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KNOWLEDGE EMPOWERMENT THROUGH CO-OPERATIVE MOVEMENT – TRIMMING DOWN THE LOSSES FROM 'LOST HARVEST' AND 'FOOD WASTE' IN INDIA

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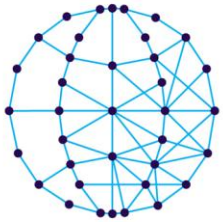

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Abstract

Around 1.3 billion tonnes of food, one third of the annual global food production, is lost or wasted every year. An assessment of lost harvest and food waste in the most widely grown cereals, vegetables and fruits was carried out using a questionnaire involving stakeholders of the food value chain in the tribal tract of Koraput. Based on the findings, agronomic andbest practice interventions with market linkages were planned and implemented. Co-operative action, promoted through formation of five Farmers Clubs (FCs) and ten Self Help Groups (SHGs) involving all stakeholder households, was undertaken to effect the planned activities. The effects of the research initiatives were analyzed after two years using a structured questionnaire. Knowledge empowerment of the communities, reinforcement of market linkages, promotion of collective action, and strengthening of community institutionshelped in bringing down food losses by 45.15%, 24.03% and 18.75% in case of grains, vegetables and fruits, respectively.

Résumé

Environ 1,3 milliard de tonnes de nourriture, un tiers de la production alimentaire annuelle mondiale, est perdue ou gaspillée chaque année. Une évaluation des récoltes perdues et du gaspillage alimentaire touchant les principaux fruits, légumes et céréales communément produits a été réalisée au moyen d'un questionnaire auprès des parties prenantes de la chaîne de valeur alimentaire dans la communauté tribale de Koraput. À partir des résultats, des interventions agronomiques ou engageant des meilleures pratiques en lien avec le marché ont été planifiées et mises en œuvre. Des interventions coopératives, soutenues grâce à la formation de cinq clubs de fermiers (FC dans le texte) et dix groupes de solidarité (SHG) intégrant des ménages parties prenantes, ont vu le jour afin de réaliser les activités planifiées. Les retombées de la recherche ont été analysées après deux ans à l'aide d'un questionnaire structuré. L'encapacitation des communautés par la connaissance, le renforcement des liens avec le marché, la promotion de l'action collective et le renforcement des institutions communautaires ont contribué à réduire les pertes alimentaires de 45,15 %, 24,03 % et 18,75 % en ce qui concerne respectivement les céréales, les légumes et les fruits.

Resumen

Cada año, se pierden o desperdician 1300 millones de toneladas de alimentos, o sea, un tercio de la producción mundial anual de alimentos. Se realizó una evaluación de las cosechas perdidas y los desperdicios de alimentos en el caso de los cereales, verduras y frutas con más alta tasa de cultivo mediante un cuestionario que involucra a las partes interesadas de la cadena de valor alimentario en la zona tribal de Koraput. Sobre la base de los hallazgos, se planearon e implementaron intervenciones agrícolas y de mejores prácticas con los vínculos mercantiles. Se emprendió una acción cooperativa, promovida a través de la formación de cinco clubes de agricultores y diez grupos de autoayuda (FC y SHG respectivamente, por sus siglas en inglés), que involucra a todos los hogares de las partes interesadas, para llevar a cabo las actividades planeadas. Dos años más tarde, se analizaron los efectos de las iniciativas de investigación mediante un cuestionario estructurado. El empoderamiento de las comunidades a través del conocimiento, el refuerzo de los vínculos mercantiles, la promoción de la acción colectiva y el fortalecimiento de las instituciones comunitarias contribuyeron a disminuir las

pérdidas de alimentos en 45,15 %, 24,03 % y 18,75 % para el caso de granos, verduras y frutas, respectivamente.

