Table 2). The result concluded that maximum plant height (85.53cm) was recorded in plants grown from the variety BARI piaz-4 and the lowest plant height (76.19cm) was obtained from Jhitka variety. The plant height in different varieties varied mainly due to inherent characters of varieties. The recorded data proved that the highest number (16.24) of leaves per plant was obtained from the variety BARI-4 which was statistically identical to variety BARI-2 (15.20), BARI-1(15.02) and variety Taherpuri and the lowest from Jhitka variety.

The analyzed data of number of flowering stalks per plant was higher (5.66) in the variety BARI piaz-4 and the lowest number flowering stalks (3.69) was found in variety Jhitka. Similar results were reported (Mohanty et al., 1998). Singh and Sachan, 1999. Days to emergence of 50% flowering results revealed that minimum (58.00) days for BARI piaz-4 variety which was statistically identical to BARI piaz -2 and the maximum (62.92) days required in Taherpuri which was statistically identical to BARI piaz-1 and Jhitka variety. The number of umbels per plant was found highest (3.60) in variety BARI piaz-4 and lowest (2.85) recorded from Jhitka variety. Singh and Sachan also reported the wide variation in the number of umbels per plant among varieties (Singh and Sachan, 1999).

The analyzed data of number of flowers per umbel concluded that maximum (433.93) was observed in the variety BARI piaz-4 which is followed by BARI piaz-2 (406.34), BARI piaz-1 (395.38) and Taherpuri (391.60) and the minimum was found from the Jhitka variety. This result is similar to the reported values (Mohanty et al., 1998; Mohanty, 2000b). Mohanty denoted that moderate to high heritability, genotype coefficient of variation and genetic gain were observed for the number of seed stalks per plant, flowers per umbel, seed yield, diameter of umbel and 1000-seed weight (Mohanty, 2000a). In case of the result of number of fruits per umbel the highest (348.50) was found in BARI piaz-4 treatment and the

lowest (257.85) was obtained in Jhitka treatment. The number of fruits per umbel in different varieties varied mainly due to inherent characters of cultivars.

The maximum fruitset (80.11%) was observed in variety BARI piaz-4, followed by BARI piaz-2 (77.01%), Taherpuri (75.96%), BARI piaz-1 (74.66%) and minimum (69.04) fruit set was found from Jhitka variety. The seed yield per umbel results proved that highest (1.61g) was observed in the variety BARI piaz-4 and the lowest (1.36) were obtained from Jhitka variety which was statistically similar to BARI piaz-1(1.41). A group researchers worked with some onion varieties and obtained similar results (Ambulkar et al., 1995; Aklilu et al., 2001; Islam et al., 2011). The highest (5.90g) seed yield per plant was obtained from BARI piaz-4 treatment and lowest seed yield (3.94g) per plant was obtained from Jhitka variety. The result of seed yield per plant revealed that onion variety BARI piaz-4 produced significantly higher seed yield per hectare (1476.04kg) in comparison to the other four. The lowest seed yield (986.10kg) per hectare was obtained in Jhitka.

This result is agreeing with others who reported that seed yield varies with the cultivars (Rahim et al., 1983; Mohanty, 2000; Mohanty and Prusti, 2001). Thousand seed weight parameters of five onion varieties concluded that the maximum weight (3.66g) in BARI piaz-4 which was statistically similar to BARI piaz-2 (3.64g) and BARI piaz-1(3.49g).and minimum (3.16g) was found in Jhitka variety. The germination percentage of onion seed showed significance influence among the onion varieties. The maximum germination percentage (95.21) observed in BARI piaz-4 variety which was significant differ from BARI piaz-2 (87.32%), BARI piaz-1 (85.78%), Taherpuri (84.11%). The minimum seed germination percentage (82.50) found in Jhitka variety.

