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# Effect of growing methods on seed yield and quality in bottle gourd (*Lagenaria siceraria*)

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ABSTRACT

The present investigation was planned to know the feasibility of trailing method of growing vis-a-vis traditional method and their effects on growth, flowering, fruit set, seed yield and quality traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl]. The results revealed that trailing method had significantly higher vine length (4.56 m), number of leaves/vine (40.48), leaf area (42 807 $cm^2$) and number of nodes/vine (40.48) at 55 DAS. The reduction in number of days to anthesis to first male flower (49.8 days) and female flower (54.6 days) in trailing as compared to traditional method. The fruit development attributes, viz. number of fruit set (4.08), matured fruits/vine (3.55), fruit weight (2.30 kg) were recorded significantly higher in trailing but significantly less fruit width (9.56 cm), fruit cavity (7.21 cm) and cavity volume (1996.2 $cm^3$) were recorded in trailing method. Seed yield attributes, i.e. the number of total seeds/fruit (723.01), number of filled seeds/fruit (651.88), seed yield/fruit (98.33 g), seed yield/vine (346.16 g) and seed yield/acre (410.13 kg) was significantly higher in trailing method. The significant increase in germination (97.54%) was recorded in trailing system as compared to traditional system (95.21%). Similarly, seedling length (42.66 cm), seedling dry weight (6.56 mg) and embryo weight (7.49 mg) were significantly higher in trailing. Vigour index I (4161.07) and VI II (63.92) were also significantly superior in trailing. The presence of fungi was lower in trailing than traditional among the infected fruits.

**Key words:** Seed yield, Seed quality, Trailing, Traditional**,** Vigour index

The seed production of cucurbits especially bottle gourd [*Lagenaria siceraria* (Mol.) Standl] is largely done through the traditional system of growing in which the vines are allowed to spread on the ground. Because of which the production of more number of male flowers, fruit setting and development is greatly affected. Secondly the fruits left in field till maturity especially in seed crop resulting to decay of more number of fruits and highly prone to the damage of soil born insects. In traditional method the plant population is also low more space for the spread of the vines and more damage to the vines during cultural practices as well as rouging and monitoring resulting in lower seed yield and quality, than trailing method. However, to enhance the seed yield and quality the intervention of trailing system can play a vital role particularly in rainy season or under irrigated condition when compared to trailing on bower or pendals. Thereby the vines and fruits can be prevented from direct contact with the soil and water thereby check on fruit rot and damage to the vine is possible. Higher seed yield and quality could be obtained through better exploitation of sunlight by production of maximum number of leaves and higher number of side branches resulting into better assimilation of carbohydrates (Hilli *et al.* 2009). Egun (2007) recommended staking of *Telfairia occidentalis* for enhanced marketable leaf yield. Okonmah (2011) recommended raised platform staking method for increased pod yield, enhanced market value, and higher estimated revenue for such climbing vegetables as cucumber and *Telfairia occidentalis*. Amina *et al.* (2012) recommended staking of tomatoes and other fruit crops for higher yield and good quality fruits with higher market value. Kalyanrao *et al.* (2012) reported significantly higher vine length, number of nodes/vine at flowering, number of fruit set (6.65), matured fruit/vine (5.30), fruit length, fruit width, fruit weight, seed yield/vine (517.5 g), seed yield/acre (689.6 kg) and seed quality in trailing in hybrid seed production of bottle gourd cv. Pusa Hybrid 3. Similar results were observed by Solangi *et al.* (2009) in sponge gourd, ridge gourd and Singh *et al.* (2014) in bitter gourd. The beneficial role of trailing in crop production has been established but information available for seed production in bottle gourd over trailing is scanty. Thus, keeping in view of the facts explained above, it is indeed necessary to develop and demonstrate the seed

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production technology for trailing bottle gourd during *kharif* season under Delhi weather conditions.

