Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; Sp 9(4): 76-80
Received: 07-05-2020
Accepted: 09-06-2020

Alok Kumar
Faculty of Agricultural Sciences, Jharkhand Rai University, Namkum, Ranchi, Jharkhand, India

Rahul Jain
Department of Extension education, SHUATS Allahabad Utter Pradesh, India

Dhananjay Kumar
Faculty of Agriculture sciences, Jharkhand Rai University, Namkum, Ranchi, Jharkhand, India

Corresponding Author:
Alok Kumar
Faculty of Agricultural Sciences, Jharkhand Rai University, Namkum, Ranchi, Jharkhand, India

Evaluation of storage strategies of grains perceived by farmers of Bihta block in Bihar

Alok Kumar, Rahul Jain and Dhananjay Kumar

Abstract
Study on valuation of grain storage methods adopted by farmers was carried out during the year 2013-2014. For this study sixty farmers adopted improved method of storage and sixty farmers adopted traditional method of grain storage designed the sample. The data was elicited through the personal interview method using pre-tested schedule. The study revealed that the socio-economic status of the respondents was medium level. Pucca koti was most preferred method by farmers adopting improved method and farmers adopting traditional method with first rank. The study also reported that cereals and pulses were threshed by machines, whereas oil crops by manually. Grain loss was maximum when grains were transported by manually than the bullock cart and tractor. Over 47 per cent of maize and mustard growers used gunny bags for storage. Higher per cent (46.00%) paddy growers used Pucca koti for storage of grains. Highest loss (20.90%) was observed in case of fertilizer bag of paddy crop, while in case of gunny bags and earthen pot, the loss was about 7.38% and 7.71%. Minimum loss of grains was observed in metal bin (5.98%). Farmers reported that pre-storage loss during drying and cleaning was higher than the loss during the storage. By applying Chi-square ($\chi 2$) test the association between independent variables and knowledge of the respondents results implied that Age ($\chi 2 = 0.223$), Education ($\chi 2 = 1.845$), and Farm size ($\chi 2 = 0.541$) Annual Income ($\chi 2 = 1.612$), Social participation ($\chi 2 = 9.24$), and Mass Media Exposure ($\chi 2 = 7.226$) have significant association with the knowledge level of respondents. The average storage cost per quintal per year was highest (Rs. 21) in gunny bags and lowest (Rs. 11) in case of metal bin.

Keywords: Storage methods, preferences, problems, storage losses, post-harvest losses

Introduction
Agriculture is the backbone of Indian economy and also one of the strong holds of Indian economy and it contributes 13.7% of the country's gross domestic product in 2012-13, according to the Central Statistical Organization's (CSO) estimates. As a result of strategic approach followed after independence, the food grain production, which remained at 51 million tonnes in 1951, has impressively gone up to 255.60 million tonnes in 2012-2013; it was more in last year.

The per capita availability of food grains, which remained less than 500gm/day in the past, has reached beyond 500 g/day in recent peak production years. It is evident that food grain production growth and is competitive with the population growth in the country. The current buffer stock of food grains oscillates around 53 million tonnes. However, new problems such as widening gap in demand and supply in pulses and oilseeds, stagnancy in the productivity of wheat and rice in major producing states, the ever increasing population growth and the liberalized trade of agricultural commodities have posed greater challenges to food and nutrition security of Indian population.

The post-harvest losses of food grains and oilseeds are estimated to be 10 to 20% while that of different horticultural crops vary from 15 to 50% (Chahal, 2011) [11] in developing countries including India. The bulk of these losses occur during storage for most of the commodities. The storage losses are due to biotic factors such as rodents, insect's, pests and microbiological factors such as fungi and bacteria. Chemical factors resulting in loss of colour, flavour, texture and its nutrient value and most importantly a biotic or mechanical factors due to faulty storage structures.

India is experiencing massive losses of food grains in storage. In 2012, as per official reports, loss of 11,700 tonnes of food grains was reported to have occurred in the government godowns. In a surplus producing state like Punjab alone, out of procurement during 2008-09 and 2009-10, loss of 48,000 tonnes wheat was reported to have rotten, the stock which is enough to feed around five lakh people for a year (Chagall, 2011). The actual food grain losses were however estimated much higher than the official figures in many reports. About 21-22 million tonnes of food grains per annum are lost at the present level of production in India,

which values to 33-35 thousand crore rupees. In addition, about 10 percent loss of oilseeds on similar line amounts to 3 million tonnes which in monetary terms amounts to 6 thousand crore rupees.