Introduction

The food basket of tribal communities in the Eastern Ghat mountain range of the Koraput district, Odisha, India, is comprised of several cereals, tubers, greens, fruits and vegetables. The traditional rainfed agricultural system in this hilly terrain has been declared as a 'Globally Important Agricultural Heritage Site' because of its rich agro-biodiversity (FAO, 2012).Paddy and finger millet are the major cereal crops in this region followed by little millet, sorghum and maize. The most widely cultivated vegetables in this hilly tract are cauliflower, tomato, okra, pumpkin and eggplant. Jackfruit, mango and banana contribute towards dietary diversity providing higher monetary benefit to the farmers. The conventional agricultural and storage practices such as pest and disease management, harvesting, threshing, grading, cleaning, hulling, dehusking, protectingagricultural produce from extreme ambient conditions, limiting the moisture content, packaging, and transportation play vital roles in determining the extent of loss of harvest.

Physical spoilage and partial deterioration rendering the food unsuitable for consumption are termed as lost harvest(Parfitt et al, 2010). The loss of harvest during cultivation, post-harvest processing, transportation and the retailing process involves both quantitative and qualitative losses. The discarded food represents the portion of agricultural produce lost due to diseases, deformity, bruises or damages by insects and pests, which has no monetary value in the market. The fraction of food designated as 'sorted out' denotes the produce thatis deformed, bruised, diseased or damaged by insects and pests bearing low economic value based on the degree of damage. Still the term 'lost harvest' is a relative term, seeing thatthe food considered unsuitable during times of abundance may be regarded as consumable during a period of scarcity. The term 'food waste' refers to 'food losses occurring at the end of the food chain' (Parfitt et al, 2010).Although stress has been laid on improving agricultural productivity to ensure food security, theattempts carried out to reduce food losses have been insignificant.

Around 1.3 billion tonnes of food, one third of the annual global food production, is lost or wasted every year. Globally, this amounts to 30% of total cereals, 40-50% of root crops, fruits and vegetables, 20% of oil seeds and 30% of meat, dairy and fish products (Gustavsson et al, 2011).The per capita food waste differs significantly, ranging from 95-115 kg per annum in North America and Europe and only6-11 kg per annum in sub-Saharan Africa and south and south-eastern Asia. The food waste in the south and south-eastern Asia is mostly comprised of food losses in the terminal phases of the food value chain due to poor handling followed by insignificant losses at the time of consumption at the household level owing to low per capita income, limited access to and little availability of quality food, the high rate of unemployment and a relatively poor standard of living. This report also reveals that the extent of food loss and waste at different stages of the value chain varies forcountries at different levels of economic growth. In cases of developing countries, the food loss is highly evident in the initial phases of the value chain due to 'financial, managerial and technical constraints in harvesting techniques as well as storage and cooling facilities'.

In India, food losses may negate the effects of growth in agricultural production and may adversely affectthe food and nutrition securityof a nation facing grave challenges of malnutrition. The National Family Survey, 2005-2006 presented a grim picture of the health sector in India with incidences of anemia in 56% and 24% of women and men, respectively. Anemia was reported in 79% children in the age group of 6 to 35 months. Incidences of stunting, wasting and underweight in 45%, 23% and 40% of children below three years of age, respectively, raised concern over food and nutrition security in India.

Objectives

The present study attempts to:

1. 1. Gauge the food loss at various levels of value chain
2. 2. Assess the effect of interventions on lost harvest and food waste over a period of
3. 4 months.
4. 3. Employ co-operative movement as a service provider for awareness creation,
5. knowledge dissemination and experience sharing

Methodology

From a total population of 2004households, 50farmers were sampled for each of the three cereal crops, namely paddy, finger millet andlittle millet. In total 150 vegetable cultivators were selected with 30 farmerseach for cauliflower, tomato, okra, pumpkin and eggplant. Thirty fruit growers for each fruit, namely Jackfruit, mango and banana, were chosen for the study. Equal numbers of men andwomen farmers belonging to Poraja, Bhumia, Penthia and Bhatra tribes were selected undereach category. A random selection of 20wholesalers and 30 retailers for each of thecereals, vegetables and fruits was followed by employing the methodology of ‘overallassessment of the commodity movement system’ for evaluation of food loss. Stakeholders of thefood value chain such as cultivators, wholesalers and retailers were interviewed using aquestionnaire to assess food losses at different stages. The benchmark information was collectedin November 2011. Based on the findings, research initiatives were planned involving thestakeholders. The impact of the research was analyzed based on the information collected usingthe same questionnaire in January 2014. The study area comprised 32 villages under threeGram Panchayats of Kundra block in Odisha state, India. The findings were presented in percentages with respect to the total population.

