



## RESEARCH PAPER

# Processing of black pepper (*Piper nigrum* L.) through solarisation

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**Abstract :** Appearance of red or yellow colour in any of the black pepper berries of a spike indicates optimum maturity. During the production of black pepper, harvesting is done at this stage. Open sun drying method is prevailing in Uttara district of Karnataka and in any other parts of the country too. Traditionally, black pepper is sun dried on a floor coated with cow dung slurry resulting in poor quality produce with less per cent recovery, oleoresin, piperine and aroma and ultimately resulting low market price. In CFTRI technique, the pepper berries/spikes are dipped in boiling water for one minute and then sun dried to get a quality produce. However, it is cumbersome and requires skill. An experiment was conducted at Krishi Vigyan Kendra, Sirsi and in farmer's fields of Siddapur Taluk, Uttar Kannada. In T<sub>1</sub> and T<sub>4</sub> whole spikes and de-berried berries were sun dried in open sun on cement floor, respectively. Whereas in T<sub>2</sub> and T<sub>5</sub> whole spikes and de-berried berries were processed by dipping in hot water for one minute and then sun dried. In T<sub>3</sub> and T<sub>6</sub> whole spikes and de-berried berries were processed in between polythene sheets (200 gauge) for 2-3 hours (till they become black) on first day and then sun dried for 3-4 days. The dry weight of the produce was recorded and per cent recovery was worked out. The samples were analysed for physical and chemical characteristics like bulk density, aroma, colour, per cent oil, oleoresin, piperine and moisture at IISR, Calicut. The treatments T<sub>3</sub> and T<sub>6</sub> recorded higher recovery of dry berries, good colour, higher aroma and higher market price. In large scale studies T<sub>6</sub> performed better in recovery as well as quality parameters such as oleoresin and piperine contents.

**Key Words :** Balck pepper, Salarization, Oleoresin, Recovery

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## INTRODUCTION

Black pepper (*Piper nigrum* L.), the king of spices exported from India and earning foreign exchange of Rs.41,651 million to the country (Rajan and Sarma, 2000),

which is about 70 per cent of the total earnings from spices to the national economy. Black pepper is cultivated in approximately 2,00,000 ha in India with annual production of about 50,000 MT. This accounts for more than 50 per cent of world's area of pepper cultivation,

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but contributes only around 25 per cent of global production. Though India had a pre-eminent position during 1950's by meeting 80 per cent of world's supply of black pepper, the export has now dwindled to less than 33 per cent as a result of stiff competition from newly emerged pepper producing countries such as Indonesia, Malaysia, Brazil and Vietnam (Senthilkumara and Vadivel, 2000 and Thomas, 2002). Black pepper contains an array of phytochemicals. Volatile oil, oleoresin and piperine are the important products of high commercial value extracted from pepper. The post-harvest processing of black pepper comprise many steps like threshing, blanching, drying, cleaning, grading, and packaging. Each step is important but, drying is the most crucial step for attaining quality and storage life. Harvesting of pepper is done by manual picking of spikes containing unripe, but mature berries. Appearance of red or yellow colour in any of the berries of a spike indicates optimum maturity of that spike. For the production of black pepper, harvesting is done at this stage. Open sun drying method is prevailing in Uttara district of Karnataka and in other parts of the country too.

The threshed berries are subjected to 'blanching', *i.e.* they are dipped in boiling hot water exactly for one minute these are then dried. In open sun drying method drying depends upon the climatic conditions (Krishnamurthy *et al.*, 1993). Dried berries are collected and cleaned. Traditional methods of pepper processing and post-harvest operations have a lot of problems. Unhygienic techniques and mishandling of the crops most often leads to contamination and low quality produce (Joy *et al.*, 2002). It has been reported that open drying of berries results in contamination by dust, bits of reeds, stalks, bird droppings etc. (Sreekumar, 2001). Moreover, as the drying period prolongs there is chance of microbial contamination. The delay in drying time and degree of microbial contamination can easily affect the aroma quality though no great changes may occur in the physico-chemical characteristics (Govindarajan, 1977). Generally farmers dry pepper only to a moisture level of 16-18 per cent instead of the standard 11-12 per cent. Quite often, the produce supplied by the farmers is not properly dried, cleaned, graded or packed according to recommended standards.

Pepper drying can also be done using solar dryers, but prevailing solar dryers have limitations. They suggested that in black pepper, lot of importance is given on the glossy finish. However, pepper is grown in coastal

region, where quality deterioration due to fungus on dried product is quite evident. Intensive research on drying principles and dryers has been carried out in India. The foremost value of pepper is its flavour, aroma and pungency. The quality is attributed by its volatile oil, oleoresin and piperine in general. Moisture content and level of physical contaminants are also important while analysing export quality. Alkaloid piperine is considered to be the major constituent responsible for the biting taste of black pepper. Retention of piperine, volatile oil and oleoresin is the prime criteria to be conserved while drying.

In India, the major pepper growing states are Kerala, Karnataka and Tamil Nadu. Traditionally, black pepper is sun dried on a floor coated with cow dung slurry resulting in poor quality produce with less per cent recovery, oleoresin, piperine and aroma and ultimately resulting low market price.