## MATERIALS AND METHODS

The experiment comprises two methods of growing, viz trailing and traditional with bottle gourd cv. Pusa Naveen was raised at Seed Production Unit Farm (SPUF) and following observations, viz. germination percentage, seed vigour indexes, electric conductivity, seed coat and embryo weight were carried out at seed testing lab of Division of Seed Science and Technology, ICAR-IARI, New Delhi during *kharif* 2014. The furrows were opened by middle buster at the spacing of 2.5 m and 3 m in trailing and traditional method, respectively in well prepared field. The channels were finally prepared by removing the excess soil and pressed both the sides manually. The seeds were soaked overnight in Bavistin solution @ 2 g per kg of seeds and shade dried for two hours. The treated seeds were planted by dibbling method and by keeping two seeds per hill with a spacing of 0.50 m in both the methods. The plants were thinned out 20 days after sowing by keeping single healthy seedlings/hill. In traditional method, the vines were allowed to grow over ground naturally following the hill-channel practice. In trailing method, eight feet length bamboo poles (1.5 inch diameter) were fixed in the soil at 12 feet distance and two poles were connected with 12 feet long bamboo with pole and supported with other bamboos in one side to form right triangle. On the poles, at a height of one meter onwards five to seven rows of flat white plastic rope were tied. The vines were loosely tied with jute thread and trailed over a criss-cross network of plastic ropes.

Thirty plants were randomly selected in trailing and traditional plots for recording the biometric observations, viz. vine length (m), number of leaf nodes, leaf area ($cm^2$), number of primary and secondary laterals, number of leaves on primary and secondary laterals, days to first male and female flowering, number of fruit set and number of fruit developed to maturity. Forty fruits from tagged vine were harvested after ripening for recording observations on fruit length (cm), fruit width (cm), fruit weight (kg), fruit cavity (cm), cavity volume ($cm^3$), 100 seed weight (g), number of seeds/fruit, seed yield/fruit (g), seeds/vine (g), seed yield/acre (kg), germination (%), seedling length (cm), seedling dry weight (mg), vigour index-I, vigour index-II, electric conductivity (µmhos/cm/g), seed coat weight (mg) embryo weight (mg) and seed health test. The seed health test was carried out using standard blotter method (ISTA 2008). The observations on the environmental parameters such as temperature and light intensity were recorded during flowering and fruit setting (starting with days to anthesis of first male flower to next $30^{th}$ day). Temperature within crop canopy were recorded at different heights, i.e. at ground level, bottom, middle and top level of canopy (10 cm below the top most point) with the help of Infra-Red Thermometer (Model no. 6210L) developed by Everest Interscience Inc. Around 2:00 pm (i.e. time of occurrence of daily maximum temperature). Light intensity was measured at 50% height of the crop canopy using Lux Meter (Model: LX-101A LUX METER) developed by HTC$^{TM}$ Instruments at both the side of trailing (exposure and shadow side) at three different times, i.e. at 8:00 am, 12:00 noon and 4:00 pm. Six sets of such measurements were recorded randomly at different points in each growing method. The quantitative data generated were analysed statistically for testing the heterogeneity of means adopting the t-test at 5% probability (P=0.05).

## RESULTS AND DISCUSSION

*Canopy temperature and light intensity*

The observation on temperature behavior and light intensity in trailing and traditional method during the reproductive period is given in Table 1 and 2. The data given in Table 1 showed that the range of temperature in traditional method was high (48.13°C to 35.95°C) as

Table 1 Comparison of canopy temperature (°C) in trailing and traditional method of growing in bottle gourd cv. Pusa Naveen

| Period | Traditional method | Trailing method | | |
|---|---|---|---|---|
| | Ground | Bottom | Middle | Top |
| 1 | 38.45 | 35.55 | 33.20 | 32.25 |
| 2 | 41.95 | 37.05 | 34.40 | 32.20 |
| 3 | 42.20 | 35.85 | 34.20 | 31.65 |
| 4 | 42.40 | 36.05 | 34.05 | 31.95 |
| 5 | 38.30 | 34.25 | 33.45 | 31.90 |
| 6 | 40.30 | 35.05 | 33.00 | 31.25 |
| 7 | 46.03 | 37.10 | 34.10 | 32.00 |
| 8 | 45.15 | 37.20 | 34.00 | 32.90 |
| 9 | 44.65 | 35.95 | 34.00 | 32.55 |
| 10 | 46.45 | 35.45 | 33.65 | 32.15 |
| 11 | 35.95 | 33.15 | 31.70 | 30.90 |
| 12 | 37.80 | 34.55 | 32.50 | 31.90 |
| 13 | 36.70 | 34.15 | 32.40 | 31.20 |
| 14 | 39.60 | 34.00 | 32.65 | 31.50 |
| 15 | 38.38 | 34.65 | 32.65 | 32.10 |
| 16 | 37.90 | 34.10 | 32.90 | 31.95 |
| 17 | 42.20 | 35.00 | 32.60 | 31.40 |
| 18 | 42.90 | 35.00 | 32.65 | 30.95 |
| 19 | 42.30 | 35.45 | 33.30 | 31.80 |
| 20 | 42.20 | 34.65 | 32.60 | 31.05 |
| 21 | 43.40 | 34.90 | 32.45 | 31.40 |
| 22 | 42.30 | 34.75 | 32.55 | 31.05 |
| 23 | 44.93 | 35.10 | 32.70 | 31.15 |
| 24 | 43.30 | 34.05 | 31.90 | 30.80 |
| 25 | 45.27 | 35.65 | 32.80 | 31.15 |
| 26 | 44.60 | 34.75 | 32.10 | 30.40 |
| 27 | 44.20 | 33.55 | 31.80 | 29.85 |
| 28 | 43.90 | 33.80 | 31.35 | 30.00 |
| 29 | 44.07 | 33.40 | 31.90 | 30.80 |
| 30 | 44.10 | 33.90 | 32.20 | 30.55 |
| Mean | 42.06 | 34.94 | 32.85 | 31.42 |