Establishmentof aCo-operative Platform through Community Based Organizations (CBOs): Identification of major determinantsof lost harvest and food waste from the benchmark information was followed by planning research initiatives to curtail the food loss, in consultation with the farming community. Forimplementation of the interventions and collective action by the community, sound socialmobilization was carried out. Five Farmers Clubs (FCs) and ten Self Help Groups (SHGs) were constituted and attention was paid to the equalparticipation of men and women farmers in the establishment and management of the CBOs. A collective action platform was promoted to (a) reach out to a significantly large population within a relatively short time frame, (b) facilitate inter and intra community learning, experience sharing and knowledge dissemination, and (c) undertake applied research with the most efficient utilisation of resources. Theresearch initiatives were implemented through FCs and SHGs employing a mix of information andcommunication technology (ICT) tools

aimed at efficient knowledge dissemination, experiencesharing among farmers, economic and knowledge empowerment of the community, a greaterparticipation of women and higher sustainability of research initiatives. These programs werecategorized either as knowledge empowerment or skill empowerment and hadpredefinedcommunication tools for intended behavioural change. Training programmes on the organization andmanagement of farmers clubs, participatory varietal selection trials, integrated pest and diseasemanagement, crop nutrient management, post-harvest food processing, safe storage practices andefficient transportation of agricultural produce were organized to cover all the households in the study. Information and communication technologies were employed to increase the farmers' access to information in order to create awareness and the dissemination of knowledge on food loss prevention. The demonstration of informational audio-visual presentations, phone-in programmes,voice messaging to mobile phones and video conferencing with plant pathologists and valuechain experts were some of the initiatives for spreading information tomarginalizedcommunities. The creation of posters with a graphic presentation of information andno written text were displayedat strategic locations in villages to target illiteratefarmers. The local self-governance was involved in this applied research to increase the effectivenessof this initiative at the grassroots level.

Results and Discussion

Research initiatives aiming at curbing food losses were comprised of activities addressing issuesrelated to food loss.

Integrated pest and disease management: Fungal contaminations, pest infestations and improper disposal of pest and disease-affected plants were found to be responsible for decreasing shelf life and food quality thus restricting the economic benefits. Therefore, farmers were given guidance on pest and disease management. This included promoting organic pesticides, introducing preventive practices, using trap crops, and identifying pests and diseases and the right dose rate of inorganic pesticides. Quality seed production, seed treatment with brine solution and the application of inorganic pesticides to crops in their recommended rates helped reduce the incidence of disease. Sprayers were provided to the farmers through FCs, which replaced the earlier inefficient practice of sprinkling pesticides with country-made brooms. Application of neem (Azadirachta indica) oil in nursery beds of vegetables and paddy was promoted as a preventive measure to counterpest infestations in the early life of the plants and to enhance plant immunity. Neem oil is an effective organic pesticide known for its insecticidal and antifeedant bioactivities (Murray et al, 1990). The wide-scale use of trap crops such as Indian mustard (Brassica juncea) and marigolds in vegetable cultivation, and niger (Guizotia abyssinica) in finger millet and little millet farming significantly reduced pest and disease incidences. Periodic training programmes on common pest infestations and diseases with effective crop residue disposal of diseased plants resulted in considerable prevention of the spread of bacterial, and fungal and viral pathogens to nearby agriculturalfields. The interaction of farming communities with agronomists, exposure visits to well-managedfarms,the facilitation of intra-community knowledge and experience-sharing contributed tosocial mobilization for gradual adoption of improved pest and disease management practices.A lack of helpful mechanisms to check the loss of produce from rodents and birds led to reducedeconomic proceeds because of the loss of quality and contamination with excreta. The useof physicaltraps was promoted to limit food loss in the agricultural field.

