

Economics of cucumber (*Cucumis sativus* L.) grown under shade net house with different fertigation levels

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■ **ABSTRACT** : The field experiment was conducted at the Instructional Farm of Department of Irrigation and Drainage Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri during the period from January 2012 to May 2012. The cost economics of cucumber (var. Gypsy) production per m² under shade net house with 35, 50 and 75 per cent shading with open field trial and different fertigation levels were worked out. While working out the cost economics, cost of production, gross monetary returns, net income were considered to work out the benefit cost ratio. The study showed that, the maximum cost of production was recorded under the shade net with 75 per cent shading with application of NPK ratio as per the growth stage of cucumber with 125 per cent NPK of Rs. 74.34/m², the maximum gross monetary returns and net returns were recorded under shade net with 75 per cent and application of 125 per cent NPK through drip of Rs. 125. 2/- and Rs. 51.28/m², respectively with benefit – cost ratio of 1.69.

■ **KEY WORDS** : Cost economics, Fertigation, Shade net house, Benefit – cost ratio

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Agriculture is the backbone of India's economic activity and our experience during the last 50 years has demonstrated the strong correlation between agricultural growth and economic prosperity. The present agricultural scenario is a mix of outstanding achievements and missed opportunities. If India has to emerge as an economic power in the world, our agricultural productivity should equal to those countries, which are currently rated as economic power of the world. We need a new and effective technology which can improve continuously the productivity, profitability, sustainability of our major farming systems. One such technology is the protected cultivation technology. About 95 per cent of plants, either food crops or cash crops are grown in open field, so far for higher and qualitative

yield cultivation under shade net with low cost is affordable.

Cucumber (*Cucumis sativus* L.) is an important and commercially popular cucurbitaceous vegetable crop which native to India, is one of the most nutritive vegetable, rich in vitamins and minerals such as phosphorus, potassium, calcium and iron. It is mainly grown for its fruits both in tropics and subtropics of the world and produces tender fruits continuously. Growing plants under cover improves the quality of their produce. This in turn is helpful in getting higher price that becomes remunerative to the grower. It is also possible to make the produce available in the market, when it is in great demand, provided the grower takes the action of protected cultivation (Agarwal and Satapathy, 2003). The

growers can be offered to cultivate a crop in any season under protected environment, as he can provide the temperature, humidity and light, as required by the plant species (Singh *et al.*, 2003).

Economic analysis permits to identify the strengths and weaknesses of technical and economic results, to take immediate and decisive action, at any time, and to solve problems affecting the agricultural activity, helping the grower to manage and use the available resources more efficiently, favoring their maximization and increasing the level of the production system with a simultaneous reduction in costs. Thus, an economic analysis of cucumber under a protected environment was carried out with the aim of increasing the grower's profitability (Naik *et al.*, 2006). The aim of this study was to determine the investment and operation – maintenance expenses for cucumber under shade net house with different shading per cent and fertigation levels.

■ METHODOLOGY

Study area :

The investigation on economics of cucumber under shade net house with different fertigation levels was carried out at the Instructional Farm of Department of Irrigation and Drainage Engineering which is situated in the transitional tract 74° 38' 00" E longitudes and 19° 20' 00" N latitude at 557 m above the mean sea level, in the central campus of Mahatma Phule Krishi Vidyapeeth, Rahuri. Experiment was carried during January-May, 2012 under four different shading percentages of 288 m² area each. Fig. A and B shows the general and internal



Fig. A : General view of shade net house



Fig. B : Internal view of shade net house

view of the shade net house. “Gypsy” variety of cucumber was selected for the study under shade net with different fertigation levels and are as given below:

Main treatment details :

- S₁: – 35 % shading
- S₂: – 50 % shading
- S₃: – 75 % shading
- S₄: – 0 % shading

Sub treatments :

- T₁ = Soil application of recommended dose of NPK (control),
- T₂ = Application of 100 per cent N through drip and soil application of P and K,
- T₃ = Application of 125 per cent N through drip and soil application of P and K,
- T₄ = Application of 100 per cent NPK through drip,
- T₅ = Application of 125 per cent NPK through drip,
- T₆ = Application of NPK ratio as per the crop growth stages with 125 per cent N

Cost economics :

Cost economics of the cucumber per shade net house and per hectare was worked out by adopting following procedure:

Cost of cultivation :

The total cost of cultivation for cucumber grown under shade net house included labour charges, fertilizer, water charges, seeds, insecticide and pesticide and miscellaneous etc.

