J Krishi Vigyan 2019, 7 (2) : 73-77 DOI : 10.5958/2349-4433.2019.00013.8

# Economics of Peach (*Prunus persica* L. ) Production under Different Nitrogen Regimes through Neem Coated Urea and Calcium Sprays

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## ABSTRACT

An investigation was conducted at Krishi Vigyan Kendra (ICAR- VPKAS), Kafligair- Bageshwar (Uttarakhand) during the years 2016 and 2017 in peach cv. Red June planted at 3 m x 3 m spacing with varying nitrogen regimes through neem coated urea along with three sprays of calcium chloride. There were ten treatments i.e., 375g N/ tree + 0.5% Ca $Cl_2$ ($T_1$), 375g N / tree + 1.0% Ca $Cl_2$ ($T_2$), 375g N/ tree + 1.5% Ca $Cl_2$ ($T_3$), 500g N/ tree + 0.5% Ca $Cl_2$ ($T_4$), 500g N/ tree + 1.0% Ca $Cl_2$ ($T_5$), 500g N/ tree + 1.5% Ca $Cl_2$ ($T_6$), 625g N/ tree + 0.5% Ca $Cl_2$ ($T_7$), 625g N/ tree + 1.0% Ca $Cl_2$ ($T_8$), 625g N/ tree + 1.5% Ca $Cl_2$ ($T_9$), 500g N/ tree + water spray as control ($T_{10}$). The fruits were harvested at uniform maturity, packed and stored at ambient conditions. Economic analysis was done according to the average of two years data. Fruit yield, quality and storability at ambient conditions were measured and depending upon organoleptic acceptability at different storage intervals (0, 3, 6 and 8 d of harvest) and prevailing market rates the sale price was calculated. Cost of all the inputs and operational cost were calculated and summed up as cost of production. The benefit-cost ratio was highest under $T_2$ i.e., 2.99 followed by $T_5$ (2.88), $T_3$ (2.81) and $T_6$ (2.68), whereas the minimum was found with $T_{10}$ (1.71).

**Key Words:** Calcium chloride, Economic analysis, Organoleptic acceptability, Nitrogen regimes.

## INTRODUCTION

Peach (*Prunus persica* (L.) Batsch) is an important temperate fruit of attractive appearance and quality. In India, it is cultivated mostly in Himalayan region starting from the Jammu and Kashmir, Himanchal Pradesh, Uttarakhand and extending up to North – Eastern hills. In India, peach is being cultivated in an area of 18.91 thousand hectare, with a production and productivity of 96.58 thousand MT and 5.11 MT/ha, respectively (Anon, 2017). In Uttarakhand it occupies an area of 9.34 thousand hectare with the production of 49.80 thousand MT. The productivity of this fruit crop in state is 5.33 MT/ha**.** Thus, Uttarakhand alone contribute around 50 per cent of peach production and consequently occupies a vital position from income point of view of hill farmers.

As far as, the economic return from horticultural produce is concerned; yield, quality and shelf life of fruits contribute almost equally and cost of production also plays a key role in realizing the benefits. The same is true for peach also. Saraswathy *et al* (2010) described nitrogen as the nutrient having single greatest effect on post harvest fruit quality. Besides, calcium is another nutrient that plays important role in maintaining shelf life of fruits because an inverse relation exist between fruit tissue calcium level and rate of respiration. Alandes *et al* (2009) in pear and Shirzad *et al* (2011) in apple observed that calcium maintains the fibrilar packaging in the cell walls and reinforce the cell to cell contact in calcium treated

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fruits. This process is related to the production of calcium pectate that counteracts the peroxidases, pectin methyl esterase and catalases activities and thus prolongs the shelf life of fruits. Sprays with calcium have been reported to be effective in extending shelf life of fruits by maintaining firmness, minimizing respiration, tissue breakdown and thus, reducing the fruit loss (Bhat *et al,* 2011). The organoleptic acceptability is the manifestation of compiled quality attributes estimated during the course of storage.

Therefore, a study was conducted at Krishi Vigyan Kendra (ICAR- VPKAS), Kafligair-Bageshwar (Uttarakhand) during two consecutive years i.e., 2016 and 2017 to work out the economics of peach cv. Red June under different nitrogen regimes through neem coated urea which is now available in plenty due to the decision of Government of India which made it mandatory for the domestic urea manufactures to produce neem coated urea up to a minimum of 75 per cent of their total production of subsidized urea from 35 per cent earlier and allowed them to go up to 100 per cent. At the same time, three concentrations of calcium chloride were also applied as foliar spray. Thus, the influence of these factors on economic aspect of peach production was studied.