Farooque and Rahim denoted that plant growth and seed yield were significantly affected by the variety and mulching and also by their combinations (Farooque and Rahim, 1999). The highest seed yield of (181.12 kg/ha) was obtained by the variety Ratan while it was the highest (209.80 kg/ha) in case of black polythene mulch. Ratan with the black polythene mulch resulted in maximum seed yield (257.77 kg/ha). Rohini and Paramaguru revealed that there were significant variation exists on bulb, seed yield and seed quality performance among the genotypes (Rohini and Paramaguru, 2016). A group researchers worked with thirty onion genotypes from Bangladesh, India and Myanmar and found genetic divergence on plant growth seed and bulb yield (Rashid et al., 2012).

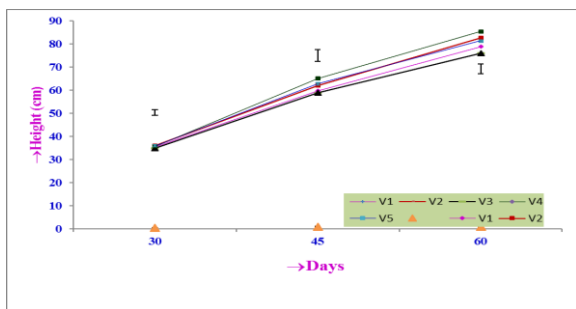


Figure 3: Effect of variety on the plant height of onion. Vertical bars represent LSD at 5% level of probability.

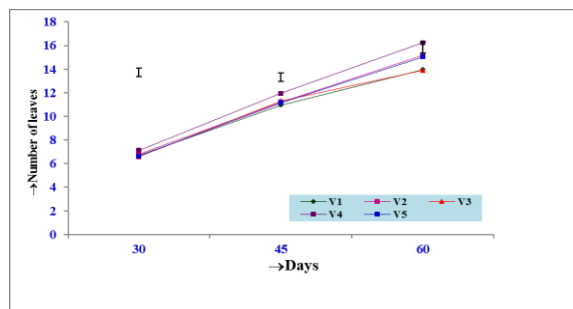


Figure 4: Effect of variety on the leaf number of onion crop, Vertical bars represent LSD at 5% level of probability

Table 2: Main Effect of Varieties on the Seed Yield and Seed Quality Characters of Onion Seed

| Treatment (Variety) | Days to Emergence 50% Flowering Stalk | No. of Umbels Plant ⁻¹ | No. of Flowering Stalks Plant ⁻¹ | No. of Flowers Umbel ⁻¹ | No. of Seeded Fruits Umbel ⁻¹ | Percentage of Fruit Set | Seed Yield Plant ⁻¹ | Seed Yield Hectare ⁻¹ | 1000 Seed Weight | Germination Percentage | |
|---------------------|---------------------------------------|-----------------------------------|---|------------------------------------|--|-------------------------|--------------------------------|----------------------------------|------------------|------------------------|-------|
| V ₁ | 4.15b | 62.92a | 3.17b | 391.60d | 297.64c | 75.96c | 4.68c | 1170.47c | 3.40b | 84.11d | |
| V ₂ | 4.34b | 58.00b | 3.27b | 406.34b | 313.46b | 77.10b | 5.23b | 1301.31b | 3.64a | 87.32b | |
| V ₃ | 3.61c | 61.92a | 2.85v | 371.93e | 257.85d | 69.04e | 3.94d | 986.10d | 3.16a | 82.50e | |
| V ₄ | 5.66a | 58.08b | 3.60a | 433.93a | 348.50a | 80.11a | 5.90a | 1476.04a | 3.66a | 95.21a | |
| V ₅ | 4.41b | 62.00a | 3.06bc | 395.38c | 295.61c | 74.66d | 4.36cd | 1088.83cd | 3.49ab | 85.78c | |
| CV (%) | | 4.25 | 4.85 | 7.11 | 5.47 | 5.96 | 5.58 | 4.57 | 5.47 | 6.31 | 4.58 |
| Level of Sig. | | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| LSD (.05) | | L 0.154 | 0.959 | 0.085 | 0.893 | 1.010 | 0.233 | 0.130 | 32.427 | 0.055 | 0.364 |

V₁ = Taherpuri, V₂ = BARI piaz-2, V₃ = Jhitka, V₄ = BARI piaz-4, V₅ = BARI piaz-1

* = Significant at 5% level of probability

** = Significant at 1% level of probability

NS = Not significant

In a column figure with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).