Cost of production :

The cost of production was worked out for each treatment. The cost includes paid out cost on hired human labour, seeds, fertilizers, water charges, interest on working capital, interest on fixed capital, depreciation, repair and maintenance for drip irrigation system and shed net house.

Gross monetary returns :

The gross monetary returns per hectare were worked out by considering the fruit yield from different treatments and the prevailing market price of cucumber.

Net income :

The net income was worked out by subtracting the cost of production from the gross momentary returns in each treatment.

Benefit-cost ratio :

The benefit-cost ratio was worked out by dividing the cost of production to the gross returns in each treatment under study. The data were statistically analyzed to check its suitability.

RESULTS AND DISCUSSION

The cost economics of cucumber production per

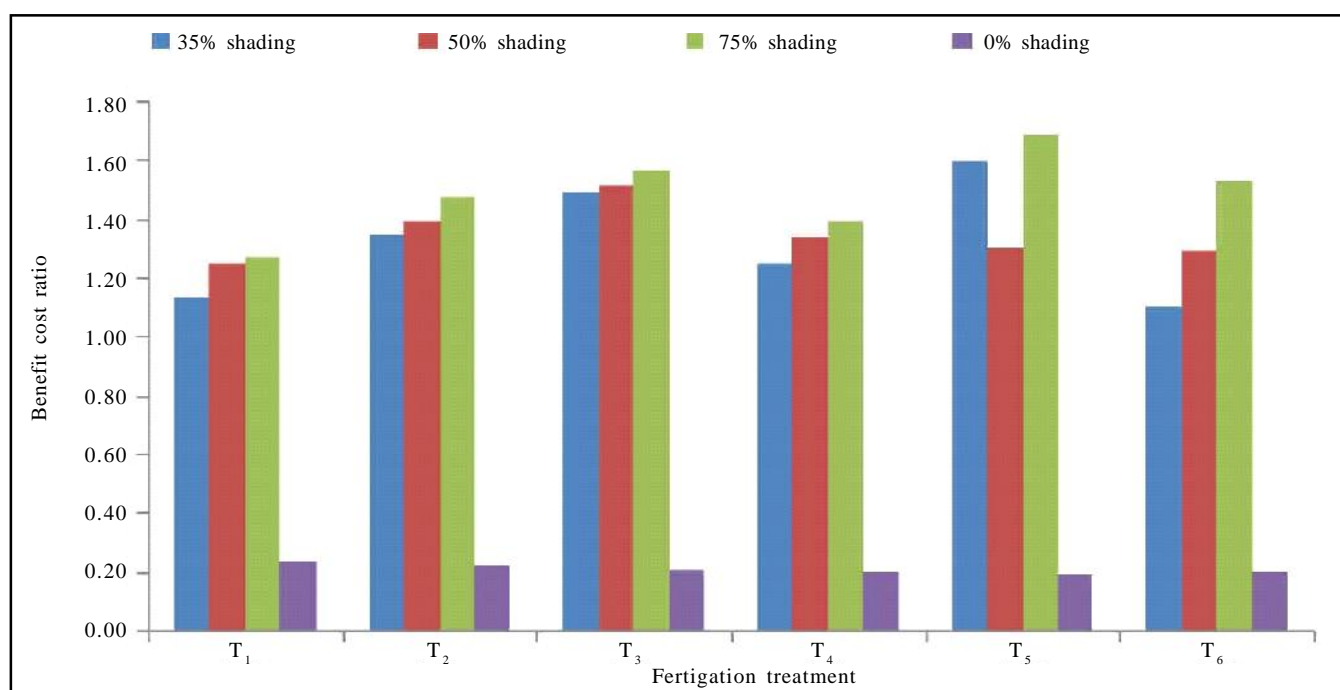


Fig. 1 : Benefit cost ratio observed in different treatments

Table 1 : Statistical analysis of benefit – cost ratio

| Treatments | S ₁ | S ₂ | S ₃ | S ₄ | Mean |
|----------------|----------------|----------------|----------------|----------------|------|
| T ₁ | 1.13 | 1.25 | 1.27 | 0.24 | 0.97 |
| T ₂ | 1.35 | 1.39 | 1.47 | 0.22 | 1.11 |
| T ₃ | 1.49 | 1.51 | 1.56 | 0.21 | 1.20 |
| T ₄ | 1.25 | 1.34 | 1.39 | 0.20 | 1.04 |
| T ₅ | 1.60 | 1.30 | 1.69 | 0.19 | 1.20 |
| T ₆ | 1.11 | 1.30 | 1.53 | 0.21 | 1.03 |
| Mean | 1.32 | 1.35 | 1.49 | 0.21 | 1.09 |
| Interaction | S. E. ± | | C. D. (P=0.05) | | |
| Level A | 0.10 | | NS | | |
| Level B | 0.11 | | NS | | |

Note: Level A – Between subplots means at same level of main plot mean NS=Non-significant
 Level B – Between main plots means at same level of sub plot mean

m² under shade net house with different shading percentage and different fertigation levels was worked out. While working out the cost economics, cost of production, gross monetary returns, were considered to work out the benefit cost ratio and are presented in Table 2 to 6 and also graphically represented in Fig. 1.

Total yield of cucumber :

The maximum yield of fruit per plot was observed

under 75 per cent shading (21.31 kg), significantly superior to 50 per cent shading (19.13 kg) which was at par to 35 per cent shading (18.60 kg). Minimum yield (2.83 kg) was observed in open field condition. The total fruit yield recorded from shade net with 35, 50 and 75 per cent shading were 23.84, 24.52 and 27.32 t/ha, respectively which were 8 to 10 times more than open field condition *i.e.* 3.63 t/ha.

