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Effect of Pricking Methods on Physical Properties and Pricking Capacity of Aonla (*Phyllanthus Emblica* L.) Fruit Used for Preparation of Candy

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Abstract: *An effect of pricking methods involving hand pricking with pricking fork having seven brass spikes and machine pricking having needles of different diameter were studied for post pricking physical properties of aonla fruit used for preparation of candy. The results of study revealed that, among needles of different diameter used in pricking machine, 3 mm needle was found to be significant for average percent surface area pricked (17.17%) and average pricking capacity (5.80 kg/hr) over hand operated pricking fork. The average depth of penetration (8 mm) and damage to the fruits (1.30%) the parameters considered beneficial for improving quality of candy were also promising over hand operated pricking fork.*

Keywords: *Pricking, Physical Properties, Aonla Candy.*

INTRODUCTION

Aonla fruit is currently grown over hacters and had emerged as one of the commercial dry land horticultural crops in recent past. The significant increase in area under this crop is apparently due to medicinal properties such as, high ascorbic acid 450-682 mg/100g (Shrivastava and Shrivastava, 1964) used to cure disease such as scurvy (en.wikipedia.org/wiki/scurvy), antiscorbulic, diuretic laxative, and alternative antibiotic (Ray and Mujumdar, 1976) and used in treating jaundice and cough (Burkill,1935). It is used in Ayurvedic and Unani systems of Indian Medicines (Khan and Moheet, 1958, Tripathi *et.al., 1979*). Apart from its medicinal properties aonla is also used for preparation of various household products on commercial scale such as; Juice, Murramba, Pickles, Syrup, Squash, RTS beverages, candies, etc.(Kalra, 1988, Bhosale, 1998,).

For proceeding to process whole fruit for preparation of any product, pricking is the first step involved. Various workers have observed pricking an important operation in various fruits such as; grapes (Thorat *et.al.*), ber (Gharte, 1984) and aonla (Patil, 2001) for rapid moisture loss during preparation of grape raisins, ber and aonla candy respectively.

At present pricking is done with help of an ordinary wooden fork having seven spikes made up of brass. The fork pricking is manual operation and its time consuming moreover, it involves excessive handling, which is not desirable unless hygienic conditions are maintained. Apart from this fork pricking doesn't ensure uniform area to be pricked, penetration, and damage to the fruit as that of machine pricking. The machine pricking also has high capacity of pricking compared to hand operated fork pricking.

Considering the above intricacies the study was conducted to observe effect of pricking methods on physical properties and pricking capacity of aonla (*Phyllanthus emblica* L.) fruit used for preparation of candy.

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MATERIAL AND METHOD

Procedure for Pricking

Hand Pricking

The hand operated pricking fork having 7 brass spikes was used for hand pricking. The diameter of spike was 1.5 mm. The fruits were pricked with eight strokes creating 7 × 8 = 56 holes on the fruit.

Machine Pricking

The manual operated pricking machine comprised of; three separate dies with two cavities having eighteen needles. The diameters of needles were, 1, 2 and 3 mm, and pricking frequency was two stokes creating 18 × 2 = 36 holes on the fruit.

Average Surface Area Pricked (%)

The percent surface area pricked was calculated for each method by multiplying the circular area of holes made by needles with number of holes. The area was then worked out in percentage.

Average Depth of Penetration (mm)

Average depth of penetration of the spikes was measured by inserting a very thin needle into the prickled holes of fruit, and scaling it on measuring scale milli-meter (mm) as unit of measurement.

Damage to the Fruits (%)

Damage to the fruit was calculated by working out pre and post pricking percent physiological loss in weight. The physiological loss in weight was attributed to removal of fibers, moisture, and pulp from the surface area of the pricked fruit. The percent loss in weight was investigated over total weight of pre-pricked fruit.

Average Pricking Capacity (Kg/hr.)

The pricking capacity was calculated by total quantity of fruits pricked in an hour time and was tabulated in kilogram per hour.

