Ind. Jn. of Agri. Econ.
Vol. 61, No. 1, Jan.-March 2006

An Economic Analysis of Post-Harvest Losses in Vegetables in Karnataka

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I

INTRODUCTION

Outputs of all agricultural commodities produced in the field have to undergo a series of operations such as threshing, transportation, processing, storage and exchange before they reach the consumer, and there are appreciable losses of outputs during these stages of their handling. The sum quantity of outputs lost in these operations at all of these stages is referred to as **"post harvest losses"**. The seriousness of the problem of post-harvest losses has been discussed at several meetings, conferences, symposia, etc., at national and international levels. Many studies have been conducted for estimating the post-harvest losses particularly in the developed countries. However, the importance of post-harvest losses in agricultural commodities is not fully recognised in developing countries where agricultural production is not fully linked with marketing. The number of scientists involved in production research in these countries is significantly higher than those concerned with post-harvest losses in agricultural commodities. It is distressing to note that so much time is being devoted to the culture of the plant, so much money is spent on irrigation, fertilisers and crop protection measures, but little attention is paid and resources devoted to the issues related with post-harvest losses resulting in failure to meet food requirement of the hungry millions. The wastage of agricultural commodities would mean not only monetary loss but also destabilisation of the economy and a decline in the nutritional standards that is already low in developing countries (FAO, 1980).

In perishable crops like fruits and vegetables, proper and scientific storage, packaging, transport and handling technologies are not adequate and hence, considerable amount of produce is wasted. The vegetable crops because of their moisture content are inherently more liable for deterioration in quality and quantity especially under tropical conditions. Moreover, they are biologically active and carry

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This paper is a part of M.Sc. (Agri. Economics) Thesis submitted by the first author under the guidance of second author to the University of Agricultural Sciences, Dharwad for the award of Master Degree in Agricultural Economics.

The authors are thankful to the anonymous referee for critical comments and suggestions.

out transpiration, respiration, ripening and other biochemical activities, which contribute for deterioration in quality of the produce. Post-harvest losses in vegetables during post-harvest operations due to improper handling and storage are enormous. Gauraha (1997) reported that the post-harvest loss in vegetables ranges from 5.42 per cent in the case of bottle gourd to 32.64 per cent in the case of tomato. Post-harvest losses can occur in the field, in packing areas, in storage, during transportation and in the wholesale and retail markets. Severe losses occur because of poor facilities, lack of know-how, poor management and improper market facilities or due to careless handling of the produce by farmers, market intermediaries and consumers. It is, therefore, important that the post-harvest practices be given as much attention as production practices.

The study on post-harvest losses in vegetables at various stages of handling would help in assessing the extent and magnitude of losses and in identifying the factors responsible for such losses. This in turn would help in developing proper measures to reduce post-harvest losses at different stages from production point to consumption point. Under the circumstances, the reduction in post-harvest losses can help in increasing the availability of vegetables to a great extent without increasing the production. In the absence of reliable and objective estimates of post-harvest losses at different stages, the ways to evolve correct policies for minimising such losses is more difficult. Very few studies have attempted to assess the extent of post-harvest losses in horticultural crops. The present study attempts to estimate the post-harvest losses of major vegetable crops in Karnataka. The information on the extent of losses at various stages is important not only for scientists and technologists but it would also be useful to policy makers, administrators and industrialists. The scientists and technologists would be guided by the findings of such studies in carrying out improvements in the crop production and post-harvest technologies aimed at minimising these losses. The planners and the policy makers would be guided by the findings of such studies in formulating suitable policies that will help in reducing the post-harvest losses. The specific objectives of the study are: (1) To measure the extent of post-harvest losses in the selected vegetables at different stages and (2) To study the factors affecting post-harvest losses at the farm level.

II

METHLODOLOGY

The present study aims at estimation of post-harvest losses in vegetables in Karnataka, as the State with a total vegetable production of 4.95 million tonnes is the sixth largest producer of vegetables after states like West Bengal, Uttar Pradesh, Orissa, Bihar and Tamil Nadu. The Karnataka state has ten agro-climatic zones suitable for growing a variety of vegetables all round the year. The area under vegetable crops in the state increased from 2.61 lakh ha in 1993-94 to 3.77 lakh ha in 2000-01. Dharwad, Belgaum, Kolar, Hassan, Chitradurga, Haveri, Bijapur and

Bangalore (R) are the major districts growing vegetable crops in the state. The important vegetables grown in these districts are onion, potato, tomato, brinjal, gourd varieties and cole crops.