Table 2 : Benefit cost ratio for cucumber under shade net house with 35 per cent shading (288 m²)

| Sr. No. | Particulars | T ₁ | T ₂ | T ₃ | T ₄ | T ₅ | T ₆ |
|---------|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 1. | Fixed cost | | | | | | |
| | Cost of structure (excluding fogger and cladding material) Rs. 180/m ² | 51840 | 51840 | 51840 | 51840 | 51840 | 51840 |
| | Life of structure (years) | 25 | 25 | 25 | 25 | 25 | 25 |
| | Depreciation/year (a/b) | 2074 | 2074 | 2074 | 2074 | 2074 | 2074 |
| | Cost of cladding material@ Rs. 13/m ² | 3744 | 3744 | 3744 | 3744 | 3744 | 3744 |
| | Life of cladding material | 5 | 5 | 5 | 5 | 5 | 5 |
| | Depreciation/year (d/e) | 748 | 748 | 748 | 748 | 748 | 748 |
| | Weed mat Rs. 10/m ² | 2880 | 2880 | 2880 | 2880 | 2880 | 2880 |
| | Life of weed mat | 8 | 8 | 8 | 8 | 8 | 8 |
| | Depreciation/year (g/h) | 360 | 360 | 360 | 360 | 360 | 360 |
| | Drip irrigation/288 m ² | 1285 | 1285 | 1285 | 1285 | 1285 | 1285 |
| | Fogging system Rs. 25/m ² | 7200 | 7200 | 7200 | 7200 | 7200 | 7200 |
| | Life of system (years) | 7 | 7 | 7 | 7 | 7 | 7 |
| | Depreciation (m/n) | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 |
| | Trellis system Rs. 35/m ² | 10080 | 10080 | 10080 | 10080 | 10080 | 10080 |
| | Life of system (years) | 20 | 20 | 20 | 20 | 20 | 20 |
| | Depreciation (p/q) | 504 | 504 | 504 | 504 | 504 | 504 |
| | Total | 75744 | 75744 | 75744 | 75744 | 75744 | 75744 |
| 2. | Repair and maintenance (2 % of total cost) | 1515 | 1515 | 1515 | 1515 | 1515 | 1515 |
| 3. | Interest rate (10 % of total cost) | 7574 | 7574 | 7574 | 7574 | 7574 | 7574 |
| 4. | Total operational cost/m ² | 52.03 | 52.03 | 52.03 | 52.03 | 52.03 | 52.03 |
| 5. | Cost of cultivation | 19.61 | 19.72 | 19.82 | 20.36 | 20.61 | 21.03 |
| 6. | Total cost of production/m ² (4+5) | 71.63 | 71.74 | 71.84 | 72.38 | 72.64 | 73.06 |
| 7. | Average yield of produce (kg/m ²) | 2.03 | 2.42 | 2.68 | 2.25 | 2.9 | 2.02 |
| 8. | Average market price | 40 | 40 | 40 | 40 | 40 | 40 |
| 9. | Gross monetary returns (7 x 8) | 81.2 | 96.8 | 107.2 | 90.0 | 116.0 | 80.8 |
| 10. | Net income/m ² | 9.57 | 25.06 | 35.36 | 17.62 | 43.36 | 7.74 |
| 11. | B:C | 1.13 | 1.35 | 1.49 | 1.24 | 1.60 | 1.11 |