Crop nutrient management: Several studies indicate that improper nutrient management in crops, i.e. over-application and under-application of macro and micronutrients, led to an increased incidence of disease (Termorshuizen, 2002). Katan (2009) reported that the foliar spray of phosphorus boosts 'local and systemic protection against some foliar pathogens, e.g. powdery mildew in mangos'. Potassium deficiency in tomatoes enhances the severity of Fusarium wilt whereas a balanced NPK application lessens the severity of Fusarium wilt (Katan 2009). The overuse of nitrogen in paddy increases the incidence of blast and causes a severe loss of harvest (Long et al, 2000). Even complex interactions among nutrients affect the incidence of disease and their severity. Severity of blast disease in paddy is low with a high K:N ratio in leaf tissue, while a low K:N ratio enhances the blast severity (Prabhu et al 2007). Giving guidance to the community on the recommended doses of macro and micronutrients for common cereals, vegetables and fruits played a vital role in decreasingthe incidence of disease andcontributedtowards a reduced loss of harvest.

Participatory Variety Selection (PVS) trials to decrease the shattering of grains:The selection of suitable varieties of paddy, finger millet and little millet was carried out by conducting Participatory Variety Selection (PVS) trials involving improved varieties and local landraces. Shattering of grains is one of the major 20 selection criteria in the PVS trials while developing the scorecard. Improved varieties (GPU 67, 21 GPU 45 and GPU 28) and landraces (Dasaramandia and Telengamandia) of finger millet with the attribute of least grain shattering were promoted to curb this unwanted food loss. Based on the findings from paddy PVS trials, improved varieties, namely Jajati, Pratikshya and Sahabhagi and local landraces such as Machakanta and Sapuri, were encouraged for cultivation. In case of little millet, the Badasuan variety was found to be most suitable for decreasing the shattering of grain during cultivation. Adoption of the best performing varieties of cereal crops by the community resulted in a decreased loss of grain due to shattering in the field.

Efficient transportation of agricultural produce: Traditionally, the agricultural produce is transported from the field to the storage facility or threshing yard on shoulders, heads, bullock carts or by bicycle. Tractors were seldom hired by the farmers because of lack of availability in terms of time and high rental charges. This delayed the transportation of agricultural produce from the farmers' fields and ledto a higher loss of harvest due to theft, rain/ hailstones, and damage by birds, rodents and stray animals. The improper maintenance of containers/trailers of irregular sizes or shapes, with cracks, uneven surfaces and corners, serrated ends, the absence of strong guarding walls and a lack of a waterproof top leads to the shattering of grains, pitted surfaces, the pressing and splitting of fruits and vegetables and a lower quality harvest.

Five power tillers with trailers were provided to the community through farmer co-operatives comprising five FCs and ten SHGs. This community-managed transportation facility was made available to the farmers as a not-for-profit service. A nominal amount was charged as the 'User Fee' to cover operational expenses, maintenance costs and the operators' remuneration which made this facility affordable to even small and marginal farmers. The trailers were equipped with proper plastic containers, waterproof tops, round and smooth edges and compact side guards. This facilitated the timely transportation of agricultural produce from remotely located farms to storage areas. This initiative further decreased losses from theft, rain/ hailstones, damage by birds, rodents and stray animals and physical damage during transportation (spillage/breakage of grains/leakage). This collective action improved market linkages while cutting down the average transportation time of agricultural produce

from its storage area to the wholesalers/retailers by 38%. This saving in time further contributed towards a remarkable decrease in the loss of quality of agricultural produce during transportation, ultimately leading to less lost harvest during transportation.

Post-harvest food processing: The traditional methods of paddy hulling and little millet dehusking involved the use of foot operated pounders (dhinki) and hand held pounders (musala) that led to the drudgery of women. These time-consuming processes demand relatively higher physical labour, compromise the safety of women operators and increase the broken grain ratio. Five community-operated paddy hullers brought down the average broken grain content in rice to 6.5%. In case of traditionally hulled rice, the average broken grain contentsin foot operated pounding and hand held pounding are 18.3% and14.7%, respectively. Similarly little millet dehusking machines helped reduce the broken/damaged grain content from 14% in hand pounding to 4.3% in the mechanically processed grains.