RESULTS AND DISCUSSION

Average Surface Area Pricked (%)

The data on effect of pricking method on percent average surface area pricked was calculated and presented in Table 1. The data reveals that percent surface area pricked increased with increase in the diameter of the needle when pricked with the machine. For 1, 2 and 3 mm needle diameter in pricking machine the average percent surface area pricked was found to be 1.92, 7.20, and 17.20% respectively. For hand pricking method using brass spikes fork of 1.5 mm diameter the average percent surface area pricked was 6.73%. Increase in average surface area pricked with increase in needle diameter is due to apparent reason of increased thickness of pricking point of needle cutting larger surface area of the fruit.

Table 1
Effect of Pricking Methods and Needle Diameter on Per cent Surface Area Pricked

Sr. No.	*Pricking Methods*	*Diameter of needle*	*Percent surface area pricked*	
			Range	*Average*
1.	Hand pricking	1.5 mm	5.46 to 8.39	6.73
2	Machine pricking	1 mm	1.57 to 2.39	1.92
		2 mm	6.28 to 9.54	7.20
		3 mm	14.05 to 21.48	17.17

Average Depth of Penetration (mm) and Damage to the Fruits (%)

The data on effect of pricking method on average depth of penetration (mm) and percent damage to the fruits is tabulated in Table 2. The results could conclude that average depth of penetration (mm) reduced with elevated levels of needle diameter in machine pricking. The needles of 1, 2 and 3 mm diameter could penetrate into fruit upto 12, 10 and 8 mm depth respectively. The spikes of hand pricking fork penetrated into fruit surface upto 10 mm depth. The decrease in depth (mm) of penetration with increase in diameter of needle in machine pricking could be attributed to higher resistance of fruit surface to needle of higher diameter than lower ones.

Table 2
Effect of Pricking Methods and Needle Diameter on Average Depth of Penetration (mm)

Sr. No.	*Pricking Methods*	*Diameter of needle*	*Average Depth of Penetration (mm)*
1.	Hand pricking	1.5 mm	10
2.	Machine pricking	1 mm	12
		2 mm	10
		3 mm	8

Percent damage to the fruit, a characteristic which is found to be promising for improving the quality of aonla candy, and was higher (1.30%) in 3 mm needle diameter in machine pricking. The 1.5 mm spikes of hand pricking fork could damage the fruit upto 0.50%. The cause of damage to fruit by thicker needle could be due removal of larger surface area thus removal of moisture and fibers from the pulpy portion of the fruits.

Average Pricking Capacity (Kg/hr.)

The data on effect of pricking methods on average pricking capacity (kg/hr) is recorded in Table 3. The data in table shows that, with increase in diameter of needles in machine pricking the pricking capacity has reduced. The maximum (10.0 kg/hr) pricking capacity could be achieved in 1 mm needle diameter whereas, it was minimum (2.0 kg/hr) in hand pricking fork method. It was 8.5 and 5.8 kg/hr. for 2 and 3 mm needle diameter of machine pricking method respectively. The maximum pricking capacity in 1 mm needle diameter could be due to less resistance of fruit surface for thinner needle.

Table 3
Effect of Pricking Methods and Needle Diameter on Percent Damage to Fruit (%)

Sr. No.	*Pricking Methods*	*Diameter of needle*	*Percent damage to fruit (%)*
			Average
1.	Hand pricking	1.5 mm	0.50
2.	Machine pricking	1 mm	0.00
		2 mm	0.67
		3 mm	1.30

Table 4
Effect of Pricking Methods and Needle Diameter on the Pricking Capacity (kg/hr)

Sr. No.	*Pricking Methods*	*Diameter of needle*	*Capacity kg/hr*
1.	Hand pricking	1.5 mm	2.0
2.	Machine Pricking	1 mm	10.0
		2 mm	8.5
		3 mm	5.8

Gradual decrease in pricking capacity with increase in needle diameter infers to increase resistance of fruit surface for thicker needle. The lower values of pricking capacity (2.0 kg/hr) in hand pricked method is because of consumption of long time in hand pricking.

CONCLUSION

It could be concluded from above results that, compared to hand operated brass spike pricking fork, average surface area pricked (%) was maximum from 3 mm needle diameter in machine pricking whereas, average depth of penetration (mm) was least but caused maximum percent damage to the fruits, a characteristic found to be beneficial for preparing good quality aonla candy. These results are in confirmation with that of Jino Chacko, *et.al*. (2003), who had developed and tested low cost aonla pricking machine.

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