Cost of cultivation :

The cost of cultivation for cucumber grown under shade net house ranged from Rs. 19.61 to Rs. 21.03/ m² and average total cost of cultivation was Rs. 20.19/ m² (Table 2-5).

observed under treatment combination of shade net of 75 per cent shading and with application of NPK ratio as per the crop growth stages with 125 per cent N (Rs. 74.34/m²) and minimum under control treatment (Table 6).

Cost of production :

The maximum cost of production Rs. 74.34/m² was

Gross monetary returns :

Maximum gross monetary returns of Rs. 125.2/m²

| Table 3 : Benefit cost ratio for cucumber under shade net house with 50 per cent shading (288 m²) | | | | | | | |
|---|---|----------------|----------------|----------------|----------------|----------------|----------------|
| Sr. No. | Particulars | T ₁ | T ₂ | T ₃ | T ₄ | T ₅ | T ₆ |
| 1. | Fixed cost | | | | | | |
| | Cost of structure (excluding fogger and cladding material) Rs. 180/m ² | 51840 | 51840 | 51840 | 51840 | 51840 | 51840 |
| | Life of structure (years) | 25 | 25 | 25 | 25 | 25 | 25 |
| | Depreciation/year (a/b) | 2074 | 2074 | 2074 | 2074 | 2074 | 2074 |
| | Cost of cladding material Rs. 15/m ² | 4320 | 4320 | 4320 | 4320 | 4320 | 4320 |
| | Life of cladding material | 5 | 5 | 5 | 5 | 5 | 5 |
| | Depreciation/year (d/e) | 864 | 864 | 864 | 864 | 864 | 864 |
| | Weed mat Rs. 10/m ² | 2880 | 2880 | 2880 | 2880 | 2880 | 2880 |
| | Life of weed mat | 8 | 8 | 8 | 8 | 8 | 8 |
| | Depreciation/year (g/h) | 360 | 360 | 360 | 360 | 360 | 360 |
| | Drip irrigation/288 m ² | 1180 | 1180 | 1180 | 1180 | 1180 | 1180 |
| | Fogging system Rs. 25/m ² | 7200 | 7200 | 7200 | 7200 | 7200 | 7200 |
| | Life of system (years) | 7 | 7 | 7 | 7 | 7 | 7 |
| | Depreciation (m/n) | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 |
| | Trellis system Rs. 35/m ² | 10080 | 10080 | 10080 | 10080 | 10080 | 10080 |
| | Life of system (years) | 20 | 20 | 20 | 20 | 20 | 20 |
| | Depreciation (p/q) | 504 | 504 | 504 | 504 | 504 | 504 |
| | Total | 76320 | 76320 | 76320 | 76320 | 76320 | 76320 |
| 2. | Repair and maintenance (2 % of total cost) | 1526 | 1526 | 1526 | 1526 | 1526 | 1526 |
| 3. | Interest rate (10 % of total cost) | 7632 | 7632 | 7632 | 7632 | 7632 | 7632 |
| 4. | Total operational cost/m ² | 52.67 | 52.67 | 52.67 | 52.67 | 52.67 | 52.67 |
| 5. | Cost of cultivation | 19.61 | 19.72 | 19.82 | 20.36 | 20.61 | 21.03 |
| 6. | Total cost of production/m ² (4+5) | 72.27 | 72.39 | 72.48 | 73.03 | 73.28 | 73.70 |
| 7. | Average yield of produce (kg/m ²) | 2.25 | 2.51 | 2.74 | 2.44 | 2.38 | 2.39 |
| 8. | Average market price | 40 | 40 | 40 | 40 | 40 | 40 |
| 9. | Gross monetary returns (7 x 8) | 90.0 | 100.4 | 109.6 | 97.6 | 95.2 | 95.6 |
| 10. | Net income/m ² | 17.73 | 28.01 | 37.12 | 24.57 | 21.92 | 21.90 |
| 11. | B:C | 1.25 | 1.39 | 1.51 | 1.34 | 1.30 | 1.30 |