## MATERIALS AND METHODS:

Krishi Vigyan Kendra, Kafligair- Bageshwar is situated in the mid Himalayas between 29º45'07'' N latitude and 79º44'03'' E longitude at an altitude of 1245 meters above the mean sea level and represents humid sub- temperate climate with average annual rainfall of 1256 mm. The summer is warm with occasional rainfall and the winter is chilly with frosting occur usually from mid December to mid February.

The experiment was conducted on 6 -7 yr old peach cv. Red June trees raised on seedling rootstocks and planted at 3m x 3m spacing. This self fertile peach cultivar is extensively grown in Kumaun hills and is very popular among the farmers due to its attractive appearance, early maturity and consumer preference. The experiment was conducted in randomized block design with three replications and ten treatments. Forty trees of uniform vigour and trunk girth were selected. One tree under each replication was used as treatment unit and the experimental area was 400 $m^2$. The treatments comprised three levels of nitrogen fertilization (375 g, 500 g and 625 g / tree through neem coated urea) along with three concentrations (0.5%, 1.0% and 1.5 %) of calcium chloride for foliar spray, and a control (500 g N per tree through neem coated urea along with water spray). Trees of uniform vigour and trunk girth were selected for each replication. One tree under each replication was used as treatment unit. Thus there were ten treatments *viz*., 375 g N/ tree + 0.5% Ca $Cl_2$ ($T_1$), 375 g N/ tree + 1.0% Ca $Cl_2$ ($T_2$), 375 g N/ tree + 1.5% Ca $Cl_2$ ($T_3$), 500 g N/ tree + 0.5% Ca $Cl_2$ ($T_4$), 500 g N/ tree + 1.0% Ca $Cl_2$ ($T_5$), 500 g N/ tree + 1.5% Ca $Cl_2$ ($T_6$), 625 g N/ tree + 0.5% Ca $Cl_2$ ($T_7$), 625 g N/ tree + 1.0% Ca $Cl_2$ ($T_8$), 625 g N/ tree + 1.5% Ca $Cl_2$ ($T_9$), 500g N/ tree + Water spray ($T_{10}$ control). Foliar sprays of calcium chloride were given thrice, first at petal fall stage, second at 25 days after $I^{st}$ spray and third at 25 days after $II^{nd}$ spray. Common doses of Farm yard manure (40 kg/tree), $P_2O_5$ (250 g/tree) and $K_2O$ (500 g/tree) were also applied uniformly in each tree. Source of N, $P_2O_5$ and $K_2O$ were neem coated urea, single super phosphate and muriate of potash, respectively. Whole quantity of FYM, $P_2O_5$ and $K_2O$ were applied in December. Half of the N was applied in mid February about three weeks before flowering and remaining half in last week of March after fruit set.

Bruiseless fruits of almost same maturity from all forty trees were separately selected, packed in corrugated fiber boxes and stored at ambient temperature. Separate boxes were used for different storage periods. Provision of ten fruits per tree was made to record organoleptic acceptability at each storage interval. Depending upon organoleptic acceptability at different storage intervals (0, 3, 6

and 8 day of harvest) and prevailing market rates the sale price was assigned.

**Organoleptic acceptability**

A panel of five judges ranked the overall acceptability of fruits for each treatment based on taste, aroma and texture at harvest as well as at all three storage durations. A five point scale indicating the following quality preferences was used for evaluation (Barwal and Kumar, 2014).

**Rating of fruits**

| Sr. No. | Quality preference | Marks |
|---|---|---|
| 1. | Excellent | 5 |
| 2. | Very good | 4 |
| 3. | Good | 3 |
| 4. | Fair | 2 |
| 5. | Poor | 1 |

**Economic parameters**

The cost of production was calculated by putting together values of all inputs, operational cost and treatment cost. The Gross returns or gross income was calculated by multiplying the average fruit yield with expected sale price. The net return was calculated by subtracted the value of cost of cultivation to gross return. Benefit- Cost for all the treatments was calculated by dividing the gross return from cost of production.