Revival of efficient storage practices: The use of unsuitable containers, exposure to extreme temperatures, inappropriate storage facilities,improper storage practices leading to high moisture content, the growth of moulds, insect and rodent infestations, the loss of quality due to rodent and insect droppings, and the spillage and leakage of agricultural produce during transportation are key factors affecting food loss. To restrict moisture content within a safe margin, we introduced simple and affordable practices. The use of traditional earthen pots and bamboo containers with covers as well as sealing the containers with a uniform layer of clayey soilwere promoted.This restricted the exposure of grains to ambient moisture, insects and rodents. Turmeric, neem leaves and char wereadded to grains during storage because of their insecticidal, nematicidal and fungicidal effect. This enhances the grain shelf life and decreasesfood loss during storage and marketing.

A lack of refrigeration facilities is a major constraint in the efficient storage of vegetables and fruits in the hilly tracts of Koraput, especially during the warmer months of the year. The traditional methods of fruit and vegetable storage and transportationdo not use any packing material. Abundantly-available paddy straw was promoted as an affordable and effective packing material during storage and transportation to prevent any cuts, bruises, or physical impaction and as a natural means of moisture control. This resulted in a notable improvement in the quality and economic value of fruits and vegetables during storage, transportation and marketing.

Strengthening of market linkages: The participation of the community in the management of post-harvest food processing facilitiesencouraged entrepreneurship among farmers.Community-owned economic transportation facilities helped the farmers offer their agricultural produce at a cheaper price in local and distant markets. Improved time management decreased post-harvest losses during storage and transportation, mostly evident in the case of perishable goods such as fruits and vegetables. The availability of bulk quantities of post-harvest processed grainsinone place in a relatively short timespan further strengthened the market linkages.These initiatives directly benefitted small and marginal farmers who suffered from harvest loss due to poor market linkages, inadequate transportation facilities, the high cost of transportation, drudgery in post-harvest food processing, a dependence on women for traditional post-harvest food processing,a low bargaining power due to little quantity of agricultural produce and the absence of collective action in the community with respect to agri-business management.

Table 1: Decreased incidences of major pests and diseases in crops with improved management practices

Crop	Pest infestations	Decreased incidence in 2013-14 over 2010-12 (in %)	Diseases	Decreased incidence in 2013-14 over 2010-12 (in %)
Paddy	Plant Hoppers (BHP)	52	Blast disease	29
	Stem borer	36	False Smut	17
	Swarming caterpillar	42	Sheath Blight	22
	Rice hispa	27	Stem rot	81
Finger millet	Caterpillar	19	Cercospora leaf spot	21
	-	-	Seedling and leaf blight	16
Cauliflower	Diamondback moth	72	Stalk rot	34
	-	-	Black rot	44
Tomato	Fruit borer	41	Damping off disease	52
	White fly	31	Early blight	43
	Mite	12	Fusarium wilt	61
Okra	Shoot and Fruit Borer	58	Yellow vein mosaic virus	07
	Leaf Hopper	31	Powdery mildew	56
	Okra Stemfly	24	Fusarium wilt	14
Pumpkin	Phytophthora Blight	06	Bacterial Wilt	19
	Powdery Mildew	17	-	-
Eggplant	Shoot and fruit borer	48	Leaf blight and fruit rot disease	37
	Stem borer	39	Fungal wilt	78
	Epilachna beetle	83	Bacterial wilt	62
Jackfruit	Shoot-borer caterpillar	21	Pink disease	26
	Mealy bugs	81	Stem rot	16
	Spittle bug	12	Gray blight	37
	Jack scale	03	Charcoal rot	29
Mango	Mealy Bugs	08	Anthracnose	22
	Inflorescence	19	Phoma Blight	35

	Midge			
	Shoot Borer	28	Red Rust	19
	Leaf Webber	13	Diplodia Stem-end Rot	31
Banana	Banana Aphid	32	Panama Wilt	17
	Rhizome Weevil	21	Leaf Spot, Leaf Streak or Sigatoka Disease	04
	Pseudostem Borer	22	Crown Rot	18
	Burrowing Nematode	09	Pseudostem Heart Rot	07

Table 2:A comparative study on food loss in major food grains cultivated in Kundra