At farmer's level about 10% of the grain that reaches the consumers, after hard labour of farmers and use of scarce capital resources, is lost due to faulty and unhygienic storage conditions. The farmers either store the grains in bags, which are costly and not rodent proof, or in rooms in open heaps or underground stores. Some farmers store the grains in storage structures like metal bins, wooden bins and cement bins. However, they store the grains without giving due importance to air tightness of the structure and other sanitation aspects. The farmers store their produce for own consumption, for sale at some later date or for seed purposes. There is a need to develop cost effective and user friendly mode of storage technologies and transfer it to farmers for skilful storage to avoid quantitative and qualitative losses during storage.

Improved storage structures play a major role in minimizing the losses in post-harvest stages. The traditional storage structures, which the farmers use, do not give adequate protection against the various factors responsible for spoilage of food grains.

Efforts have been made to develop suitable methods of grain storage and educate the farmers on post-harvest management. The department of food and public distribution launched countrywide programme, called save grain campaign. The main objectives of the save grain campaign was to create awareness of grain storage management and popularize improved methods like Pucca koti and metal bins. These programmes are carried out by 17 offices located in different parts of the country in collaboration with the developmental departments of respective states. Demonstrations were carried out on various improved techniques of storage and preservation to impart skills to farmers and traders to show the effectiveness of the recommended techniques. The extension activities to educate farmers on identification of damages, disinfection of food grains, rat control measures in houses, rat burrow fumigation, rat proofing of storage places, moisture proofing techniques, improvement of existing storage structures and use of metal bin and non-metal bins were conducted under this programme. The non-metal bins include Reinforced Cement Concrete (RCC) ring bins, reinforced brick bins, training courses with special emphasis on farm level storage to the lower level functionaries of the state Governments and representatives of farm and trade communities were also organized. Food Corporation of India (FCI) and Central Warehouse Cooperative (CWC) conduct in–service training courses to their employees. Central Food Technological Research Institute (CFTRI) conducts specialized training programmes on pest control techniques and pesticide residue analysis. Recently, Canadian International Development Agency (CIDA) funded project on "Consolidation of food security in south India, was implemented in selected areas of south India. The project had adopted cluster of villages to educate farmers on post-harvest management.

The Food and Agriculture organization (FAO) estimates that global food production need to increase more than 40% by 2030 and 70% by 2050 compared to average 2005-07. Clearly, a large part of the consumption will occur in India and China. This would require an additional 1.6 billion hectares of land to be brought in to cultivation compared to the current 1.4 billion hectares being cultivated now. There is little scope for bringing more area under cultivation, which means clearly that we need to produce more from the available land, and minimize post-harvest losses. This signifies the importance of grain storage to reduce losses. Reduction in loss of the grains increases the income level of the farmers as well. With increasing food grain requirement to the growing population of India, adoption of improved storage methods to reduce the losses would contribute to the food security. However farmers have been adopted traditional method for storage of grains of different crops.

The efforts made till now have resulted in motivating the famers to adopt storage Practices however the programme has been well taken up only in certain areas in the country and intensified efforts are also needed in other areas. Though several studies have been conducted on post-harvest management and grain losses during storage, no systematic attempt have been made to evaluate grain storage methods adopted by the farmers, management practices and grain losses. Hence it was felt necessary to evaluate the different storage methods adopted by farmers and grain losses during storage. In this background, the study was conducted view of the following: Extent of post-harvest losses after harvesting of crop, Extent of post-harvest losses during transportation of crop, Method of storage of food grains by farmers, Extent of perceived loss of grains in different methods of storage, Preferences and reasons for storage methods, Problems faced by farmers during storage of food grains

Table 1: Explain losses after harvesting of crop.