was reported under shade net of 75 per cent shading and 125 per cent NPK through drip and minimum (Rs. 80.8/m²) was reported under shade net of 35 per cent shading and 100 per cent NPK soil application when compared only under shade net besides, minimum gross monetary returns were obtained from control treatment (Rs. 13.2/m²) (Table 6).

Net income :

Maximum net income was gained from treatment combination of shade net of 75 per cent shading and 125 per cent NPK through drip (Rs. 51.28/m²) whereas minimum was reported in open field condition (Rs. 7.57/m²) (Table 6).

Benefit cost ratio :

The calculated benefit – cost ratio data were

| Table 4 : Benefit cost ratio for cucumber under shade net house with 75 per cent shading (288 m ²) | | | | | | | |
|--|---|----------------|----------------|----------------|----------------|----------------|----------------|
| Sr. No. | Particulars | T ₁ | T ₂ | T ₃ | T ₄ | T ₅ | T ₆ |
| 1. | Fixed cost | | | | | | |
| | Cost of structure (excluding fogger and cladding material) Rs. 180/m ² | 51840 | 51840 | 51840 | 51840 | 51840 | 51840 |
| | Life of structure (years) | 25 | 25 | 25 | 25 | 25 | 25 |
| | Depreciation/year (a/b) | 2074 | 2074 | 2074 | 2074 | 2074 | 2074 |
| | Cost of cladding material Rs. 17/m ² | 4896 | 4896 | 4896 | 4896 | 4896 | 4896 |
| | Life of cladding material | 5 | 5 | 5 | 5 | 5 | 5 |
| | Depreciation/year (d/e) | 979 | 979 | 979 | 979 | 979 | 979 |
| | Weed mat Rs. 10/m ² | 2880 | 2880 | 2880 | 2880 | 2880 | 2880 |
| | Life of weed mat | 8 | 8 | 8 | 8 | 8 | 8 |
| | Depreciation/year (g/h) | 360 | 360 | 360 | 360 | 360 | 360 |
| | Drip irrigation/288 m ² | 1180 | 1180 | 1180 | 1180 | 1180 | 1180 |
| | Fogging system Rs. 25/m ² | 7200 | 7200 | 7200 | 7200 | 7200 | 7200 |
| | Life of system (years) | 7 | 7 | 7 | 7 | 7 | 7 |
| | Depreciation (m/n) | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 |
| | Trellis system Rs. 35/m ² | 10080 | 10080 | 10080 | 10080 | 10080 | 10080 |
| | Life of system (years) | 20 | 20 | 20 | 20 | 20 | 20 |
| | Depreciation (p/q) | 504 | 504 | 504 | 504 | 504 | 504 |
| | Total | 76896 | 76896 | 76896 | 76896 | 76896 | 76896 |
| 2. | Repair and maintenance (2 % of total cost) | 1538 | 1538 | 1538 | 1538 | 1538 | 1538 |
| 3. | Interest rate (10 % of total cost) | 7690 | 7690 | 7690 | 7690 | 7690 | 7690 |
| 4. | Total operational cost/m ² | 53.31 | 53.31 | 53.31 | 53.31 | 53.31 | 53.31 |
| 5. | Cost of cultivation | 19.61 | 19.72 | 19.82 | 20.36 | 20.61 | 21.03 |
| 6. | Total cost of production/m ² (4+5) | 72.91 | 73.03 | 73.12 | 73.66 | 73.92 | 74.34 |
| 7. | Average yield of produce (kg/m ²) | 2.31 | 2.69 | 2.86 | 2.56 | 3.13 | 2.84 |
| 8. | Average market price | 40 | 40 | 40 | 40 | 40 | 40 |
| 9. | Gross monetary returns (7 x 8) | 92.4 | 107.6 | 114.4 | 102.4 | 125.2 | 113.6 |
| 10. | Net income/m ² | 19.49 | 34.57 | 41.28 | 28.74 | 51.28 | 39.26 |
| 11. | B:C | 1.27 | 1.47 | 1.56 | 1.39 | 1.69 | 1.53 |