## RESULTS AND DISCUSSION

**Organoleptic acceptability**

The data (Table 1) showed that the treatments $T_2$ and $T_3$ had maximum mean organoleptic acceptability (4.4 score), that was significantly higher to all other treatments. The minimum (2.2 score) was observed under $T_{10}$ (control). It may be concluded from the presented data that the lowest nitrogen regime resulted in better organoleptic acceptability and increase in nitrogen levels led to inferior quality preference. Moreover, sprays of calcium chloride above 0.5 per cent concentration imparted better organoleptic acceptability. Our results were also in accordance with the findings of Barwal and Kumar (2014) who reported the beneficial effects of calcium chloride sprays above 0.5 per cent concentration on overall acceptability of nectarines during storage at ambient conditions. Moreover, increase in nitrogen fertilization led to dilution of calcium in the fruit due to high vegetative growth (Rato *et al*, 2010**)** and might elucidate the negative effect of increased nitrogen levels on storability

**Economic analysis**

The findings of economic work out (Table 2 and 3) revealed that maximum cost of production i.e., Rs. 3.19 lakh/ha was incurred under treatment $T_9$ followed by $T_6$ (Rs. 3.17 lakh/ha), $T_3$ (Rs. 3.15 lakh/ha) and $T_8$ (Rs. 3.01 lakh/ha), while the minimum was estimated under control i.e., $T_{10}$ (Rs. 2.64 lakh/ha). The estimated gross return per plant and per hectare for peach on the basis of two years average showed that the highest gross return of Rs. 802/-tree corresponding to Rs. 8.91 lakh/ha was calculated under treatment $T_2$ followed by $T_3$ (Rs. 797/tree and Rs. 8.86 lakh/ha), $T_5$ (Rs.776 per tree and Rs. 8.63 lakh/ha) and $T_6$ (Rs. 765 per/tree and Rs. 8.50 lakh/ha), whereas the minimum gross income was estimated under $T_{10}$ (Rs. 408/tree and Rs. 4.54 lakh/ha). The highest net return of Rs. 5.94 lakh/ha was estimated with $T_2$ followed by $T_3$ (Rs. 5.71 lakh/ha), $T_5$ (Rs. 5.64 lakh/ha) and $T_6$ (Rs. 5.33 lakh/ha), while the lowest net return was calculated for $T_{10}$ *viz*., Rs.1.90 lakh/ha. The benefit-cost ratio was highest under $T_2$ i.e., 2.99 followed by $T_5$ (2.88), $T_3$ (2.81) and $T_6$ (2.68), whereas the minimum was found with $T_{10}$ (1.71).

Treatment cost of urea (neem coated) and calcium chloride played important role in determining the variation in cost of production. The gross return and consequently the net return and benefit-cost ratio were highly influenced by the fruit yield as well as the expected price of produce according to organoleptic acceptability. The yield was statistically *at par* for $T_2$, $T_3$, $T_5$ and $T_6$ but the better

**Table 1. Response of N regimes through neem coated urea and foliar application of calcium chloride on mean organoleptic acceptability of peach cv. Red June and expected sale price on the basis of two year's data (2016 and 2017)**

| Sr. No. | Treatment | Mean organoleptic acceptability | Expected sale price (Rs./ q) |
|---|---|---|---|
| 1. | $T_1$ | 3.7 [bc] | 3,100 |
| 2. | $T_2$ | 4.4 [a] | 3,400 |
| 3. | $T_3$ | 4.4 [a] | 3,400 |
| 4. | $T_4$ | 3.4 [c] | 3,000 |
| 5. | $T_5$ | 3.9 [b] | 3,200 |
| 6. | $T_6$ | 3.8 [b] | 3,200 |
| 7. | $T_7$ | 2.7 [d] | 2,500 |
| 8. | $T_8$ | 2.9 [d] | 2,600 |
| 9. | $T_9$ | 2.9 [d] | 2,600 |
| 10. | $T_{10}$ | 2.2 [e] | 2,000 |
| CD (0.05) | | 0.3 | |

* Values within columns having common letter are statistically *at par*.