9 Sept 2014 to 8 Oct 2014

Table 2 Comparison of availability of light intensity (lux) in trailing and traditional method of growing in bottle gourd cv. Pusa Naveen

| Period | Traditional method | | | Trailing method (Pooled direction) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Exposure side (Front) | | | Shadow side (Back) | | |
| | 8:00 AM | 12:00 NOON | 4:00 PM | 8:00 AM | 12:00 NOON | 4:00 PM | 8:00 AM | 12:00 NOON | 4:00 PM |
| 1 | 540 | 1062 | 545 | 70.49 | 907.74 | 480.83 | 362.99 | 320.08 | 114.41 |
| 2 | 610 | 1136 | 228 | 139.41 | 965.00 | 167.99 | 509.58 | 580.41 | 38.41 |
| 3 | 638 | 1244 | 639 | 135.49 | 1087.49 | 449.33 | 529.83 | 640.08 | 72.74 |
| 4 | 597 | 1276 | 645 | 112.41 | 1086.00 | 461.41 | 477.16 | 623.74 | 79.33 |
| 5 | 604 | 1223 | 628 | 151.24 | 1009.83 | 489.91 | 458.58 | 606.55 | 87.58 |
| 6 | 635 | 1087 | 260 | 144.91 | 871.41 | 225.99 | 442.00 | 507.58 | 42.16 |
| 7 | 625 | 1049 | 574 | 144.41 | 919.75 | 428.08 | 467.08 | 528.99 | 82.49 |
| 8 | 734 | 1186 | 445 | 109.50 | 1070.41 | 454.33 | 498.74 | 620.58 | 86.50 |
| 9 | 754 | 1246 | 665 | 120.24 | 1078.58 | 480.58 | 589.00 | 606.58 | 79.91 |
| 10 | 709 | 1204 | 659 | 124.49 | 1077.75 | 452.08 | 521.74 | 629.91 | 78.16 |
| 11 | 724 | 1252 | 567 | 125.83 | 1088.08 | 425.24 | 507.16 | 646.41 | 78.66 |
| 12 | 772 | 1276 | 643 | 127.74 | 1070.91 | 457.91 | 511.16 | 615.83 | 76.33 |
| 13 | 654 | 1236 | 672 | 116.99 | 1057.66 | 440.83 | 511.16 | 627.33 | 80.50 |
| 14 | 764 | 1256 | 607 | 120.33 | 1058.41 | 430.91 | 503.99 | 632.50 | 73.33 |
| 15 | 724 | 1267 | 704 | 125.83 | 1052.25 | 443.41 | 526.99 | 624.41 | 71.83 |
| 16 | 697 | 1234 | 634 | 114.49 | 974.25 | 438.50 | 487.91 | 521.83 | 81.49 |
| 17 | 718 | 1212 | 694 | 109.41 | 1094.25 | 438.83 | 507.83 | 628.99 | 84.58 |
| 18 | 642 | 1216 | 558 | 116.66 | 1078.99 | 433.41 | 512.24 | 627.83 | 83.75 |
| 19 | 636 | 1229 | 529 | 109.99 | 1078.16 | 438.66 | 510.58 | 637.74 | 72.08 |
| 20 | 617 | 1247 | 528 | 117.33 | 1092.66 | 445.00 | 506.99 | 618.33 | 78.25 |
| 21 | 574 | 1187 | 503 | 114.33 | 1069.33 | 440.91 | 499.33 | 596.74 | 72.83 |
| 22 | 576 | 1209 | 536 | 109.33 | 1024.91 | 431.16 | 496.66 | 606.16 | 64.83 |
| 23 | 546 | 1167 | 517 | 114.16 | 968.16 | 372.08 | 483.83 | 576.74 | 69.16 |
| 24 | 535 | 1156 | 519 | 104.50 | 950.58 | 381.49 | 482.16 | 565.25 | 70.75 |
| 25 | 534 | 1165 | 526 | 102.50 | 949.41 | 376.24 | 478.08 | 563.13 | 69.58 |
| 26 | 487 | 1087 | 498 | 97.33 | 926.91 | 362.33 | 469.33 | 556.50 | 62.16 |
| 27 | 456 | 1054 | 466 | 83.91 | 867.74 | 349.58 | 432.08 | 530.25 | 59.66 |
| 28 | 439 | 1063 | 438 | 83.87 | 859.67 | 344.46 | 436.66 | 526.71 | 59.19 |
| 29 | 454 | 1073 | 457 | 77.20 | 859.22 | 342.86 | 433.77 | 525.97 | 57.24 |
| 30 | 438 | 1064 | 450 | 73.47 | 858.72 | 334.23 | 427.72 | 521.48 | 55.12 |
| Mean | 614.43 | 1178.76 | 544.47 | 113.27 | 1001.81 | 407.29 | 486.08 | 580.49 | 72.76 |