S. No.	Food grains	Immediately after harvest		% of loss q/kg	Not immediately after harvest		% of Loss q/kg
		F	%		F	%	
1	Paddy	91	75.83	0.49	29	24.16	1.12
2	Maize	87	72.50	0.89	33	27.50	01.33
3	Wheat	96	80.00	0.61	24	20.00	1.20
4	Lentil	54	45.00	0.46	66	55.00	01.22
5	Mustard	59	49.16	0.48	61	50.83	01.99

The above table shows that maximum losses 1.99 in paddy in manual and minimum losses is 1 in maize followed by bullock cat and tractor maximum losses 01.3 in wheat followed by paddy.

Table 2: Shows the losses during transportation.

	Mode of transportation						
S. No.	Food grains	Tractor	% Loss	Bullock cart	% Loss	Manual	Loss
1	Paddy	**19**	.99	46	01.63	52	1.99
2	Maize	**17**	01	44	01.2	59	1
3	Wheat	**21**	01.11	31	01.36	68	1.66
4	Lentil	**16**	.89	54	01	50	1.88
5	Mustard	13	.93	61	01.12	46	1.67

Table 3: Methods of Storage for different crops

S. No	Food grains	Pucca koti		Metal Bins		Gunny Bags		Plastic Bags		Earthen Port	
		F	%	F	%	F	%	F	%	F	%e
1	Paddy	56	46.66	23	19.16	11	09.16	09	07.50	07	05.83
2	Maize	29	24.16	16	12.50	58	48.33	03	02.50	05	04.16
3	Wheat	33	27.50	21	17.50	49	40.83	04	03.33	02	01.66
4	Lentil	19	15.83	59	49.16	14	11.66	02	01.66	09	07.50
5	Mustard	18	15.00	61	50.83	08	06.66	05	04.16	09	07.50

Table 4: Shows losses in paddy storage in different storage structure.

Food grains	Method of storage	Percentage loss on different factor				Total
		Insect	Rats	Moisture	Bandicoots	
Paddy	Pucca koti	2.11	2	2.44	00	6.55
	Metal bins	2.29	00	3.69	00	05.98
	Plastic bags	3.14	2.11	2	1.16	07.89
	Gunny Bags	2.11	2.79	1.22	1.56	07.71
	Earthen pot	2.17	2.01	2.03	1	7.59

From the above table maximum losses 07.89 in fertilizer bags followed by 07.71gunny bags, minimum losses in metal bins 05.98 followed by 06.55 pucca koti.

Table 5: Shows losses in maize storage in different storage structure.

Food grains	Method of storage	Percentage loss on different factor				Total
		Insect	Rats	Moisture	Bandicoots	
Maize	Pucca koti	03.11	02.33	2.19	00	07.63
	Metal bins	3.29	00	3.23	00	6.43
	Plastic bags	3.13	2.19	2.11	1.07	07.50
	Gunny Bags	01.03	2.19	1.09	2.07	07.38
	Earthen pot	02.33	1.99	2.29	1.16	07.67

From the above table maximum losses 07.50 in fertilizer bags followed by 07.38gunny bags, minimum losses in metal bins 05.98 followed by 06.55 pucca koti.

Table 6: Shows losses in wheat storage in different storage structure

Food grains	Method of storage	Percentage loss on different factor				Total
		Insect	Rats	Moisture	Bandicoots	
Wheat	Pucca koti	2.09	2.18	2.01	2.02	06.30
	Metal bins	2.29	00	2.43	00	04.72
	Plastic bags	2.39	2.06	2	1.09	07.61
	Gunny Bags	3.13	2.59	1.11	1.19	07.43
	Earthen pot	2.31	1.44	2.11	1.88	07.74

From the above table maximum losses 07.61 in fertilizer bags followed by 07.43gunny bags, minimum losses in metal bins 04.72 followed by 06.30 pucca koti.

Table 7: Shows losses in mustard storage in different storage structure.

Food grains	Method of storage	Percentage loss on different factor				Total
		Insect	Rats	Moisture	Bandicoots	
Mustard	Pucca koti	2.11	2.13	3.19	00	07.43
	Metal bins	3.29	00	3.41	00	06.70
	Gunny Bags	2.29	2.06	02.2	1.14	07.51
	Plastic bags	2.39	2.49	2.04	1.17	07.89
	Earthen pot	3.13	2.61	1	1.04	07.98

From the above table maximum losses 07.89 in fertilizer bags followed by 07.71 gunny bags, minimum losses in metal bins 05.98 followed by 06.55 pucca koti.