In CFTRI technique, the pepper berries/spikes are dipped in boiling water for one minute and then sun dried to get a quality produce. However, it is cumbersome and requires skill. Hence, there is need to develop a technique which does not require skill and produce quality product which fetches high price in the market.

## MATERIAL AND METHODS

An experiment was conducted at Krishi Vigyan Kendra, Sirsi and in farmer's fields of Siddapur Taluk, Uttar Kannada. The experiment was laid out in RCBD (Completely Randomized Design) with 6 treatments replicated 10 times using 100 kg spikes in each treatment. And in large scale trial in each treatment 5.0 quintal spikes were used. The spikes were harvested when 2-3 berries in each spike were ripe. In T<sub>1</sub> and T<sub>4</sub> whole spikes and de berried berries were sun dried in open sun on cement floor, respectively. Whereas in T<sub>2</sub> and T<sub>5</sub> whole spikes and de-berried berries were processed by dipping in hot water for one minute and then sun dried. In T<sub>3</sub> and T<sub>6</sub> whole spikes and de-berried berries were processed in between polythene sheets (200 gauge) for 2-3 hours (till they become black) on first day and then sun dried for 3-4 days. The dry weight of the produce was recorded and per cent recovery was worked out. Number days taken for drying was also low in these two treatments as compared to others.

$$\text{Per cent recovery} = \frac{\text{Dry weight of berries after drying}}{\text{Fresh weight of berries}} \times 100$$

The samples were analysed for physical and chemical characteristics like bulk density, aroma, colour, per cent oil, oleoresin, piperine and moisture.

## RESULTS AND DISCUSSION

The results on different methods of drying of berries of black pepper indicated that dry recovery (%) of berries

**Table 1 : Dry recovery (%) of berries**

Treatments	Per cent recovery			
	First year	Second year	Third year	Pooled mean
T <sub>1</sub> : Drying of whole spikes in open sun on cement floor	34.20	33.30	33.42	33.65
T <sub>2</sub> : Blanching whole spikes in hot water for one minute and then sun drying	35.00	35.00	34.91	34.97
T <sub>3</sub> : Processing of whole spikes in between polythene sheets and then sun drying	36.00	35.60	35.08	35.56
T <sub>4</sub> : De-berried and then sun drying	34.60	34.60	33.95	34.38
T <sub>5</sub> : De-berried and dipping in hot water for one minute and then sun drying	35.00	35.20	34.91	35.04
T <sub>6</sub> : De-berried and processing in between polythene sheets and then sun drying	35.90	35.50	35.08	35.49
S.E.±	0.35	0.44	0.46	0.18
C.D. (P=0.05)	1.04	1.30	1.35	0.53
C V(%)	1.99	2.51	2.63	1.03

**Table 2: Qualities of dried berries (3 years Avg.)**

Treatments	No. of days taken for drying	Colour of berries	Aroma	Market price* (Rs./kg)
T <sub>1</sub> : Drying of whole spikes in open sun on cement floor	07	Dark grey with mixture of red and green tinge	Mild	105.00
T <sub>2</sub> : Blanching of whole spikes in hot water for one minute and the sun drying	06	Even dark berries with good luster	Strong	116.00
T <sub>3</sub> : Processing of whole spikes in between polythene sheets and then sun drying	05	Even dark berries with good luster	Very strong	120.00
T <sub>4</sub> : De berried and then sun drying	07	Dark grey with mixture of red and green tinge	Mild	108.00
T <sub>5</sub> : De berried and dipping in hot water for one minute and then sun drying	06	Even dark berries with good luster	Strong	118.00
T <sub>6</sub> : De berried and processing in between polythene sheets and then sun drying	05	Even dark berries with good luster	Very strong	120.00

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**Table 3 : Large scale processing of black pepper berries in between polythene sheets (Third year)**

Treatments	% recovery
T <sub>1</sub> : Drying of whole spikes in open sun on cement floor	32.60
T <sub>2</sub> : Blanching of whole spikes in hot water for one minute and the sun drying	32.80
T <sub>3</sub> : Processing of whole spikes in between polythene sheets and then sun drying	34.00
T <sub>4</sub> : De berried and then sun drying	33.40
T <sub>5</sub> : De berried and blanching in hot water for one minute and then sun drying	33.50
T <sub>6</sub> : De berried and processing in between polythene sheets and then sun drying	34.20
S.E.±	0.25
C.D. (P=0.05)	0.75
CV(%)	1.98

**Table 4 : Physical and chemical characteristics of berries\***

Method of drying	Bulk density (g/litre)	Per cent (%)*			
		Oleoresin	Piperine	Oil	Moisture
Sun drying on cement floor (T <sub>1</sub> )	540	7.3	2.5	3.2	12.0
Blanching in hot water and then sun drying (T <sub>2</sub> )	550	7.0	2.6	3.2	10.0
Processing in between polythene sheets and then sun drying (T <sub>3</sub> )	510	7.7	3.3	3.2	8.0
Processing in between polythene sheets and then sun drying (large scale)	500	8.1	3.8	2.8	6.0