Particulars	Paddy (in %)		Finger millet (in %)		Little millet (in %)	
	2010-11	2013-14	2010-11	2013-14	2010-11	2013-14
1. Production losses						
a)Pest	5.92	2.12	0.72	0.19	0.96	0.57
b)Disease	7.81	3.43	0.94	0.24	1.09	0.35
c)Damage by birds, rodents and stray animals	1.21	1.18	0.52	0.54	1.22	1.18
d)Rain/ hailstones						
e)Shattering of grains	0.18	0.22	0.48	0.53	0.86	0.96
f)Theft	0.49	0.17	0.69	0.69	0.51	0.22
	0.32	0.29	-	-	-	-
2. Post-harvest losses						
a)Harvesting	0.43	0.45	0.09	0.10	0.28	0.25
b)Shattering of grains during transportation to the threshing yard	0.61	0.16	0.29	0.11	0.72	0.31
c)Damage by rodents in the threshing yard	1.06	1.09	1.18	1.14	1.22	1.25
d)Broken grains/ excessive hulling/ dehusking	0.89	0.26	1.02	0.42	0.87	0.07
e)Storage (moulds/ humidity/ insect/ rodents)	2.28	0.91	1.76	0.57	1.04	0.49
f)Physical damage during transportation (spillage/ breakage of grains/ leakage)	0.37	0.12	1.61	0.39	1.31	0.17
3. Losses during marketing						
a)Damage during handling	0.03	0.04	0.18	0.17	0.17	0.19
b)Discarded (quality loss)	0.51	0.19	0.64	0.34	0.13	0.09
c)Storage (moulds/ humidity/ insect/ rodents)	1.79	0.61	2.06	1.67	0.99	0.64
Total loss	23.90	11.24	12.18	7.10	11.37	6.74

Table 3:A comparative study on food loss in major vegetables grown in Kundra

Particulars	Cauliflower (in %)		Tomato (in %)		Okra (in %)		Pumpkin (in %)		Eggplant (in %)	
	2010-11	2013-14	2010-11	2013-14	2010-11	2013-14	2010-11	2013-14	2010-11	2013-14
1. Production losses	5.07	3.09	2.06	1.75	7.24	5.45	2.54	2.33	8.05	7.14
a)Pests	11.74	7.45	8.16	4.89	11.92	8.01	14.87	9.07	13.03	8.79
b)Disease	0.32	0.33	2.31	2.21	0.09	0.1	1.67	1.54	-	-
c)Damage by birds	0.93	0.49	1.82	1.63	0.27	0.29	6.17	5.19	1.38	1.4
d)Damage by rodents and stray animals	0.47	0.51	4.46	4.25	0.21	0.19	0.22	0.15	0.52	0.44
e)Rain/ hailstones	-	-	2.18	1.88	0.41	0.48	-	-	0.04	0.04
f)Delayed harvest leading to excess ripening	-	1.28	3.03	2.47	-	-	0.21	0.17	1.67	1.39
g)Rotten crops due to contact with ground	1.32		0.97	1.02	0.25	0.3	0.54	0.48	0.21	0.25
h)Theft										
2. Post harvest losses										
a)Picking/harvesting	0.11	0.12	0.28	0.21	0.06	0.08	-	-	0.26	0.24
b)Grading/sorting	0.21	0.18	1.02	0.96	0.6	0.44	0.09	0.1	0.36	0.25
c)Damage by rodents	0.46	0.48	0.57	0.55	0.04	0.06	0.22	0.19	0.04	0.05
d)Packing the produce	0.22	0.16	1.89	1.58	0.02	0.02	0.01	0.01	0.03	0.03
e)Temporary storage	0.07	0.04	0.71	0.47	0.12	0.07	-	0.01	0.21	0.17
f)Fungal contamination	0.94	0.81	0.64	0.51	0.19	0.14	0.33	0.27	0.18	0.18
g)Physical damage during transportation (pressed/pockmarked)	0.22	0.16	1.52	1.32	0.41	0.28	0.21	0.16	0.27	0.24
h)Economic loss due to partial damage	0.27	0.17	0.39	0.11	0.24	0.16	0.23	0.09	1.01	0.92