Table 8: Shows losses in lentil storage in different storage structure.

Food grains	Method of storage	Percentage loss on different factor				Total
		Insect	Rats	Moisture	Bandicoots	
Lentil	Pucca koti	02.66	1	2.19	.50	6.35
	Metal bins	03.59	00	2.51	00	6.10
	Gunny Bags	2.11	1.96	2.33	1.14	7.54
	Plastic bags	2.36	2.29	2.12	1.11	7.87
	Earthen pot	2.33	1.51	2.66	1.51	07.69

From the above table maximum losses 07.89 in fertilizer bags followed by 07.71gunny bags, minimum losses in metal bins 05.98 followed by 06.55 pucca koti.

Table 9: Shows Preferences and reasons for storage methods.

Sl. No.	Reasons	F	%
I	Pucca koti		
1	More quantity in less space	22	18.33
2	No rat damage	46	38.33
3	No insect damage	7	5.83
4	No moisture damage	17	14.17
5	Easy handling	21	17.50
6	High durability	10	8.33
7	Less costly method	11	9.17
II	Metal bins		
1	No rat damage	49	40.83
2	No insect damage	23	19.17
3	Easy handling	34	28.33
	Advantageous for small quantity	8	6.67
III	Gunny bags		
1	Easy handling	42	35.00
2	No insect damage	38	31.67
3	No moisture damage	8	6.67
4	Advantageous for small quantity stored	8	6.67
5	Advantageous for seed purpose storage	15	12.50
6	More types of grains in less space	9	7.50
7	Insects are visible	10	8.33
8	Advantageous for poor families	3	2.50
IV	Plastic bags		
1	Easy handling	10	8.33
2	No insect damage	15	12.50
3	Advantageous for small quantity storage	5	4.17
V	Earthen pot		
1	More quantity in less space	14	11.67
2	No insect damage	33	27.50
3	No rat damage	13	10.83
4	Cost effective method	12	10.00
5	Advantageous for long term storage	9	7.50

Table 10: Problem faced by the farmer during storage.

S. No	Problem	Farmers adopting improved method (n_1=60)		Farmers adopting traditional method (n_2=60)	
		F	%	F	%
1.	Lack of storage space	12	20.00	20	33.33
2.	Lack of knowledge about scientific storage methods	8	13.33	12	20.00
3.	Lack concrete threshing yard facility	4	6.67	4	6.67
4.	Costly storage methods	2	3.33	10	16.67
5.	Labour problem for digging ground storage structures and for handling grains	3	5.00	2	3.33
6.	Non availability insecticides in villages	3	4.00	8	13.33
7.	Loss due to insect and pest damage to grains	21	35.00	29	78.33

8.	Loss due to rat damage to grains	11	18.33	27	45.00
9.	Loss due to moisture damage to grains	3	5.00	2	3.33

The above table shows that the maximum problem faced by the improved farmer is insect and pest damage 35 percent to grains followed by 18 percent rates. The maximum problem faced by the traditional farmer is insect and pest damage78.33 to grains followed by rates45 percent followed lack of storage place 20 percent.

The study was conducted in the year 2014 February and March in Bihta block of Patna districts of Bihar state. Cluster of villages in the Bihta block of Patna district. Some village in these areas uses improved method of storage because land holding is good. Accordingly Bihta block of Patna district where some villages were selected for the study. The villages in which more number of farmers has adopted improved method of grain storage were selected purposively for the research. The list of farmers in selected villages who have adopted improved methods of grain storage was collected from the village Pradhan and discussed with other educated members of the village.

Sixty farmers from the list were selected by following proportionate random sampling method. In order to compare with traditional methods equal no of farmers who have not adopted improved method in it village were selected respectively. Thus total of 120 respondents constituted sample for the study.

Conclusion

It is concluded that the socio economic condition of the respondent were medium level, the respondent preferred pucca koti and metal bins for grain storage. The major problem faced by the respondent in grain storage, where losses due to rats, insects, moisture and also lack of knowledge about the scientific storage method. It was found that perceived loss of grain during storage where maximum in fertilizer and gunny bags.

