

**Short Communication**

## **Perspicacity analysis for priority setting in processing and post-harvest sector of vegetables in India**

**Shubhadeep Roy\*, Neeraj Singh, RN Prasad, Shriprakash Singh and Jagdish Singh**

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The production of fruits and vegetables in India are growing at compounded annual rates of 5% and 6%, respectively over the past decade (Singh 2019). So far as its contribution to Indian economy is concerned, fruits and vegetables are grown only on 7–8% of gross cropped area but contribute more than 18.8% of the gross value of agricultural output and 52% export earnings from total agricultural produce (Singh 2019). Although, India is the second largest producer of vegetables and third largest producer of fruits with annual production of 141 and 80 million tones, respectively, it is estimated that 20–30 percent of horticultural crop such as fruits and vegetables perish due to lack of proper methods of processing and storing. The loss in monetary term is estimated to be about Rs.20 crores annually. It is also estimated that only 2% fruits and vegetables produced in our country is being processed (Singh 2019). However, the scenario of processing output of fruits and vegetables in many developing and developed countries are at a very higher proportion (Bartz and Brecht 2002; Sagar et al 2010). Wastage is estimated to be very high and value addition on an average in fruits and vegetable sector is only about 7%. Agro processing sector in India ranks fifth in the country in size and employs over 1.6 million workers (20% of nation's labour force). Horticulture could be diversified with increase in food processing sector, which would give a strong boost to rural income and major effects on employment generation throughout the country (Kader 1983, Kader 2002). However, the integrated efforts of handling of fresh harvested vegetables with good post-harvest management practices are confined to few big cities in India as large quantities of vegetables produced in our villages perish due to poor post-harvest management such as lack of washing,

grading, packaging and cold chain storage facilities. Vegetables after harvest spoil rapidly due to high moisture content as well as high respiratory activity during storage in room temperature. The shelf life extension of fresh vegetables is of greater importance in the present context for increasing nutritional and food security for growing population. There are few techniques like dehydration, hurdle technology, minimal processing, steeping preservation, bio-preservation of vegetables etc on which food technologists are working to reduce post-harvest losses and could be easily practiced at small scale value addition of vegetables or at households. But there are huge challenges and structural limitations for proper implementation of processing and post-harvest technologies in our resource scarce economy. Hence priority setting of the research and development agendas in post-harvest and processing sector is a must for easy identification of the problem and ease of implementation. Lots of gaps are there like insufficient cold chain management, lack of mechanised sorting or grading facility, non-availability of variety suitable for processing, complete value chain of vegetables which need to be answered for efficient and sustainable processing and post-harvest sector in India. On this background this study was planned to identify priority areas in processing and post-harvest sector particularly in vegetable crops.

The study was conducted through online survey. The survey questionnaire had been sent purposively to 50 scientists of ICAR institutes, 50 teachers of SAUs and 50 subject matter specialists of KVKs who deal with vegetable crops and post-harvest management, for their response. Among them 75 respondents replied from 22 different states representing different agro-climatic regions of India (Table 1). The questionnaire contained multiple choice type questions related to problems in post-harvest management in vegetable sector and the respondents were asked to score each problem in a five-

**Table 1:** Distribution of the respondents from different states of India

State	Number of respondents		
	ICAR institutes	SAU	KVK
Jammu and Kashmir	-	1	1
Himachal Pradesh	-	5	-
Punjab	-	1	-
Haryana	-	1	-
Rajasthan	-	2	1
New Delhi	1	-	-
Uttar Pradesh	15	-	1
West Bengal	2	4	1
Odisha	-	-	1
Chhattisgarh	-	-	1
Gujrat	1	7	2
Maharashtra	1	1	-
Andhra Pradesh	1	3	3
Karnataka	1	2	2
Kerala	-	1	1
Tamil Nadu	2	1	1
Goa	1	-	-
Assam	-	1	1
Arunachal Pradesh	-	-	1
Nagaland	-	-	1
Manipur	-	-	1
Andaman and Nicobar Island	1	-	-
Total	26	30	19

point continuum ranging most important (5), important (4), undecided (3), less important (2) and not important (1) as they perceived. The total score for each problem was obtained by summing the scores given by 75 respondents.