9 Sept 2014 to 8 Oct 2014

compared to trailing method (37.1°C to 29.85°C). The mean temperature in traditional method was 42.13°C, whereas in trailing it was 34.94°C at the bottom, 32.85°C at middle of vine and 31.42°C at top of vine with the range (mean) 34.94°C to 31.42°C in trailing at different heights of vine. The higher mean temperature in traditional is due to accumulation of higher radiations while mean is low in trailing is due to diffusion of heat due to air circulation. The reduction in mean temperature in trailing from bottom to middle and middle to top of vine correlated with increased in circulation of air. These results are in agreement with the reports of Bisheshwor *et al.* (2013) in wheat, Weldemichael *et al.* (2013) in maize and Amandeep *et al.* (2014) in rice.

The data on light intensity presented in Table 2 on exposure side and shadow side within the crop canopy in trailing and traditional methods indicated that the light intensity in traditional method was high 614.43 klux (at 8:00 am), 1178.76 klux (at 12:00 noon) and 544.47 klux (at 4:00 pm) than trailing (both the side). In trailing method, it was 113.27 klux (at 8:00 am), 1001.81 klux (at 12:00 noon) and 407.29 klux (at 4:00 pm) in exposure side of the vine and 486.08 klux, 580.49 klux and 72.76 klux in shadow side of the vine, respectively. The lower light intensity in trailing (exposure side and shadow side) attributed to horizontal arrangement as well as shadow effect of the vine leading to low light penetration in bottom and middle to the crop canopy, whereas no such effect is operational in traditional method. These results are in agreement with the reports of Bisheshwor *et al.* (2013) in wheat and Amandeep *et al.* (2014) in rice.

*Performance of growth attributes and anthesis of flowers*

The data given in Table 3 revealed significantly higher vine length (4.56 m), number of leaves/vine (40.48), leaf area (42807 $cm^2$) and number of nodes (40.48) in trailing as compared to traditional method. However, the growth

Table 3 Effect of growing methods on growth attributes in bottle gourd cv. Pusa Naveen during flowering.

| Character | Methods of growing | | Level of significance |
|---|---|---|---|
| | Trailing Mean | Traditional Mean | |
| Vine length (m) | 4.56 | 4.33 | * |
| Number of leaves/vine | 40.48 | 38.03 | * |
| Leaf area ($cm^2$) | 42807 | 33560 | * |
| Number of nodes | 40.48 | 38.03 | * |
| Number of primary laterals | 9.77 | 9.55 | NS |
| Leaf on primary laterals | 81.80 | 75.50 | NS |
| Number of secondary laterals | 4.30 | 3.57 | NS |
| Leaf on secondary laterals | 10.07 | 9.30 | NS |
| Days taken to anthesis of first male flower | 49.82 | 50.77 | * |
| Days taken to anthesis of first female flower | 54.67 | 58.50 | * |

Significant at CD (P=0.05); NS, Non-significant

attributes, viz. number of primary laterals, leaves on primary laterals, secondary laterals and leaves on secondary laterals were at par among the methods of growing. An increase in the growth characters attributed to the more penetration and better utilization of sunlight might have increased the photosynthetic activity and assimilation of photosynthates resulting higher number of leaves and side branches. These results were in accordance with the findings of Hilli *et al.* (2009) in ridge gourd, Kalyanrao *et al.* (2011) in bottle gourd cv. Pusa Hybrid 3 and Nweke *et al.* (2013) in cucumber. Significant reduction for anthesis of first male flower (49.8 days) and female flower (54.6 days) in trailing than traditional method. The less time taken to opening of male and female flower attributed to more photosynthesis and switch on the reproductive phase. The results are in agreement with Ara *et al*. (2011).