3.3 Interaction Effect of Mulches and Varieties on Plant Growth, Seed Yield and Seed Quality Characteristics of Onion Crop

Table 3: Combine Effect of Mulches and Varieties on The Plant Growth Characters of Onion Crop

| Mulching × Variety | Plant Height at Different Days (cm) | | | Number of Leaves Per Plant at Different Days | | | |
|--------------------|-------------------------------------|-------|-----------|--|-----------|-----------|-------|
| | 30 | 45 | 60 | 30 | 45 | 60 | |
| V1M1 | 33.07 | 55.96 | 71.47gh | 6.39 | 9.61 g | 11.85 g | |
| V1M2 | 34.95 | 60.21 | 81.38 b-f | 6.44 | 10.63 e-g | 14.09 ef | |
| V1M3 | 36.04 | 59.30 | 76.47 e-h | 6.76 | 11.28 b-f | 14.41 c-f | |
| V1M4 | 37.63 | 63.89 | 86.40 ab | 7.18 | 12.37 b | 15.50 b-e | |
| V2M1 | 34.81 | 58.31 | 76.86 d-h | 6.49 | 10.27 fg | 13.81 f | |
| V2M2 | 34.65 | 61.25 | 81.75 b-f | 6.42 | 10.94 d-f | 15.07 b-f | |
| V2M3 | 37.35 | 65.28 | 89.11 a | 7.13 | 11.31 b-f | 15.78 b-d | |
| V2M4 | 37.28 | 63.54 | 83.38 a-e | 7.16 | 12.34 b | 16.14 b | |
| V3M1 | 32.67 | 53.25 | 70.39 h | 5.15 | 9.53 g | 10.46 g | |
| V3M2 | 34.67 | 61.60 | 79.10 c-f | 6.79 | 11.64 b-e | 13.77 f | |
| V3M3 | 35.74 | 61.67 | 80.51 b-f | 7.48 | 12.00 b-d | 15.46 b-e | |
| V3M4 | 36.97 | 59.57 | 74.74 f-h | 6.89 | 12.07 b-d | 15.87 b-d | |
| V4M1 | 34.96 | 64.22 | 85.25 a-c | 6.14 | 10.58 e-g | 14.33 d-f | |
| V4M2 | 35.56 | 64.16 | 83.33 a-e | 6.55 | 11.40 b-f | 15.86 b-d | |
| V4M3 | 37.62 | 66.22 | 87.72 ab | 7.37 | 12.22 bc | 16.02 bc | |
| V4M4 | 35.07 | 66.00 | 85.83 a-c | 8.43 | 13.62 a | 18.75 a | |
| V5M1 | 37.21 | 64.14 | 83.97 a-d | 6.02 | 11.20 b-f | 14.67 b-f | |
| V5M2 | 36.03 | 62.29 | 81.46 b-f | 6.74 | 10.93 d-f | 14.72 b-f | |
| V5M3 | 35.25 | 61.41 | 77.91 d-g | 7.17 | 11.02 c-f | 14.82 b-f | |
| V5M4 | 35.60 | 63.53 | 82.36 a-e | 6.63 | 11.48 b-e | 15.94 b-d | |
| CV (%) | | 4.23 | 4.57 | 5.12 | 6.22 | 4.74 | 5.25 |
| Level of sig. | | NS | NS | ** | NS | ** | ** |
| LSD at 5% level | | 2.017 | 3.991 | 3.530 | 0.629 | 0.591 | 0.815 |

V₁ = Taherpuri, V₂ = BARI piaz-2, V₃ = Jhitka, V₄ = BARI piaz-4, V₅ = BARI piaz-1