Weightage calculation: For obtaining weightages of each problem, 10 subject experts sampled randomly from the concerned fields were asked to score the problems in a three-point continuum ranging most urgent, urgent and less urgent and give a score of 3, 2 and 1 respectively. Those 10 Subject experts had not been selected as respondents in the study. The weightage for each problem was calculated with the following formula:

Weightage =

$$\frac{\text{Obtained score}}{(\text{Maximum possible score}) - (\text{Minimum possible score})}$$

Weighted sum was calculated by multiplying weightages of the individual problems with the total score obtained and the weighted average (WtAvg) was obtained by dividing the weighted sum with the total number (75) of respondents.

In India about 15–20 percent post-harvest losses in fruits and vegetables have been reported every year. Apart from quantitative loss, qualitative loss such as loss of calorific and nutritive value, loss of acceptability by the consumers and loss of edibility are more difficult to measure (FAO 1981). According to this study establishment of well-defined postharvest handling techniques for major vegetables should be given 1<sup>st</sup> priority (WtAvg = 6.26). As post-harvest handling techniques are not well defined, the quality of vegetables get deteriorated due to physical, chemical and microbial contamination during transportation, storage and marketing and was identified as 2<sup>nd</sup> priority issue (WtAvg = 5.56) to address. Development of new cultivars with better shelf life should be given 3<sup>rd</sup> priority (WtAvg = 5.25,) particularly for those vegetables which require distant marketing and have demand in processing industry. Vegetables which reach to processing industry must be free from pesticides and toxic chemical residues. Referral laboratories should be established where samples of such vegetables can be tested. It was identified 4<sup>th</sup> priority issue (WtAvg = 5.23) in this sector. Accordingly overcoming the socio-economic constraints, such as inadequacies of infrastructure, storage and poor marketing system should be taken care of and was identified as 5<sup>th</sup> priority issue (WtAvg =

**Table 2:** Percent distribution of the respondents categorized priority parameters from most important to not so important

Sl No		*5	4	3	2	1	WtAvg	Rank
1.	Post-harvest handling techniques for vegetables not well-defined	28	48	16	4	4	6.26	1
2.	Post-harvest loss in quality of vegetable due to physical, chemical and microbial contamination	42	39	12	7	0	5.56	2
3.	Non-availability of quality traits of vegetables suitable for processing	44	39	11	3	3	5.25	3
4.	Level of pesticide and toxic chemical residues in vegetables not known	48	33	11	5	3	5.23	4
5.	Storage conditions of vegetables with respect to temperature, relative humidity and packaging materials for maximum shelf life is not well defined	41	39	16	3	1	5.23	4
6.	Estimates of postharvest losses of vegetables not precise	52	41	5	1	1	4.99	5
7.	Maturity indices for different vegetables not well-defined	59	29	11	1	0	4.50	6
8.	Information on suitability of vegetable genotype for processing is not available	51	33	13	3	0	4.18	7
9.	Post-harvest losses of different vegetables are high	57	27	12	3	1	3.94	8
10.	Poor shelf life of vegetables	44	39	11	5	1	3.40	9

\*Most important (5), Important (4), Undecided (3), Less important (2) Not so important (1); WtAvg= Weighted Average

5.23) in this area. The other priority areas are non-precision in the estimates of post-harvest losses in vegetables (WtAvg = 4.99), maturity indices for different vegetables not well defined (WtAvg = 4.50), information on suitability of vegetable genotype for processing is not available (WtAvg = 4.18), poor shelf life of vegetables (WtAvg = 3.40).

Vegetable is a sunrise industry in India and processing sector is very important to economise the sector and make the vegetable production and marketing sustainable. Ten issues have been ranked accordingly for future intervention in vegetable processing and post-harvest management in India. Researchers, policy makers, marketing personnel and other stakeholders may work accordingly to address the issues. Resources of intervention should be allocated according to the priority rank came under the study.

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