*Performance of fruit characters*

The data on fruit attributes (Table 4) as influenced by growing methods revealed that the number of fruit set (4.08 per vine) and number of fruits developed to maturity (3.55 per vine) were significantly higher in trailing than the traditional method (3.48 and 2.70 per vine respectively). The higher fruit set and mature fruits/plant attributed to better pollination opportunity to the flower and fertilization of more number of ovules in trailing due to high activity of pollinator and congenial temperature. Whereas the stigmas have received fewer pollen grains in traditional consequent upon the drop of fruit and more fruit rot. Number of rotten or diseased fruits/vine was significantly lower in trailing (1.14) as compared to traditional method of growing (1.21). Since, trailing does not allow the fruit to the contact of ground and preventing them from being infected by pathogens.

The fruit attributes, viz. fruit weight (2.30 kg) and fruit lengths (48.49 cm) are significantly higher in trailing than traditional method. The better fruit length in trailing may be due to the gravitational force and better fruit weight might be the result of translocation of more dry matter from source (leaf) to these components being significant growth characters. Fruit width (9.56 cm), fruit cavity (7.21 cm) and cavity volume (1996.2 $cm^3$) in trailing were significantly lower than the traditional method (Table 4). These results are in conformation with the results of Hilli *et al.* (2009) in ridge gourd, Kalyanrao *et al*. (2012) and Chukwudi *et al.* (2014) in pumpkin.

Table 4 Effect of growing methods on fruit attributes in bottle gourd cv. Pusa Naveen.

| Character | Methods of growing | | Level of significance |
|---|---|---|---|
| | Trailing Mean | Traditional Mean | |
| Number of fruit set/vine | 4.08 | 3.48 | * |
| Number of mature fruit | 3.55 | 2.70 | * |
| Number of fruit rot/vine | 1.14 | 1.21 | * |
| Fruit weight (kg) | 2.30 | 2.10 | * |
| Fruit length (cm) | 48.49 | 43.20 | * |
| Fruit width (cm) | 9.56 | 9.92 | * |
| Fruit cavity (cm) | 7.21 | 7.87 | * |
| Cavity volume ($cm^3$) | 1996.20 | 2121.81 | * |

Significant at CD (P=0.05); NS, Non-significant

*Seed yield contributing characters*

The data presented in Table 5 had indicated significantly higher number of seeds/fruit (723.01), number of filled seeds (651.88), seed weight/fruit (98.33 g), seed yield/vine (346.16 g) and seed yield/acre (410.13 kg) in trailing as compared to traditional method of growing. This might be due to better growth of the plant, such as increased number of leaf and leaf area, fruit set, fruit weight and number of filled seeds/fruit. Besides, the above production of more food and their translocation might favour the development of seed yield components. It is also consistent with the reports of FAO (2007) and Amina *et al.* (2012) who recommended staking of fluted pumpkin or tomatoes for better exposure to sunlight to enhance fruit yield. It is also in consonance with the findings of Okonmah (2011) who recommended raised platforms staking method for increased

Table 5 Effect of growing methods on seed yield contributing characters in bottle gourd cv. Pusa Naveen.

| Character | Methods of growing | | Level of significance |
|---|---|---|---|
| | Trailing Mean | Traditional Mean | |
| Number of seed/fruit | 723.01 | 632.78 | * |
| Number of filled seed | 651.88 | 531.60 | * |
| Number of unfilled seed | 71.14 | 101.06 | * |
| Seed weight/fruit (g) | 98.33 | 77.64 | * |
| 100 seed weight (g) | 15.66 | 15.10 | NS |
| Seed yield/vine (g) | 346.16 | 227.34 | * |
| Seed yield/acre (kg) | 410.13 | 371.00 | |

Significant at CD (P=0.05); NS, Non significant

Table 6 Effect of growing methods on seed quality attributes in bottle gourd cv. Pusa Naveen.