The study utilised both secondary and primary data. To study the growth rates in area, production and productivity, district-wise time series data on area, production and productivity of selected vegetables were collected for the period from 1982-83 to 2001-02 from the Directorate of Economics and Statistics and the District Horticulture Offices. The necessary primary data were obtained from the sample potato and onion cultivators and various market intermediaries through personal interview with the help of pre-tested and structured schedules. The data so collected pertained to the agricultural year 2003-04. The data collected from the sample farmer respondents included general information about the potato and onion cultivation, method of harvesting, method of drying, place of drying, mode of packing, storage system, mode of transportation and the quantity of produce lost during post-harvest operations. A separate schedule was used for eliciting information from market intermediaries. The schedule included information on quantity purchased, mode of transport and storage, mode of purchase and quantity marketed. The method of personal interview was adopted to ensure that the data made available by the sample respondents were relevant, comprehensive, reasonably correct and precise.

Based on the triennium (1998-99 to 2000-01) the average area under vegetable crops grown in Karnataka, two major vegetables namely, onion and potato have been selected for the study. During the triennium ending 2000-01, onion was grown on an area of 1,06,307 ha, while potato occupied an area of 42,210 ha in the state. The proportion of area occupied by onion and potato are 31.05 per cent and 12.33 per cent in the total vegetable area of the state. Thus, these two vegetables put together accounted for 43.38 per cent of the vegetable area in the state. Keeping in view the objectives of the study, a multi-stage sampling design has been adopted for the selection of vegetable growing farmers. Dharwad district with an onion area of 30,759 ha (28.93 per cent), out of a total onion area of 1,06,307 ha in the state topped the list of onion growing districts and Chitradurga district with an area of 16,542 ha (15.56 per cent) stood second. These two districts put together covered little above 44 per cent of onion area in the state. Hence, these two districts were selected for onion in the preliminary stage of sampling. With respect to potato, Hassan district with an area of 16,081 ha (38.10 per cent) and Belgaum district with an area of 8,131 ha (19.26 per cent) stood first and second in the state respectively, the proportion of potato area covered by these two districts put together works out to 57.36 per cent. Hence, these two districts were considered for potato in the first stage of sampling. In the second stage using the same criterion of area dominance two taluks were chosen from each of the selected districts. Hubli and Navalgund taluks in Dharwad district and Chitradurga and Holalkere taluks in Chitradurga district for onion crop and Hassan and Belur taluks in Hassan district and Belgaum and Bailhongal taluks in Belgaum district for potato crop were thus selected. At the third stage, three villages

predominantly growing the selected vegetables were chosen from each of the selected taluks. At the fourth and final stages, five vegetable growing farmers in each village were randomly interviewed. In all, 60 farmers for each crop were selected at the rate of 30 farmers from each district. From each of the selected districts five wholesalers and five retailers dealing with each of these crops making a sample of 10 wholesalers and 10 retailers were also interviewed for eliciting the required information on post-harvest losses.

Analytical Techniques

For computing the growth in area, production and productivity of selected vegetables in Karnataka state, the exponential compound growth equation [$Y=ab^T$] was estimated. In most of the cases, tabular presentation was used to present the data. Averages and percentages were used to estimate post-harvest losses.

Functional analysis was carried out to examine the factors affecting post-harvest losses at farm level in vegetables. Post-harvest losses at farm level were defined as a function of several socio-economic factors like age of the farmer, his education, type of family, total production of selected vegetable crops etc. Nag *et al.* (2000) used a similar type of functional analysis to assess the influence of socio-economic factors on post-harvest losses in chickpea. The following multiple linear regression function was specified in the present study.

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + \ldots + a_8X_8 + e$$

Where,

Y : Post-harvest loss at farm level in quintals per hectare,

X_1: Age of the respondents in years,

X_2: Education of the respondents in years,

X_3: Production of onion/potato in quintals per ha,

X_4: Type of family dummy [value '0' for joint family and '1' for nuclear family],

X_5: Weather condition dummy [value '1' for adverse and '0' otherwise],

X_6: Labour availability dummy [value '1' for inadequate and '0' otherwise],

X_7: Storage availability dummy [value '1' for inadequate and '0' otherwise],

X_8: Transportation availability dummy [value '1' for inadequate and '0' otherwise],

e : Random error.