**Table 2. Treatment wise total cost of production of peach cv. Red June on the basis of two year's average (2016 and 2017)**

| Sr. No. | Treatment | Operational cost (Rs. lakh / ha) [A] | Input cost (Rs lakh /ha) [B] | Treatment application cost | | Total cost of production (Rs. lakh / ha) [D=A+B+C] |
|---|---|---|---|---|---|---|
| | | | | Rs./tree | Rs./ha [C] | |
| 1. | $T_1$ | 1,68,300 | 88,884 | 20.68 | 22,975 | 2.80 |
| 2. | $T_2$ | 1,68,300 | 88,884 | 36.46 | 40,506 | 2.98 |
| 3. | $T_3$ | 1,68,300 | 88,884 | 52.27 | 58,071 | 3.15 |
| 4. | $T_4$ | 1,68,300 | 88,884 | 22.3 | 24,776 | 2.82 |
| 5. | $T_5$ | 1,68,300 | 88,884 | 38.08 | 42,307 | 2.99 |
| 6. | $T_6$ | 1,68,300 | 88,884 | 53.89 | 59,872 | 3.17 |
| 7. | $T_7$ | 1,68,300 | 88,884 | 23.91 | 26,564 | 2.84 |
| 8. | $T_8$ | 1,68,300 | 88,884 | 39.69 | 44,095 | 3.01 |
| 9. | $T_9$ | 1,68,300 | 88,884 | 55.5 | 61,660 | 3.19 |
| 10. | $T_{10}$ | 1,68,300 | 88,884 | 6.52 | 7,244 | 2.64 |

**Table 3. Treatment wise economic analysis of peach cv. Red June on the basis of two year's average.**

| Sl. No. | Treatment | Average yield | | Gross return [Av. yield x Expected sale price] | | Net return (Rs. lakh /ha) [F=E-D] | Benefit - cost ratio [G=E/D] |
|---|---|---|---|---|---|---|---|
| | | Kg/tree | q/ha | Rs. /tree | Rs. lakh/ha (E) | | |
| 1. | $T_1$ | 21.85 [b*] | 242.75 [b] | 677.35 | 7.53 | 4.72 | 2.69 |
| 2. | $T_2$ | 23.60 [a] | 262.20 [a] | 802.40 | 8.92 | 5.94 | 2.99 |
| 3. | $T_3$ | 23.46 [a] | 260.64 [a] | 797.64 | 8.86 | 5.71 | 2.81 |
| 4. | $T_4$ | 22.18 [b] | 246.42 [b] | 665.40 | 7.39 | 4.57 | 2.62 |
| 5. | $T_5$ | 24.28 [a] | 269.75 [a] | 776.96 | 8.63 | 5.64 | 2.88 |
| 6. | $T_6$ | 23.91 [a] | 265.64 [a] | 765.12 | 8.50 | 5.33 | 2.68 |
| 7. | $T_7$ | 17.97 [e] | 199.65 [e] | 449.25 | 4.99 | 2.15 | 1.76 |
| 8. | $T_8$ | 19.38 [d] | 215.31 [d] | 503.88 | 5.59 | 2.59 | 1.86 |
| 9. | $T_9$ | 19.50 [d] | 216.65 [d] | 507.00 | 5.63 | 2.45 | 1.77 |
| 10. | $T_{10}$ | 20.44 [c] | 227.09 [c] | 408.80 | 4.54 | 1.90 | 1.71 |
| CD (0.05) | | 0.83 | 9.15 | | | | |

*Values within columns having common letter are statistically *at par*.

average organoleptic acceptability during storage of peach fruits at ambient conditions under lowest nitrogen regime (375 g N tree) along with 1.0 per cent calcium chloride sprays might lead the produce to fetch the higher expected price and consequently gave higher economic return. Moreover, fruits with elevated storage capacity at ambient conditions may be transported to distant places where they have greater opportunity of getting higher prices, which in turn would be manifested in maximum net return and benefit-cost ratio.

## CONCLUSION

The economic interpretation depending on organoleptic preferences and prevailing market prices suggests that the economic benefit of peach production may be increased by alteration of nitrogen doses and calcium sprays. Therefore, nitrogen application @ 375 g/tree through neem coated urea and three foliar application of 1.0 per cent calcium chloride along with traditionally practiced doses of 40 kg/ tree FYM, 250 g phosphorus/ tree and 500 g potassium/ tree may be recommended for full grown peach cv. Red June trees under Uttarakhand hills for better economic gains.

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*Received on 22/03/2019* *Accepted on 10/04/2019*