\*Analysed at IISC, Calicut

was higher in T<sub>3</sub> (Processing of whole spikes done in between polythene sheets of 200 gauge and then sun drying for 2-3 hours, till they become black on first day and then sun dried for 3-4 days) (35.56%) followed by T<sub>6</sub> (De-berried and processing done in between polythene sheets of 200 gauge and then sun drying for 2-3 hours, till they become black on first day and then sun dried for 3-4 days) (35.49%) as compared to other treatments (Table 1). Sodha *et al.* (1985) reported that for open sun drying the grain layer thickness should not be more than 5 cm. Since the treatments T<sub>1</sub> and T<sub>4</sub> where whole spikes and de berried berries were sun dried in open sun on cement floor, respectively, they could not give higher recovery. Whereas T<sub>2</sub> and T<sub>5</sub> where whole spikes and de-berried berries were processed by dipping in hot water for one minute and then sun dried also did not recorded the higher recovery. The lowest recovery was obtained under T<sub>1</sub> (Drying of whole spikes in open sun on cement floor) (33.65).

The number of days taken for drying was lowest in T<sub>3</sub> (Processing of whole spikes in between polythene sheets and then sun drying ) (05) and T<sub>6</sub> (De berried and processing in between polythene sheets and then sun drying) (05) and it was higher in T<sub>4</sub> (De berried and then sun drying) (07).

The samples were analysed for physical and chemical characteristics like bulk density, aroma, colour, per cent oil, oleoresin, piperine and moisture at IISR, Calicut indicated that the treatments T<sub>3</sub> and T<sub>6</sub> recorded higher recovery of dry berries, good colour (Even dark berries with good luster), higher aroma (Very strong) and higher market price (Rs.120 per kg) as compared to T<sub>1</sub> (Rs.105 per kg) (Table 2). In large scale studies T<sub>6</sub> performed better in recovery as well as quality parameters such as oleoresin (7.7-8.1%) and piperine (3.3-3.8%) contents. However, according to Jacob *et al.* (1985) blanching improves the colour but affords pepper fruits depleted of significant quantum of volatiles. Black pepper dried in solar tunnel dryers was hygienic and performed high quality over commercial samples (Joy *et al.*, 2002).

### Conclusion:

Drying of black pepper in de-berried berried form

and processing in between polythene sheets of 200 gauge for 2-3 hours (till they become black) on first day and then sun dried for 3-4 days (T<sub>6</sub>) will give better recovery and good quality berries in-turn higher market price.

## REFERENCES

- Anith, K.N., Radhakrishnan, N.V. and Manomohandas, T.P. (2003).** Screening of antagonistic bacteria for biological control of nursery wilt of black pepper (*Piper nigrum*). *Microbiol. Res.*, **158** (2): 91-97.
- Govindrajan (1977).** Pepper chemistry, technology and quality evaluation. *Critical Rev. Food Sci. & Nutr.*, **9** : 115-225.
- Jacob, C.V., Varghese, M.T., Joy, T. and Mathuua, A. (1985).** Focus on pepper technology: I Drying of pepper. *Indian Spices*, **22**(3): 27-29.
- Joy, C.M., George, Peter, Pittappillil and Jose, K.P. (2002).** Drying of black pepper (*Piper nigrum* L.) using solar tunnel dryer. *Pertanika J. Trap. Agric. Sci.*, **25** (1): 39 – 45.
- Krishnamurthy, N., Sampathu, S.R., Soubhagya, H.B. and Shankaranayana, M.L.(1993).** Farm processing of some spices- pepper, turmeric and ginger. In: Proc. Post-harvest Technology of Spices Ed. C.S. Narayanan, B. Shankarikkutti, Nirmala Menon, P.N. Ravindran and B. Sasikumar. p. 50-52. RRL Spices Board, Cochin.
- Rajan and Sarma (2000).** Chapter 2 : Strategies to improve the quality of black pepper cultivated in Kerala. In Book : *Principle of drying in solar tunnel dryer*.
- Senthilkumara and Vadivel (2000).** Chapter 2 : Strategies to improve the quality of black pepper cultivated in Kerala. In Book : *Principle of drying in solar tunnel dryer*.
- Sivaramaw, K., Kandiannan, K., Peter, K.V. and Thankamani, C.K. (1999).** Agronomy of black pepper (*Piper nigrum* L.) - A review. *J. Spices & Aromatic Crops*, **8** (1) :1-18.
- Sreekumar (2001).** Chapter 2 : Strategies to improve the quality of black pepper cultivated in Kerala. In Book : *Principle of drying in solar tunnel dryer*.
- Sodha, M.S., Bansal, P.K., Dang, A. and SHARMA, S.B. (1985).** Open sundrying and analytical study. *Internat. J. Dry. Technol.*, **3** (4): 517-527.
- Thomas (2002).** Chapter 2 : Strategies to improve the quality of black pepper cultivated in Kerala. In Book : *Principle of drying in solar tunnel dryer*.