The interest in the functional analysis was to see the influence of various socio-economic features of the farmers on post-harvest losses at farm level. The post-harvest losses [dependent variable] at the farm level were measured in terms of

quintals of output lost per hectare. Age of the farmers was considered as one of the independent variables influencing the post-harvest losses at the farm level. It is assumed that as the age of the farmer increases his experience in post-harvest handling also increases and in turn helps to reduce post-harvest losses. There, it is hypothesised that age has a negative effect on post-harvest losses. Age of the farmer is measured in terms of the number of years. The level of education is another variable that can exert influence on post-harvest losses. The educated farmers would be in a better position to have access to the knowledge of post-harvest operations. Therefore a negative association between this variable and the dependent variable was hypothesised in the study. The number of years of formal education of the farmer was included as a variable in the model.

The quantity of output produced per hectare is likely to exert a positive influence on post-harvest losses. It is hypothesised that a farmer is not likely to pay full attention for post-harvest operations when large quantity of output is produced. In such cases his managerial skills might become a limiting factor and lead to higher post-harvest losses. The production is measured in terms of quantity of output produced per ha. The type of family is another variable likely to influence post harvest loss at farm level. Higher the involvement of family members in farm operations, lower would be the post-harvest loss. However, the information on the actual number of family members involved in the farm operations was not collected. Therefore, it is thought of studying the influence of this variable on dependent variable by including this as a dummy variable. The information on type of family, namely, nuclear family or joint family was used. Value '0' was assigned to joint family and value '1' for nuclear family. Therefore, the type of family dummy was hypothesised to have negative association with post-harvest loss. It is assumed that the involvement of family members in post-harvest operations is more in joint families.

The weather conditions prevailing at the time of post-harvest operations is another variable likely to influence post-harvest losses and thus was included in the model. In view of the lack of exact weather data, it was decided to include this variable as dummy variable to capture the farmers' perception regarding weather conditions at the time of harvest. The dummy variable was assigned the value '1' if the farmer felt that the weather conditions at the time of harvesting were adverse [not favourable]. This variable is expected to have positive coefficient implying lower level of post-harvest losses during favourable weather conditions. Availability of labour at the time of harvesting is one of the variables, which is likely to influence the extent of post-harvest losses. The labour availability was considered to be adequate if the farmer felt that he could avail of the required number of man-hours at the required time to carry out harvesting operations. The adequacy of labour availability was measured in terms of dummy variable, which took the value '1' if the farmer felt that labour availability for harvesting was inadequate. Therefore, this variable is expected to have a positive association with post-harvesting losses.

The storage facility available at the farm level is expected to influence the post-harvest losses at the farm level. The storage availability was assumed to be adequate if the farmer has no problem in storing his farm produce. The adequacy of storage was represented by a dummy variable. Value '1' was assigned to the dummy variable if the farmer had inadequate storage facility. Therefore, this variable is hypothesised to have a positive association with post-harvest losses. Often, it is reported that faulty methods of transporting farm produce lead to higher post-harvest losses. To examine the influence of transportation facility on post-harvest losses, a dummy variable was included among explanatory variables, which took the value '1' if the farmer had inadequate transportation facilities. The transportation was considered to be adequate if the farmer had no problem with respect to roads or the means of transportation. This variable is expected to have a positive association with post-harvest losses.

To isolate the most important socio-economic factors conditioning the post-harvest losses, step-wise regression was carried out. This facilitated to retain only those factors, which significantly influenced the post-harvest losses in the regression model. The results of the study are presented and discussed in the following sections.

III

GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF ONION AND POTATO

Onion with an area of 1,24,824 ha and potato with an area of 44,864 ha in 2001, are the two major vegetables grown in Karnataka. These two crops together accounted for 43.38 per cent of the vegetable area in the state. Dharwad and Chitradurg districts put together shared around 45 per cent of the state onion area. Hassan and Belgaum districts are the major potato growing districts in the state, which together shared about 57 per cent potato area. To know the temporal production pattern of these vegetables, it was thought of analysing the growth in area, production and productivity of these crops in the study districts and in the state. The area under onion in Dharwad district registered a significant positive annual growth of 10.27 per cent (Table 1) and the production increased at a rate of 12.16 per cent annually. However, the productivity witnessed a mild annual growth of 1.72 per cent. At the state level, the area and production showed a high positive significant growth rate of 6.59 and 6.36 per cent respectively, whereas the growth in productivity was found to be negative (-0.05 per cent) and non-significant. This implied that the increased onion output in the state has mainly come from the increased area under its cultivation. The increased demand for onion coupled with better onion prices in the recent years might have encouraged the farmers to allocate more area to onion. In Chitradurga district, growth in onion area was positive (0.89 per cent), but insignificant, the effect of which could be seen on the production in the district. The onion output in the district grew at a moderate rate of 1.13 per cent and it was not significant. Thus, the area and production of onion is almost stagnant in Chitradurga district. The growth in yield in general was found to be positive but insignificant at