M₁ = No mulch, M₂ = Natural mulch, M₃ = Straw mulch, M₄ = Plastic mulch

* = Significant at 5% level of probability

** = Significant at 1% level of probability

NS = Not significant

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Significant variations on the interaction effect of mulches and onion varieties was observed on the plant height and number of leaf (Table 3), number of flowering stalks, days to emergence 50% flowering, number of umbels plant⁻¹, number of flower plant⁻¹, number of seeded fruit, percentage fruit set, seed weight umbel⁻¹, seed weight plant⁻¹, seed yield hectare⁻¹, and germination percentage of seeds (Table 4). Treatment combination black polythene mulch with BARI piaz-4 gave the highest plant height (87.72cm), whereas the shortest plant (70.39cm) was found from the treatment combination of control with Jhitka variety. For the results of number of leaves the maximum number (18.75) of leaves per plant was obtained from the treatment combination of black polythene mulch with BARI piaz-4 and the minimum number (11.85) of leaves per plant from the control treatment with Taherpuri onion variety.

It was revealed that the highest number of flowering stalks per plant (7.37) was obtained from the treatment combination black polythene mulch with BARI piaz-4 whereas the lowest (2.78) number of flowering stalks per plant was recorded from the variety Jhitka with control plot. The lowest time of (53.33) days was required to 50% flowering was in the treatment combinations rice straw mulch with BARI-4 variety and the highest time (69.0) days was recorded from the treatment combination of control treatment with BARI-1 variety. The highest (4.92) number of umbels per plant was observed under the treatment combination of black polythene mulch with BARI-4 variety, while the lowest (2.14) number of umbels per plant was recorded from the treatment combination of control mulch treatment with BARI-2 onion variety.

The results of number of flowers per umbel was maximum (483.17) from the treatment combinations of black polythene mulch with BARI piaz-4 and the lowest (328.01) number of flowers per umbel was recorded from the treatment combination of no mulch with Jhitka variety. The maximum (401.74) number of seeded fruits per umbel was obtained from the black polythene mulch with BARI piaz-4 and the lowest (204.32) number of seeded fruits per umbel was recorded from the combinations of no mulching with Jhitka variety. It was revealed that the maximum percentage fruit set (83.15) was obtained from the black polythene mulch with BARI piaz-4 and the minimum fruit set (62.28%) was recorded from the control treatment with Jhitka onion variety. In case of the result of seed yield per plant the maximum (1.78g) was obtained from the black polythene mulch with BARI-4 variety and the lowest (1.13g) was recorded from the no mulch with Jhitka onion variety.

From the recorded data of seed yield per plant it was observed that maximum seed yield (8.75g) was obtained from the treatment combination of black polythene mulch with BARI piaz-4 and the minimum (3.05g) was found in no mulch with Jhitka onion variety. It is revealed that the maximum seed yield (2168.88kg) was attained by the treatment combination of black polythene mulch with BARI piaz-4 variety whereas the control plot with Jhitka onion variety produced lowest seed yield (761.90kg) per hectare. Maximum thousand seed weight (3.87g) was found in treatment combination of black polythene mulch with BARI piaz-4 and the minimum thousand seed weight (3.18g) was obtained from the treatment of no mulch with Jhitka onion variety. The analyzed data proved that highest germination (92.89%) was observed under the treatment combination of black polythene mulch with BARI piaz-4, while the lowest (72.25%) germination was recorded from the combined control mulch with Jhitka treatments.

Table 4: Combined Effects of Mulches and Varieties on The Seed Yield and Seed Quality Characters of Onion