analyzed statistically and tabulated in Table 1 and Fig. 1. The benefit cost ratio was significantly influenced by different shading percentage of shade net. Maximum benefit cost ratio was observed under shade net with 75 per cent shading (1.49) at par to shade net with 35 per cent shading (1.32) and shade net with 50 per cent shading (1.35). Benefit cost ratio was not significantly influenced by different shading percentage and fertigation treatment. From table, it reveals that, the benefit cost ratio was maximum under shade net with 75 per cent shading and application of 125 per cent NPK through

drip *i.e.* 1.69. Minimum benefit cost ratio was observed under shade net with 35 per cent shading application of NPK ratio as per the crop growth stages (1.11). The economic analysis of cucumber production under open field with different fertigation levels revealed that the production is not economically viable as the B: C was less than 1.0. Similar work related to the present investigation was also carried out by Agasimani *et al.* (2011); ;Barulio *et al.* (2010); Gajanana *et al.* (2003); Naik *et al.* (2006); Pattanshetti (2009) and Stachowiak (2009).

Table 5 : Benefit cost ratio for production of cucumber in control treatment

| Sr. No. | Particulars | T ₁ | T ₂ | T ₃ | T ₄ | T ₅ | T ₆ |
|---------|---|----------------|----------------|----------------|----------------|----------------|----------------|
| 1. | Fixed cost | | | | | | |
| | Cost of structure (Excluding fogger and cladding material) Rs. 180/m ² | 51840 | 51840 | 51840 | 51840 | 51840 | 51840 |
| | Life of structure (years) | 25 | 25 | 25 | 25 | 25 | 25 |
| | Depreciation/year (a/b) | 2074 | 2074 | 2074 | 2074 | 2074 | 2074 |
| | Weed mat Rs. 10/m ² | 2880 | 2880 | 2880 | 2880 | 2880 | 2880 |
| | Life of weed mat | 8 | 8 | 8 | 8 | 8 | 8 |
| | Depreciation/year (g/h) | 360 | 360 | 360 | 360 | 360 | 360 |
| | Drip irrigation/288 m ² | 1180 | 1180 | 1180 | 1180 | 1180 | 1180 |
| | Fogging system Rs. 25/m ² | 7200 | 7200 | 7200 | 7200 | 7200 | 7200 |
| | Life of system (years) | 7 | 7 | 7 | 7 | 7 | 7 |
| | Depreciation (m/n) | 1028 | 1028 | 1028 | 1028 | 1028 | 1028 |
| | Trellis system Rs. 35/m ² | 10080 | 10080 | 10080 | 10080 | 10080 | 10080 |
| | Life of system (years) | 20 | 20 | 20 | 20 | 20 | 20 |
| | Depreciation (p/q) | 504 | 504 | 504 | 504 | 504 | 504 |
| | Total | 72000 | 72000 | 72000 | 72000 | 72000 | 72000 |
| 2. | Repair and maintenance (2 % of total cost) | 1440 | 1440 | 1440 | 1440 | 1440 | 1440 |
| 3. | Interest rate (10 % of total cost) | 7200 | 7200 | 7200 | 7200 | 7200 | 7200 |
| 4. | Total operational cost/m ² | 48 | 48 | 48 | 48 | 48 | 48 |
| 5. | Cost of cultivation | 19.61 | 19.72 | 19.82 | 20.36 | 20.61 | 21.03 |
| 6. | Total cost of production/m ² (4+5) | 67.47 | 67.59 | 67.68 | 68.23 | 68.48 | 68.90 |
| 7. | Average yield of produce (kg/m ²) | 0.40 | 0.38 | 0.36 | 0.34 | 0.33 | 0.36 |
| 8. | Average market price | 40 | 40 | 40 | 40 | 40 | 40 |
| 9. | Gross monetary returns (7 x 8) | 16.00 | 15.20 | 14.40 | 13.60 | 13.20 | 14.40 |
| 10. | Net income/m ² | - | - | - | - | - | - |
| 11. | B:C | 0.24 | 0.22 | 0.21 | 0.20 | 0.19 | 0.21 |