the district level and negative at the state level indicating the scope for improving the productivity of onion.

TABLE 1. COMPOUND GROWTH RATES OF AREA, PRODUCTION AND PRODUCTIVITY OF ONION AND POTATO

(per cent per annum)

		Onion			Potato		
No.	Particulars	Dharwad	Chitradurga	Karnataka	Hassan	Belgaum	Karnataka
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Area	10.27**	0.89^{NS}	6.59**	5.80**	3.05**	4.06**
2.	Production	12.16**	1.13^{NS}	6.36**	7.88**	5.91**	6.87**
3.	Productivity	1.72^{NS}	0.24^{NS}	-0.05^{NS}	2.11*	2.92*	2.77**

Note: NS = Non-significant.
** and * Significant at 1 and 5 per cent level, respectively.

The area under potato in Hassan district expanded annually by 5.80 per cent while the production increased at a rate of 7.88 per cent annually. However, the productivity witnessed a slow increasing growth of 2.11 per cent every year. The compound growth rates for area (3.05 per cent), production (5.91 per cent) and productivity (2.92 per cent) in Belgaum district were significant and positive. At the state level, similar trends were observed with respect to area (4.06 per cent), production (6.87 per cent) and productivity (2.77 per cent). The increasing growth in area, production and productivity of potato in the study districts and at the state level might be due to semi-perishable nature of potato, shift in area from other crops to potato, wider markets, use of high-yielding varieties by the farmers in the study area and adoption of improved cultivation practices.

IV

ESTIMATED POST-HARVEST LOSSES IN ONION AND POTATO

The post-harvest losses in the selected vegetables has been assessed and presented here. Information elicited from a random sample of 60 onion growers and 60 potato growers, 10 wholesalers and 10 retailers dealing with each of these crops was the basis for estimation of post-harvest losses in these crops at different stages. The average size of holding of the sample respondents was found to be 8.88 ha for onion growers, while it was 3.60 ha for potato growers. The sample farmers were found to grow onion over an area of 2.55 ha while the potato sample farmers devoted 1.57 ha for potato cultivation. The sample farmers obtained an average yield of 46.40 qtl/ha of onion and 49.60 qtl/ha of potato. Majority of the onion growers (53.33 per cent) and potato growers (48.33 per cent) belonged to middle age group of 35 to 50 years. The proportion of illiterate farmers in the sample was 16.67 per cent for onion cultivators and 21.67 per cent for potato cultivators. Less than 27 per cent of onion and potato growers belonged to joint family. The estimated post-harvest losses in onion and potato on per quintal of output at different stages are presented in Table 2.

TABLE 2. POST-HARVEST LOSSES IN ONION AND POTATO AT DIFFERENT STAGES

No. (1)	Different stages (2)	Onion		Potato	
		Loss in kg/qtl (3)	Per cent loss (4)	Loss in kg/qtl (5)	Per cent loss (6)
I.	*Farm level losses due to*				
1.	Harvesting injuries	0.23	2.21	0.19	1.46
2.	Drying	0.95	9.12	1.06	8.17
3.	De-topping	0.50	4.80	-	-
4.	Packing	0.12	1.15	0.15	1.16
5.	Storage	3.02	28.98	4.28	33.00
6.	Transportation	1.22	11.71	1.48	11.41
7.	Marketing	0.17	1.63	0.18	1.39
	Loss at farm level	6.21	59.60	7.34	56.59
II.	*Wholesaler level losses due to*				
1.	Storage	0.55	5.28	0.70	5.40
2.	Transit	1.30	12.47	1.52	11.72
	Loss at wholesaler level	1.85	17.75	2.22	17.12
III.	*Retailer level losses due to*				
1.	Transit and storage	0.88	8.45	0.97	7.48
2.	Bad weather and foreign matter content	0.76	7.29	1.23	9.48
3.	Spoilage and multiple handling	0.72	6.91	1.21	9.33
	Loss at retailer level	2.36	22.65	3.41	26.29
	Total loss	10.42	100.00	12.97	100.00