| Treatment | Number of Flowering Stalks Plant | Days to Emergence 50 % Flowering Stalk | Number of Umbels Plant ⁻¹ | Number of Flowers Umbel ⁻¹ | Number of Seeded Fruits Umbel ⁻¹ | Percentage of Fruit Set | Seed Yield Plant ⁻¹ | Seed Yield Hectare ⁻¹ | 1000 Seed Weight | Germination Percentage |
|-------------------------------|----------------------------------|--|--------------------------------------|---------------------------------------|---|-------------------------|--------------------------------|----------------------------------|------------------|------------------------|
| V ₁ M ₁ | 3.38fg | 61.33a-d | 2.16hi | 351.46i | 262.59k | 74.72f | 3.24h | 810.74h | 3.34b-e | 75.80i |
| V ₁ M ₂ | 4.38def | 63.33abc | 2.92d-g | 398.18e | 301.75fg | 75.78ef | 4.32fg | 1080.20fg | 3.82a | 87.41def |
| V ₁ M ₃ | 4.37def | 61.67a-d | 3.24def | 401.83e | 306.07f | 76.17def | 5.31def | 1326.64def | 3.19e | 83.73g |
| V ₁ M ₄ | 4.46def | 65.33ab | 4.37ab | 414.92d | 320.16e | 77.16cde | 5.86cd | 1464.28cd | 3.24de | 89.49cd |
| V ₂ M ₁ | 3.84efg | 57.33cde | 2.14i | 369.44h | 282.54i | 76.48def | 3.04h | 738.68h | 3.44a-e | 80.00h |
| V ₂ M ₂ | 4.36def | 55.00de | 3.27de | 403.16e | 307.06f | 76.17def | 5.29def | 1323.28def | 3.64 a-e | 86.72def |
| V ₂ M ₃ | 4.40def | 56.33cde | 3.50cd | 415.53d | 321.10e | 77.27b-e | 5.59de | 1396.53de | 3.69 a-d | 88.43cde |
| V ₂ M ₄ | 4.77cde | 63.33abc | 4.18b | 437.23c | 343.13c | 78.48bc | 6.99b | 1746.76b | 3.81a | 94.13b |
| V ₃ M ₁ | 2.78g | 57.33cde | 2.56f-i | 328.01j | 204.32m | 62.28i | 3.05h | 761.90h | 3.18 a-d | 72.25j |
| V ₃ M ₂ | 3.73efg | 64.00abc | 2.76e-i | 368.52h | 260.09k | 70.59h | 4.38fg | 1095.42fg | 3.23a | 82.76g |
| V ₃ M ₃ | 4.09def | 58.00b-e | 2.65e-i | 388.89f | 274.46j | 70.58h | 3.44gh | 861.18gh | 3.38 a-d | 86.45ef |
| V ₃ M ₄ | 3.83efg | 68.33a | 3.43cd | 402.29e | 292.53h | 72.71g | 4.90def | 1225.88def | 3.44 a-e | 88.53cde |
| V ₄ M ₁ | 3.48fg | 68.00a | 2.73f-i | 391.51f | 302.08fgh | 77.16cde | 3.56gh | 890.13gh | 3.33b-e | 88.98cde |
| V ₄ M ₂ | 5.82bc | 54.67de | 2.84d-h | 410.62d | 319.85e | 77.90bcd | 4.67ef | 1167.23ef | 3.65 a-d | 93.52b |
| V ₄ M ₃ | 5.98b | 53.33e | 3.92bc | 450.44b | 370.35b | 82.22a | 6.63bc | 1658.13bc | 3.73ab | 98.47a |
| V ₄ M ₄ | 7.37a | 56.33cde | 4.92a | 483.17a | 401.74a | 83.15a | 8.75a | 2188.68a | 3.87ab | 99.89a |
| V ₅ M ₁ | 3.95efg | 69.00a | 2.28ghi | 363.42h | 252.99l | 69.62h | 3.29h | 822.98h | 3.46 a-e | 72.32j |
| V ₅ M ₂ | 4.35def | 61.33a-d | 2.59e-i | 404.15e | 295.05g | 73.01g | 3.23h | 806.42h | 3.27cde | 84.71fg |
| V ₅ M ₃ | 4.11def | 61.33a-d | 3.21def | 380.58g | 300.48fg | 78.96b | 4.33fg | 1082.58fg | 3.53 a-e | 90.81c |
| V ₅ M ₄ | 5.23bcd | 56.33cde | 4.16b | 433.36c | 333.93d | 77.06cde | 6.57bc | 1643.36bc | 3.70abc | 95.26b |
| CV (%) | 4.25 | 4.85 | 7.11 | 5.47 | 5.96 | 5.58 | 4.57 | 5.47 | 6.31 | 4.58 |
| Level of sig. | ** | ** | * | ** | ** | ** | ** | ** | ** | ** |
| LSD (.05) | | | 0.616 | 3.835 | 0.340 | 3.572 | 4.041 | | | |

M₁= No mulch, M₂=Natural mulch, M₃= Straw mulch, M₄= Plastic mulch

V₁ = Taherpuri, V₂ = BARI piaz-2, V₃ =Jhitka, V₄ = BARI piaz-4, V₅ = BARI piaz-1

* = Significant at 5% level of probability

** = Significant at 1% level of probability

NS = Not significant

In a column figure with same letter or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).

