



Development of Best Post Harvest Processing Technology for Quality Production of Satawar (*Asparagus racemosus* L.)

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Abstract: Satawar (*Asparagus racemosus*) is an important plant in traditional medicine in tropical and subtropical India. *A. racemosus* is a well known Ayurvedic rasayana which prevent ageing, increase longevity, impart immunity, improve mental function, and vigor to the body and it is also used in nervous disorders, dyspepsia, tumors, inflammation, neuropathy, hepatopathy. The post harvest processing is most important and crucial process in *Asparagus* cultivation; however it is very scanty or untouched by researcher. In this study, the best post harvest processing method screened out to get higher dry root yield of Satawar with good quality at CSIR-CIMAP Research Centre, Pantnagar, Udham Singh Nagar, Uttarakhand. The different concentration of Sodium hydroxide (NaOH) solutions viz; 2%, 3% and 5%, and only water were used as boiling of Satawar to facilitate easy peeling and for good quality dry root yield. The effects of chemical on peeling of Satawar were determined by physical properties, physical appearance, quality, and dry root yield of Satawar. The highest yield of dry root were recorded in control (boiling of Satawar root in water at 100°C for 80 minute, followed by boiling of Satawar in 2% NaOH solution at 100°C for 35 minute, boiling of Satawar in 3% NaOH solution at 100°C for 18 minute, and lowest was observed in boiling of Satawar in 5% NaOH solution at 100°C for 10 minute. However, the physical appearance was excellent in 2% concentration of Satawar as Satawar appeared a yellowish to golden colour. The post harvest processing i.e. boiling of Satawar in 2% NaOH solution at 100°C for 35 minute provides excellent quality of dry root and reduces the boiling time up to 56.25% as compared to control (boiling in normal water) and dry root yield 55.68 quintal ha⁻¹. Therefore, it recommended that boiling of Satawar in 2% NaOH solution at 100°C for 35 minute followed by peeling and drying is the best method for post harvest processing to obtain excellent quality and profitable higher yield.

Key words: *Asparagus racemosus*, lye solution (NaOH), Concentration, Temperature, Dry root yield, Quality.

1. INTRODUCTION

Asparagus racemosus (Asparagaceae) is an important plant in traditional medicine in tropical and subtropical India. Shatavari means “who possesses a hundred husbands or acceptable to many”. Asparagine A, a polycyclic alkaloid was isolated from the dried roots. Steroidal saponins, shatavarioside A, shatavarioside B, filiasparoside C, shatavarins, immunoside, and schidigerasaponins D5 (or asparanin A) were isolated from the roots of *Asparagus racemosus*. *A. racemosus* is a well known Ayurvedic rasayana which prevent ageing, increase longevity, impart immunity, improve mental function, and vigour to the body and it is also used in nervous disorders, dyspepsia, tumors, inflammation, neuropathy, hepatopathy. Reports indicate that the pharmacological activities of *A. racemosus* root extract include antiulcer, antioxidant, and anti-diarrhoeal, antidiabetic activities. The roots are used in Ayurvedic medicine, following a regimen of processing and drying. It is generally used as a uterine tonic, as a galactagogue (to improve breast milk), in hyperacidity, and as a best general health tonic.

Satawar (*Asparagus racemosus*) is a high economic value crop and provides 8 to 10 time higher net returns and income to the farmers as compared to traditional crops. It is mostly free from insect, pest, diseases, and animals' infestation. Satawar requires less input and attention upto harvest stage. The most difficult and very sensitive operation in Satawar cultivation is harvest and post harvest, like digging of complete root without breakage and post major harvest process peeling of Satawar requires approximately 60-80% cost of cultivation. Being Satawar is a high value crop as above, but most of the farmers reluctant to cultivate it, only due to very difficult post harvest process i.e. requires more man power, and the same time manpower or agriculture labourers decreasing day by day.

Chemical peeling involves diffusion and chemical reactions. Once the caustic solution of NaOH comes in contact with the surface of the

roots, it dissolves the epicuticular waxes, penetrates the epidermis, and diffuses through the skin into the roots (Floros JD *et al.*, 1987). Inside the roots, the NaOH reacts with macromolecules (polygalacturonic acid, other organic acids, hemicellulosic polysaccharides, proteins, etc.) and organic acids in the cytoplasm, middle lamella and cell wall. These reactions slow down the inward diffusion of NaOH and therefore at low NaOH concentration, lower diffusivity values are observed (Bolin HR *et al.*, 1991). When the NaOH concentration is sufficiently higher than a baseline needed for chemical reactions, however, a fast reaction rate is achieved. And as a result, separation of skin takes place. This method results in decrease some quality parameters color, odour and appearance of the products that will be consumed as a whole (Bayindirli *et al.*, 2001).

Keeping in view above, the present experiment planned and conducted at CSIR-CIMAP Research Centre, Pantnagar, Udham Singh Nagar, Uttarakhand. The objectives of this experiment were to evaluate the effects of chemical peeling treatments by measuring quality parameters such as peeling yield, product quality and color and to develop best and easiest post harvest method for peeling of Satawar for quality production and to enhance the farmer's income in sustainable manner.