Post-Harvest Losses at Farm Level

The post-harvest loss in the selected vegetables was assessed at farm level first and then it was worked out on per hectare basis and finally it was estimated on per quintal of output produced. The post-harvest loss in onion and potato at the field level was estimated to be 6.21 kg/qtl and 7.34 kg/qtl respectively. The resultant loss at farm level were due to injury at the time of harvesting, drying de-topping (only for onion), faulty storage and transportation and improper handling of the produce at the time of marketing. Among these, loss due to faulty storage was the highest (3.02 kg/qtl in onion and 4.28 kg/qtl in potato) in both these crops followed by improper transportation, which resulted in a loss of 1.22 kg/qtl of onion and 1.48 kg/qtl of potato. This loss due to faulty storage appeared to be rather high because most of the respondents stored the produce for more than 15 days by adopting traditional on-farm heap method of storage. This facilitated heat accumulation within the stored produce and led to spoilage. Microorganisms attack fresh produce easily and spread quickly because, the produce does not have much of a natural defense mechanism and has plenty of nutrients and moisture to support microbial growth. Owing to the tender texture and high moisture content, fresh onion and potato are susceptible to sprouting, rottenness and spoilage during storage. Various types of storage losses observed in onion were decay caused by fungi and bacteria, sprouting, discoloration, shrinkage,

de-scaling and rooting. The survey by the National Horticultural Research and Development Foundation revealed that decay and sprouting in onion caused loss to the extent of 5.43 to 35.28 per cent. The study by Atibudhi (1997) revealed that the total post-harvest at farm level in onion was 13.75 per cent of the total output produced. The components of losses in this study were weight loss (8.71 per cent), spoilage loss (4.29 per cent) and sprouting loss (0.75 per cent).

The produce was transported from field to home in bullock carts or in tractors without properly packing the produce. The crude packaging while moving the produce from home to market also contributed to the loss of produce. The drying loss was 0.95 kg/qtl in onion and 1.06 kg/qtl in potato. Secondary cause of loss during drying in potato was greening which is caused due to excessive exposure of potato sacks to sunlight. The loss of output due to faulty de-topping in onion resulted in a loss of 0.50 kg/qtl because of improper cutting of the top. Generally women labourers were used for de-topping. The losses due to injuries at the time of harvest in onion and potato resulted in a loss of 0.23 kg/qtl and 0.19 kg/qtl respectively. Further, in addition to injuries at the time of harvesting some produce is left in the field and this also contributed to the loss. In some cases machines that were used to harvest the crop caused damages to some of the produce. Improper packaging and rough handling of the produce during marketing resulted in post-harvest losses and these losses were estimated to be respectively 0.12 kg/qtl and 0.17 kg/qtl for onion and 0.15 kg/qtl and 0.18 kg/qtl for potato. The average per farm post-harvest loss was estimated at 7.33 quintals for onion and 5.27 quintals for potato. The average loss per hectare worked out to be 2.87 quintals and 3.65 quintals for onion and potato respectively. The per farm total post-harvest loss in chickpea (Nag *et al*., 2000) was observed to be 6.97 per cent of which maximum loss occurred during winnowing (33.71 per cent) followed by threshing (31.70 per cent) and storage (21.95 per cent).

Post-Harvest Losses at Wholesaler and Retailer Level

Total quantity of onion and potato handled per season by each wholesaler was 455 quintals and 785 quintals respectively. The total post-harvest loss at wholesaler level was 1.85 kg/qtl in onion and 2.22 kg/qtl in potato. The storage loss in onion and potato at the wholesaler level was 0.55 kg/qtl and 0.70 kg/qtl. The other component of loss at this stage was transit loss that resulted in a loss of 1.30 kg/qtl in onion and 1.52 kg/qtl in potato. Transportation loss in both the crops was slightly more because of the use of unsuitable transport containers, negligent driving and rough roads. The crude packing method coupled with long distance travel facilitated the accumulation of heat within the lots and led to spoilage. Part of the loss was also due to loss of moisture during sales period, which mostly depended on the moisture content of the produce and temperature.