4. CONCLUSION

The results of the present experiment concluded that the growth, yield and quality of the onion seeds was significantly affected by the effect of different mulches, varieties and their interactions. Black polythene mulch showed highest results on almost all plant, seed yield (1653.79kg/ha) and seed quality characters. In case of variety, BARI piaz- 4 showed highest results almost on all vegetative, reproductive, seed yield (1476.04 kg/ha) and seed quality characters. In conclusion, the results of the present research indicated that application of black polythene mulch, variety BARI piaz-4 and their combination produced the highest plant growth, seed yield and seed quality of onion crop.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

REFERENCES

- Aklilu, S.L., Dessalegne and Currah, L., 2001. Association of characters and path coefficient analysis of seed yield and yield components in onion (*Allium cepa* L.). *Acta Agron. Hungarica*, 49 (2), Pp. 175-181. <https://doi.org/10.1556/aagr.49.2001.2.8>
- Ambulkar, M.R., Kale, P.B., Gonge, V.S., and Mahorkar, V.K., 1995. Effect of bulb size and spacing on the yield and quality of onion seed (*Allium cepa* L.). *PKV- Research Journal*, 19 (2), Pp. 107-109.
- Anisuzzaman M., Ashrafuzzaman, M., Ismail, M.R., Uddin, M.K., and Rahim, M.A., 2009. Planting time and mulching effect on onion development and seed production. *African J. Biotech.*, 8 (3), Pp. 412-416.
- Boby, Bari, F., 2011. Effect of vernalization and mulching on seed production of onion. BAU, MS thesis, Dept. of Horticulture, BAU, Mymensingh. Vol. 925.
- Borgo, R.D.M., Stahlsehmidt and Tizio, R.M., 1993. Preliminary study on water requirements of onion cv. Valcatarace in relation to seed production. *Agri. Scientia*, (10), Pp. 3-9.
- Hamma, I.L., 2013. Growth and yield of onion as influenced by planting dates and mulching types in Samaru, Zaria. *Intl. J. Advanced Agri. I Res.* 1, Pp. 22-26.
- Islam, A.K.M.A., Sultana, M., Yeasmin, S., and Islam, A.K.M.M., 2011. Screening of Local and Exotic Onion (*Allium Cepa*L.) Cultivars For Seed Production Potentiality. *Poljoprivreda*, 17, (1), Pp. 52-57.
- Islam, K.S., Miah, M.H.A., and Ahmed, S.U., 2010. Effect of Mulch and Different Levels of N and K on the Growth and Yield of Onion. *Progress. Agric.*, 21 (1 & 2), Pp. 39-46.
- Islam, M.N., Ahmed, S.U., Hossain, M.M., and Choudhury, S., 2002. The effect of mulch and bulb size on growth of onion (*Allium cepa* L.). *Pakistan J. Biol. Sci.*, 5 (6), Pp. 648-650. <https://doi.org/10.3923/pjbs.2002.648.650>
- Kashi, A., Hossainzadeh, S., Babalar, M., and Lessani, H., 2004. Effect of black polythene mulch and calcium nitrate application on growth, yield of watermelon (*Citrullus lanatus*). *J. Sci. Tech. Agric. Nat. Res.*, 7, Pp. 1-10.
- Mahajan, G., Sharda, R., Kumar, A., and Singh, K.G., 2007. Effect of plastic mulch on economizing irrigation water and weed control in baby corn sown by different methods. *African J. of Agril. Res.*, 2 (1), Pp. 019-026.