References

1. Biradar BN. A study on socio-economic profile, aspiration and work satisfaction of women workers of cotton ginning and pressing factories, Hubli-Dharwad, Karnataka. M.Sc. Thesis, Univ. Agric. Sci., Dharwad, 1992.
2. Birajdar VM. Study on knowledge level of farmers and extension personnel about the ill effects of agricultural chemical. M.Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwadm, 2002.
3. Dhaliwal AJS, Sohal TS. Extension content in relations to adoption of agricultural practices and socio-economic status of farmers.Indian Jour.of Extension Education. 1965; 1(1):58-62.
4. Abhay W, Rai DP, Kinjalk CS. A study on indigenous grain storage practices adopted in tribal households. Souvenir and Abstracts, National seminar on appropriate extension strategies for management of rural resources. UAS, Dharwad, December. 2007; 18-20:163.
5. Arjjumend H. Indigenous practices of post-harvest storage among tribal communities of central India. Leisa India. 2004; 6:8.
6. Basappa G. Post-harvest losses of maize crop in Karnataka - An economic analysis. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 2004.
7. Basavaprabhu J, Neetu K. Documentation and validation of conventional seed storage methods. Souvenir and Abstracts, National seminar on appropriate extension strategies for management of rural resources. UAS, Dharwad, December. 2007; 18-20:166.
8. Basavaraj H, Mahajanshetti SB, Naveen CU. Economic analysis of post-harvest losses in food grains in India: A case study of Karnataka. Agric.Econ. Res. Rev. 2007; 20:117-126.
9. Bhople RS, Sudha D. Indigenous grain storage practices adopted in rural household. Agric. Ext. Rev. 2000; 12(6):26-29.
10. Chahal SS. scientific grain storage system for curbing food wastage. The National Agric. Magazine. 2011 14(1):23-24.
11. Chaudhary SD, Gupta DS, Chaudary OP. Popularity and efficiency of storage structures in rural Haryana. Bull Grain Tech. 1993; 31(1):26-31.
12. Dahama OP, Bhatnagar OP. Education and communication for Development, Oxford and IBH Publishing House, Bombay, 1980.
13. Deepak. A study on perception of benefeciaries and non-beneficiaries towards WYTEP programme in Dharwad district. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 2003.
14. Kanwar, Sharma. Traditional grain storage structures in Himachal Pradesh. Indian J. Traditional Knowledge. 2006; 5(1):98-103.
15. Karthikeyan C, Veerangavatham D, Karpagam D, Ayisha Firdouse. Traditional storage practices. Indian J. Traditional Knowledge. 2009; 8(4):564-568.
16. Krishna Prasad C, Ramprasad V. Disseminating traditional seed storage practices through peoplie's participation. Leisa India. 2006; 6:34.
17. Maleka Shaheen, Vijaya Pande, Mahurkar DS. A Study of the grain storage practices in Tribal Area. Maharashtra J. Extn. Edn. 1993; 12:365-366.
18. Mohapatra S, Dash SR, Sahoo BK. Storage of cowpea and hill arhar through indigenous technical knowledge in Kandhamal District of Orissa. Souvenir and Abstracts, National seminar on appropriate extension strategies for management of rural resources. UAS, Dharwad, December. 2007; 18-20:162.
19. Mudhinamani SM, Dolii SS, Mansur CP. Scientific grain storage with Pucca koti –A success story of Lokur village in Dharwad district. Souvenir and Abstracts, National seminar on appropriate extension strategies for management of rural resources. UAS, Dharwad, December, 2007; 18-20:269.
20. Naveen. Post-harvest losses of major cereals in Karnataka- An economic analysis. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 2004.
21. Parvathi S, Chandrakant K, Karthikeyan C. Adoption of Indigenous and Modern Post Harvest practices followed by Dry land Farm Women. J. Extn. Edu. 1996; 7(1):1322 -1326.
22. Patil ER, Autka VN, Nagpure SC. Economics of storage of food grins at farm levels of Buldana district in Vidarbha regions. J. Agril. Mrktg. 2000; 16(3):52.
23. Rajulachandran, 1998, Constraints of arid farm women in grain storage. J Extn. Edu. 2000; 9(3):13-14.
24. Rao PS, Singh CP, Sharma RP. Post-harvest losses in maize in Mewar regions of Rajasthan. Indian J Agril. Mrktg. 2001; 16(3):51.