On an average a retailer handled 125.85 quintals of onion and 79.50 quintals of potato in a year. The post-harvest loss at the retail level was 2.36 kg/qtl for onion and 3.41 kg/qtl for potato. The transit and storage loss was 0.88 kg/qtl in onion and 0.97

kg/qtl in potato. The loss due to spoilage and multiple handling of produce during retailing was 0.72 kg/qtl in onion and 1.21 kg/qtl in potato. The post-harvest loss at the retailer level due to bad weather and foreign matter content was 0.76 kg/qtl in onion and 1.23 kg/qtl in potato.

Total Post-Harvest Loss in Onion and Potato

The post-harvest loss occurring at field and market was added up to 10.42 kg/qtl in onion and 12.97 kg/qtl in potato. Maximum post-harvest loss was observed at the farm level (6.21 kg/qtl in onion and 7.34 kg/qtl in potato) accounting for 59.60 per cent and 56.59 per cent of the total post-harvest loss respectively. This was understandable in the sense that the tender texture and high moisture content of vegetables led to deterioration of quality in both the vegetables and in turn the quantity loss occurred at different post-harvest stages like drying, storage, packing and transportation at field level. Further 1.85 kg/qtl and 2.22 kg/qtl of the output losses were observed at the wholesale level in onion and potato, respectively, accounting for 17.75 per cent and 17.12 per cent. The loss at retail level was to the tune of 2.36 kg/qtl (22.65 per cent) and 3.41 kg/qtl (26.29 per cent) in onion and potato, respectively. Generally, the retailer in the process of marketing retained the produce for a longer period than that of the wholesaler. As a result the post-harvest loss at the retail level was relatively more as compared to that at the wholesale level. Hence, proper storage arrangements at retail level are needed.

The per hectare post-harvest loss at the farm level was estimated to be 2.88 qtl in the case of onion and 3.64 qtl in the case of potato. The average yield for the sample farmers was 46.40 qtl/ha in the case of onion and 49.60 qtl/ha in the case of potato. This means that farmers in the process of post-harvest operations lost about 6.21 per cent of onion and about 7.34 per cent of the potato output produced by the farmers. The average per farm onion and potato output was 118.32 quintals and 77.87 quintals respectively. The per farm post-harvest loss was estimated to be 7.34 quintals in the case of onion and 5.72 quintals in the case of potato. The post-harvest loss at farm level for the sample districts put together works out to be 15,924 tonnes of onion and 4,702 tonnes of potato. Further the post-harvest loss at the farm level for the state as a whole works out to be 35,824 tonnes of onion and 16,086 tonnes of potato. The post-harvest losses in both the crops would be higher by about 40 per cent if the post-harvest at the market level were added to the above values.

V

FACTORS AFFECTING POST-HARVEST LOSSES AT FARM LEVEL

In order to study the influence of different socio-economic features of the farmers on post-harvest losses at the farm level, a multiple linear regression analysis was carried out. It was hypothesised that the factors like age, education and family type have negative effect on post-harvest losses while factors like adverse weather,

inadequate labour, inadequate storage and inadequate transportation have positive effect on post-harvest losses. The estimated regression coefficients are presented in Table 3. The variation in the eight independent variables included in the regression model explained nearly 68 per cent variation in the total post-harvest losses in onion and 81 per cent in the case of potato. The F-ratio was significant in both the crops thereby indicating the good fit of the regression models. The regression coefficients of all the variables except the age were positive in the regression function for onion. Thus the coefficients for six out of nine variables included in the model were in conformity with the postulated hypotheses. The post-harvest losses were positively and significantly conditioned by onion output per hectare, adverse weather, inadequate storage and inadequate transportation as revealed by the step down regression analysis. The post-harvest losses in onion increased with an increase in onion output per hectare. Factors such as favourable weather conditions, adequate storage facilities and adequate transportation facilities would thus help in minimising the onion post-harvest losses. The study by Nag *et al.* (2000) reported that an improvement in storage would decrease the post-harvest losses in chickpea.