Table 6 : Cost economics of cucumber under different treatments

| Items | Cost of production (Rs./m ²) | Gross monetary returns (Rs./m ²) | Net income (Rs./m ²) | B:C |
|--|--|--|----------------------------------|------|
| S₁: Shade net with 35 per cent shading | | | | |
| T ₁ | 71.63 | 81.2 | 7.57 | 1.13 |
| T ₂ | 71.74 | 96.8 | 25.60 | 1.35 |
| T ₃ | 71.84 | 107.2 | 35.36 | 1.49 |
| T ₄ | 72.38 | 90.0 | 17.62 | 1.24 |
| T ₅ | 72.64 | 116.0 | 43.36 | 1.60 |
| T ₆ | 73.06 | 80.8 | 7.74 | 1.11 |
| S₂: Shade net with 50 per cent shading | | | | |
| T ₁ | 72.27 | 90.0 | 17.73 | 1.25 |
| T ₂ | 72.39 | 100.4 | 28.01 | 1.39 |
| T ₃ | 72.48 | 109.6 | 37.12 | 1.51 |
| T ₄ | 73.03 | 97.6 | 24.57 | 1.34 |
| T ₅ | 73.28 | 95.2 | 21.92 | 1.30 |
| T ₆ | 73.70 | 95.6 | 21.90 | 1.30 |
| S₃: Shade net with 75 per cent shading | | | | |
| T ₁ | 72.91 | 92.4 | 19.49 | 1.27 |
| T ₂ | 73.03 | 107.6 | 34.57 | 1.47 |
| T ₃ | 73.12 | 114.4 | 41.28 | 1.56 |
| T ₄ | 73.66 | 102.4 | 28.74 | 1.39 |
| T ₅ | 73.92 | 125.2 | 51.28 | 1.69 |
| T ₆ | 74.34 | 113.6 | 39.26 | 1.53 |
| S₄: Open field | | | | |
| T ₁ | 67.47 | 16.0 | - | 0.24 |
| T ₂ | 67.59 | 15.2 | - | 0.22 |
| T ₃ | 67.68 | 14.4 | - | 0.21 |
| T ₄ | 68.23 | 13.6 | - | 0.20 |
| T ₅ | 68.48 | 13.2 | - | 0.19 |
| T ₆ | 68.90 | 14.4 | - | 0.21 |

Summary and conclusion :

The net income was found maximum in shade net with 75 per cent shading with application of 125 per cent NPK through drip system (Rs. 125.20/m²). The B:C (1.69) was found maximum in shade net with 75 per cent shading with application of 125 per cent NPK through drip system. Though the effect of interaction between shading percentage and fertigation levels was

found statistically non-significant in case of yield but the individual effect of shading percentage and fertigation levels gave significant results.

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