- Mia, M.H.A., 1996. Effect of mulch and different levels of N And K on the growth, bulb yield and seed yield of onion. MS Thesis, Department of Horticulture, BAU, Mymensingh. Pp. 75-76
- Mohanty, B.K., 2000a. Genetic variability, correlation, and path analysis in onion seed crop. *Indian j. Hort.*, 57, Pp. 329-333.
- Mohanty, B.K., 2000b. Screening of common onion varieties for seed production. *J. Maharashtra Agric. University*. 25 (3), Pp. 271-273.
- Mohanty, B.K., Bastia, D.K., and Mohanty, S.K., 1998. Response of onion varieties to seed production. *JNKVV-Res. J.*, 32 (1-2), Pp. 38-41.
- Mohanty, B.K., Prusti, A.M., 2001. Performance of Common Onion Varieties in Kharif Seasons. *Journal of Tropical Agriculture*, (3), Pp. 921-23.
- Mondal, M.F., Hassan, M.K., and Roy, J., 2000b. Effects of NPK nutrition on yield and quality of onion seed. *Bangladesh J. seed Sci. Tech.*, 4 (1&2), Pp. 93-97.
- Mukherjee, S.R., Paliwal, and Pareek, S., 2004. Effect of water regime, mulch and kaolin on growth and yield of ber (*Ziziphus mauritiana* cv. Mundia). *J. Hort. Sci. Biotech.*, 79, Pp. 991-994. <https://doi.org/10.1080/14620316.2004.11511879>
- Rahim, M.A., Husain, A., and Siddique, M.A., 1983. Production of bulb and storage ability of three cultivars of onion. *Punjab Vegetable Grower.*, 17 (18), Pp. 13-20.
- Rashid, M.H., Islam, A.K.M.A., Mian, M.A.K., Hossain, T., and Kabir, M.E., 2012. Multivariate Analysis in Onion (*Allium cepa* L.). *Bangladesh J. Agril. Res.*, 37 (4), Pp. 573-582.
- Rashid, M.H.A., 2010. Effect of Sulphur and GA₃ on the growth and yield of onion. *Progress. Agric.*, 21 (1-2), Pp. 57-63.
- Rhu, A.K., Mushi, A.A.A., and Khan, M.A.H., 1990. Effect of different mulches on the growth of potato (*Solanum tuberosum* L.). *Bangladesh J. Bot.*, 19, Pp. 41-46.
- Rohini, N., and Paramaguru, P., 2016. Seasons' influence on bulb, seed yield and quality of aggregatum onion, *Allium cepa* var aggregatum. *Intl. J. of Farm Sci.*, 6 (1), Pp. 174-183.
- Singh, S.R., and Sachan, B.P., 1998. Response to different bulb sizes and varieties of onion (*Allium cepa* L.). *Crop Res. Hissar*, 15 (1), Pp. 57-60.
- Singh, S.R., and Sachan, B.P., 1999. Evaluation of different bulb size, spacing and varieties for higher seed yield and attributing traits on onion (*Allium cepa* L.). *Crop Res. Hissar*, 17 (3), Pp. 351-355.
- Uddin, M.K., Akanda, M.A.R., and Mallick, M.S.A., 2011. Soil, nutrient and water management in summer onion cultivation. The paper presented in the workshop on ' Cultivation of summer onion in Bangladesh prospects and progress' held on 30th April 2011. Spices Research Centre, BARI, Shibgonj, Bogra.
- Vavrina, C.S., Roka, F.M., 2000. Comparison of plastic mulch and bare ground production and economics for short-day onions in a semitropical environment. *Hort. Technol.*, 10, Pp. 326-330. <https://doi.org/10.21273/horttech.10.2.326>
- Zaman, A., and Mallick, S., 1991. Water use and seed yield of horse-gram under different moisture regimes and mulches in Semi-arid region of Eastern India. *Agron. Crop Sci.*, 167, Pp. 39-42. <https://doi.org/10.1111/j.1439-037x.1991.tb00931.x>