TABLE 3. REGRESSION ESTIMATES OF FACTORS AFFECTING POST HARVEST LOSSES AT FARM LEVEL

		Onion		Potato	
No.	Explanatory variables	All	Step down	All	Step down
(1)	(2)	(3)	(4)	(5)	(6)
1.	Intercept	0.0437	0.1920	-0.6850	-0.8170
		(0.558)	(0.299)	(0.834)	(0.327)
2.	Age of the respondents (X_1)	-0.0013		0.0075	
		(0.009)		(0.011)	
3.	Education of the respondents (X_2)	0.0158		0.0128	
		(0.021)		(0.023)	
4.	Production of output per hectare (X_3)	0.0233*	0.0248*	0.0516*	0.0515*
		(0.004)	(0.004)	(0.006)	(0.005)
5.	Type of family dummy (X_4)	0.3020		-0.3380	
		(0.183)		(0.234)	
6.	Weather dummy (X_5)	0.4370**	0.5030*	1.3230*	1.3410*
		(0.193)	(0.186)	(0.252)	(0.248)
7.	Labour dummy (X_6)	0.1000		-0.2240	
		(0.178)		(0.260)	
8.	Storage dummy (X_7)	0.7470*	0.8110*	0.8530*	0.7670*
		(0.189)	(0.182)	(0.310)	(0.299)
9.	Transportation dummy (X_8)	0.5580*	0.6050*	-0.1940	
		(0.187)	(0.182)	(0.365)	
10.	R^2	0.68	0.64	0.81	0.80
11.	F-value	12.78*	24.15	27.01*	72.27*
12.	R^{-2}	0.62	0.61	0.78	0.78

Note: Figures in parentheses indicate standard errors of coefficients.
* and ** Significant at 5 and 1 per cent level, respectively.

In the case of potato, contrary to the hypotheses, the coefficients of labour and transportation dummies were negative and the coefficients of age and education of

the respondents were positive. Thus in four out of eight variables the estimated regression coefficients did not support the hypothesised relationship between the dependent variable and the independent variables. However, in none of these four contradicting cases, the regression coefficients were significant. The step down regression analysis showed that the post-harvest losses in potato were significantly and positively associated with potato output per hectare. The post-harvest losses in potato were positively and significantly conditioned by adverse weather, and inadequate storage. Thus, favourable weather conditions and adequate storage facilities would help minimising the potato post-harvest losses. The post-harvest losses in both the crops were found to increase with an increase in output per hectare. This might be due to the fact that the farmers might not be in a position to give full attention and care for post-harvest operations when a large quantity of output was produced. It was observed that most of the respondents stored the produce for a period more than 15 days by adopting traditional on farm heap method of storage. This resulted in heat accumulation within the stored produce and led to spoilage. Owing to the tender texture and high moisture content, fresh onion and potato are susceptible to sprouting, rottenness and spoilage during storage. Therefore the post-harvest losses in vegetables could be minimised through proper storage.

VI

CONCLUSIONS AND POLICY IMPLICATIONS

The post-harvest losses occur due to faulty methods of harvesting, threshing, cleaning, drying, storage, transportation, processing, packaging and distribution of agricultural commodities. The present study attempted to estimate post-harvest losses in two major vegetables grown in Karnataka. The total post-harvest loss in onion and potato at the field level was estimated to be respectively 6.21 kg/qtl and 7.34 kg/qtl. Further 1.85 kg/qtl and 2.22 kg/qtl of the output losses were observed at the wholesale level in onion and potato, respectively, accounting for 17.75 per cent and 17.12 per cent. The loss at the retail level was to the tune of 2.36 kg/qtl (22.65 per cent) and 3.41 kg/qtl (26.29 per cent) in onion and potato, respectively. Thus, about 60 per cent of total post-harvest losses occur at the farm level and about 25 per cent losses are observed at retailing level. The per hectare post-harvest loss at the farm level was assessed to be 2.88 qtl in the case of onion and 3.64 qtl in the case of potato. The per farm post-harvest loss was assessed to be 7.34 quintals in the case of onion and 5.72 quintals in the case of potato. The storage loss at different stages added up to about 38 per cent of the total loss while on farm harvest operations accounted for about 17 per cent of total losses. Transit loss was another important component of post-harvest loss contributing about 25 per cent of the total loss. The functional analysis revealed that inadequate storage and inadequate transportation activities coupled with bad weather conditions positively and significantly influenced the post-harvest losses at the farm level. The establishment of small sized cold

storage units in the production centres would help in reducing the storage losses in vegetables. In this direction the zero energy cool chambers technology developed by the Indian Council of Agricultural Research needs to be popularised.

Received December 2004. *Revision accepted March 2006.*

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