| Character | Methods of growing | | Level of significance |
|---|---|---|---|
| | Trailing Mean | Traditional Mean | |
| Germination (%) | 97.54 | 95.21 | * |
| Seedling length (cm) | 42.66 | 39.27 | * |
| Seedling dry weight (mg) | 6.56 | 5.87 | * |
| Vigour index I | 4161.07 | 3740.30 | * |
| Vigour index II | 63.92 | 55.91 | * |
| Seed coat weight (mg) | 8.18 | 7.90 | NS |
| Embryo weight (mg) | 7.49 | 7.13 | * |
| Electrical conductivity (µmhos/cm/g) | 98.63 | 126.47 | NS |

Significant at CD (P=0.05); NS, Non-significant

pod yield of cucumber and better fruit development in water melon. The results are corroborated with Hilli *et al.* (2009) in ridge gourd, Kalyanrao *et al.* (2012) in bottle gourd cv. Pusa Hybrid 3 and Singh *et al.* (2014) in bitter gourd. However, 100 seed weight was recorded at par among the methods of growing.

*Seed quality attributes*

The results of seed quality as influenced by growing methods presented in Table 6 showed that seed quality attributes, i.e. germination (97.54%), seedling length (42.66 cm), seedling dry weight (6.56 mg), vigour index-I (4161.07) and VI - II (63.92) and embryo weight (7.49 mg) were significantly superior in trailing as compared to traditional method (95.21%, 39.27 cm, 5.87 mg, 3740.30, 55.91 and 7.13 mg respectively). The superiority of quality attributes might be due to the sound development of fruit and seed due to an early induction of male and female flower in trailing. These results are in agreement with the reports of Hilli *et al.* (2009) in ridge gourd and Kalyanrao *et al.* (2012) in bottle gourd cv. PH 3. Whereas electrical conductivity and seed coat weight were at par among the methods of growing.

*Status of seed health (Fungus associated to the seeds)*

Seed health is a major consideration in seed production programme next to vigour and viability of seeds. The seed health testing of the seeds obtained from the rotten fruits in two growing methods showed the presence of seven different pathogens (Table 7). Traditional method of growing showed higher percent of fungal incidence, i.e. 83.08%, out of which 24.62 per cent was *Fusarium moniliforme*, followed by *Alternaria alternata* (17.45%), *Aspergillus niger* (13.36%), *Macrophomina phaseolina* (11.72%), *Chartomium* sp. (6.18%), *Cladosporium* sp. (5.43%) and *Penicillium* sp. (4.32%), while in trailing method fungal incidence percent was 45.02%, out of which 14.67% was *Fusarium moniliforme*, followed by *Aspergillus niger* (7.62%), *Alternaria alternata* (7.45%), *Macrophomina phasiolina* (6.55%), *Chaetomium* sp. (4.32%), *Cladosporium* sp. (2.17%) and *Penicillium* sp. (2.15%).

Table 7 Effect of trailing and traditional methods on the seed health in bottle gourd cv. Pusa Naveen

| Name of fungus | Trailing | Traditional |
|---|---|---|
| *Altenaria alternate* | 7.54 | 17.45 |
| *Aspergillus niger* | 7.62 | 13.36 |
| *Fusarium moniliforme* | 14.67 | 24.62 |
| *Chaetomium* sp. | 4.32 | 6.18 |
| *Cladosporium* sp. | 2.17 | 5.43 |
| *Macrophomina phaseolina* | 6.55 | 11.72 |
| *Penicillium* sp. | 2.15 | 4.32 |

The higher % of fungi in seed produced in traditional system could be due to the contact of fruit with soil and the injury caused by soil borne insect. The enhanced disease infection and severity were due to less transmission of light and air in traditional method which provide congenial environment for fungal growth and development. These fungi were also reported in bitter gourd by Sultan *et al.* (2007) and in bottle gourd by Sultan *et al.* (2009). These results are in agreement with the report of Kalyanrao *et al.* (2012) in bottle gourd cv. Pusa Hybrid 3.

*Economics of seed production*

The estimated cost of production was ₹ 1.33 lakh in trailing and ₹ 69720 in traditional method per acre. The higher cost of production in trailing is due to the cost incurred toward the purchase of bamboos. The returns from the sale of the seed was ₹ 307 500 and ₹ 278 250 in trailing and traditional, respectively. The estimated benefit cost ratio is 1:1.31 in trailing and 1:2.98 in traditional.

It is clear from the experimental results discussed that seed production of bottle gourd cv. Pusa Naveen or other varieties should be grown over trailing to obtain high seed yield and quality during *kharif* season under Delhi/NCR conditions.

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