2. MATERIALS AND METHODS

2.1. Collection of fresh roots:

Two year old plants were dug out from the field of CSIR CIMAP, Pantnagar Uttarakhand and fresh root yield 350 q/ha were recorded. The roots of plants were separated, washed and air dried. Plant height, number of branches, weight per plant and weight per hectare were recorded.

2.2. Boiling of satawar root:

Approximately 200 gm of air dried roots of Satawar were par-boiled at constant temperature of 100°C

in normal tap water (1000 ml), and in different concentration of NaOH lye solution viz, 2%, 3% and 5% NaOH for specific period 80, 35, 18, and 10 minute respectively.

2.3. Peeling yield

It was measured by weighing Satavar roots before and after peeling and calculated as percent (Bayindirli L *et al.*, 2002). Peeling dry yield was calculated on the basis of fresh roots weight in field (350q/ha).

2.4. Data analysis

The numerical data of all the components were subjected to analysis of coefficient of variance (CV) using randomized block design and statistical analysis of data was done following standard procedures (Snedecor and Cochran, 1967).

3. RESULT AND DISCUSSION

The detailed scrutiny of results presented in Table 1, revealed that highest yield 59.86 q/ha of dry root were recorded in control (T_1 -boiling of Satawar root in water at 100°C for 80 minute, followed by 55.68 q/ha of dry root under boiling of Satawar in 2% NaOH solution at 100°C for 35 minute (T_2), 51.88 q/ha of dry root under boiling of Satawar in 3% NaOH solution at 100°C for 18 minute (T_3), and lowest dry root yield 48.00 q/ha was observed in boiling of Satawar in 5% NaOH solution at 100°C for 10 minute (T_4). While comparing time required for boiling and physical appearance the best quality of well processed dry root yield 55.68 q/ha of Satawar recorded under in T_2 (boiling of Satawar in 2% NaOH solution at 100°C for 35 minute) at the same time it's also produces excellent appearance of dry root as golden colour and decreases the time of boiling roots upto 56.25% as compared to 80 minutes i.e. requires for boiling under control (normal water boiling). Peeling of satawar roots boiled in normal water was tough. In 3% of NaOH lye solution peeling time of asparagus roots decreases up to 77.5

% providing dry root yield 51.88 q ha⁻¹, but the quality and yield was poor as compared to T_2 . Maximum reduction of boiling time was observed in T_4 (5% NaOH) 87.5% with lowest dry root yield 48.00 q ha⁻¹, simultaneously poor quality as dry root look like and dark brown colour. Treating roots with lye solution is an important factor because if the solution applied for a long time or using highly concentrated solution, its action will take place deeply inside the flesh, and edible part of the roots will be lost (Aydin O. 2005). It was clearly observed that the concentration of NaOH were inversely proportion to time. Physical and peeling properties of T_2 were found to be impressive with excellent quality of roots, easy peeling and time saving (Fig. 1). Peeling of roots was not easy in 3% and 5% lye solution as if this solution made the roots very slippery. Physical appearance is also an important physical property for consumer acceptance of the peeled product (Burns J *et al.*, 2003). Very good peeling (peeled surface higher than 98%) was achieved in 2% NaOH lye solution have yellowish to golden colour, followed by T_3 having brown colour. Brown to dark brown spot color was observed in 5% lye solution. In over all boiling of Satawar in 2% NaOH solution at 100°C for 35 minute (T_2) as post harvest management process provided quality dry root yield 55.68 q/ha of Satawar and also its found economical as compared to other treatments.

4. CONCLUSIONS

The post harvest processing i.e. boiling of Satawar in 2% NaOH solution at 100°C for 35 minute provides excellent quality of dry root and reduces the boiling time up to 56.25% as compared to control (boiling in normal water) and dry root yield 55.68 quintal ha⁻¹. It can be said that chemical peeling provides the reduction of the labour cost. Depending on the temperature, concentration and treatment time, lye peeling process may be superior to other peeling processes, as it is effective and superior. Therefore, it recommended that boiling of Satawar

Table 1
Effect of different post harvest process on yield and quality of Satawar*

<i>Treatment</i>	<i>Peeling properties</i>	<i>Physical appearance</i>	<i>Dry root yield (q/ ha)*</i>	<i>Time saving (%) as compared to control</i>	<i>Overall quality</i>
T ₁	Tough	White to light yellowish colour	59.86	Check	Average
T ₂	Easy	Yellowish to golden colour	55.68	56.25	Excellent
T ₃	Very easy	Brown colour	51.88	77.5	Very good
T ₄	Very easy	Brown to dark brown spot	48.00	87.5	Below average
Coefficient of Variance			0.10	0.23	

T₁- Control (boiling of Satawar root in water at 100°C for 80 minute, T₂- Boiling of Satawar in 2% NaOH solution at 100°C for 35 minute, T₃- Boiling of Satawar in 3% NaOH solution at 100°C for 18 minute, T₄- Boiling of Satawar in 5% NaOH solution at 100°C for 10 minute

*On the basis of 350 quintal fresh root per ha



Post harvest and well processed Satawar (Boiling of Satawar root in water at 100°C for 80 minute)

Post harvest and well processed Satawar (Boiling of Satawar in 2% NaOH solution at 100°C for 35 minute)

Figure 1

in 2% NaOH solution at 100°C for 35 minute followed by peeling and drying is the best method for post harvest processing to obtain excellent quality and profitable higher yield.

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