25. Reddy SB. Indigenous technical knowledge on pulses storage and processing practices in Andhra Pradesh. Indian J. Traditional Knowledge. 2006; 5(1):87-94.
26. Roy S, Daka MB. Women enshrine traditional paddy storage practices. Leisa India. 2004; 6:11.
27. Sarangi SK, Singh R, Singh KA. Indigenous method of rat proof grain storage by adi tribes of Arunachal Pradesh. Indian J. Traditional Knowledge. 2009; 8(2):230-233.
28. Satish. Farmers perceptions, preferences and utilization of sri and traditional paddy straw for livestock in Haveri, Chikballapur and Uttar Kannada districts of Karnataka state. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad,Karnataka (India), 2010.
29. Savitha S. Storage of paddy at farm level in Soraba taluk of Shimoga District, Karnataka -An economic analysis. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 1994.
30. Sexena HK, Ajitha KR Singh, Singh KR. Assessment of post-harvest storage losses in wheat: case study in East Uttur Pradesh. J Agril. Mrktg. 2000; 16(3):54.
31. Shashikala YS. A study on the knowledge and adoption of improved methods of food grain storage by the farmers of Dharwad taluka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 1993.
32. Shinde PS, Vaidya VR, Satpute SK. Identification and adoption of indigenous agricultural practices by dryland farmers. Maharashtra Extn. Edun. 2000; 19:259-263.
33. Shivalila HB, Neena J. Grain storage practices of households in Hosaramenahalli Mysore – A case study. Bull. Grain Tech. 1984; 22(2):158-162.
34. Shobha Nagnur, Geeta Channal, Channamma N. Indigenous grain and method of storage. Indian J. Traditional Knowledge. 2006; 5(1):114-117.
35. Sidram. Analysis of organic farming practices in pigeon pea in Gulbarga district of Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci Dharwad, Karnataka (India), 2008.
36. Singh AJ, Singh RR. Growth performance of Punjab agriculture – An inter district analysis. Agric. Situ. India. 1991; 46:655-666.
37. Singh DS, Narendra Kumar Gupta, Gupta BK. A study of Post – harvest loss of wheat and its management in Kanpur district of Uttar Pradesh. Indian J. Agril. Mrktg. 2000; 16(3):53.
38. Singh J, Sidhu MS. Post-harvest losses at farm level – A case of wheat and paddy in Punjab. Indian J Agril. Mrktg. 16: 52-53.Singh, R. S., 1998, Production and marketing of food grains in Tribal regions of Chattisgarh. Indian J. Agril. Mrktg. 2000; 16(3):52.
39. Sonika Thakur, Shashi Kanta Varma, Varma SK. Assessment of existing status of post-harvest technology of Haryana. Indian J. Soc. Res. 1996; 37(2):143-147.
40. Sudha Darbha, Bhople RS, Shinde PS. Constraints in adoption of scientific grain storage practices. Maharashtra J. Extn. Edn., 16:90-95.Sudhir BN., 2009, A study on knowledge and adoption of bacillus thuringiensis (Bt) cotton practices followed by farmers in Haveri District, Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci Dharwad, Karnataka (India).
41. Sukhsanjam SS, Chahal, Toor MS. A study in to wastage vis- a- vis infrastructure facilities in grains market of Punjab. Indian J. Agril. Mrktg. 1998; 16:57.
42. Sushma KC. An analysis of entrepreneurship development in women through EDP trainings in Dharwad district of Karnataka. M. Sc. (Agr.) Thesis, Univ. Agric. Sci Dharwad, Karnataka (India), 2007.
43. Thimmareddy. A case study on organic farming in Karnataka state. M. Sc. (Agri.) Thesis, Univ. Agric. Sci Dharwad, Karnataka (India), 2001.
44. Vani P. A study on knowledge and adoption of selected health and nutritional practices by rural women in Belgaum district, Karnatka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka (India), 2007.
45. Waman GK, Patil PS. Production, storage and marketing constraints faced by onion growers. Maharashtra J. Extn. Edn. 2000; 19:104-108.
46. Wondang. Adoption gap in groundnut production in northern transition zone of Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci Dharwad, Karnataka (India), 2010.