3. Losses during marketing										
a)Damage during handling	0.05	0.03	1.09	0.92	0.17	0.19	0.12	0.14	0.42	0.36
b)Sorted out/discarded	3.41	2.85	2.62	2.5	3.07	2.85	2.02	1.88	3.48	2.48
Total loss	25.81	18.15	35.72	29.23	25.31	19.11	29.45	21.78	31.16	24.37

Table 4:A comparative study on food loss in major fruits grown in Kundra

Particulars	Jackfruit (in %)		Mango (in %)		Banana (in %)	
	2010-11	2013-14	2010-11	2013-14	2010-11	2013-14
1. Production losses						
a)Pests	4.67	2.42	3.83	2.57	4.66	3.54
b)Disease	2.44	1.91	11.27	8.64	7.62	5.95
c)Damage by birds	0.21	0.24	0.27	0.23	0.86	0.79
d)Damage by rodents and stray animals	0.02	0.03	-	0.03	0.41	0.4
e)Rain/ hailstones	1.68	1.59	2.12	2.02	1.13	1.7
f)Delayed harvest leading to excess ripening	0.01	-	-	-	-	-
g)Theft	1.07	1.02	2.74	2.86	0.56	0.63
2. Post harvest losses						
a)Picking/harvesting	0.09	0.05	0.18	0.14	0.14	0.11
b)Grading/sorting	0.27	0.22	0.47	0.33	0.59	0.47
c)Damage by rodents	0.08	0.08	0.12	0.13	0.72	0.68
d)Packing the produce	0.98	0.76	0.21	0.18	0.22	0.24
e)Temporary storage	0.04	0.03	-	0.01	0.14	0.11
f)Fungal contamination	2.08	1.85	0.19	0.14	1.37	1.18
g)Physical damage during transportation (pressed/pockmarked)	1.58	1.39	1.12	0.08	1.53	1.34
h)Economic loss due to partial damage	1.81	1.66	1.14	1.02	1.39	1.19
3. Losses during marketing						
a)Damage during handling	0.3	0.22	0.11	0.07	0.17	0.17
b)Sorted out/discarded	3.96	3.58	6.22	5.01	3.84	3.15
Total loss	21.29	17.05	29.99	23.46	25.35	21.65

Table 5: Knowledge Empowerment and Adoption of Practices by Gender

Details of Applied Research Initiatives	Knowledge Empowerment				Adoption of Practices			
	Men (in %)		Women (in %)		Men (in %)		Women (in %)	
	Baseline	End line	Baseline	End line	Baseline	End line	Baseline	End line
Integrated nutrient management	31	72	09	76	05	17	03	39
Application of recommended dose rates of inorganic fertilizer application in paddy and millet cultivation	04	71	0	76	02	29	0	16
Acidic soil status of agricultural land in project intervention area and soil acidity management	02	29	0	99	01	29	0	46
Green manure / vermicompost application to treat soil acidity in agricultural land	01	81	0	97	0	35	0	42
Farm yard manure/compost application	81	97	94	96	57	73	68	79
Line sowing/line transplanting in paddy	14	76	08	85	01	16	0	13
Line sowing in finger millet	03	83	06	81	0	07	0	21
Application of organic pesticides	14	61	05	44	07	26	05	32
Integrated pest management	13	71	02	52	09	58	0	22
Use of treadle pump for small scale irrigation*	14	78	08	91	0	06	0	48
Mechanical pulverization of finger millet*	18	97	09	99	01	44	0	87
Mechanical duelling of paddy*	04	95	02	92	0	74	0	98
Mechanical weeding*	19	57	11	75	0	05	0	11
Nutrition gardening	17	72	23	86	03	16	08	39
Collective fish farming	02	48	0	62	0	31	0	43
Use of power tillers in timely ploughing*	0	68	0	73	0	34	0	07
Use of power tillers with trailers in transportation of manure and agricultural produce*	0	77	0	81	0	26	0	12
Improved agronomic practices	12	94	02	79	04	35	01	31
Cultivation of paddy landraces found suitable in PVS trials	0	96	0	91	06*	38	04*	29

Cultivation of finger millet landraces found suitable in PVS trials	0	86	0	94	09˟	36	05˟	48
Quality seed production	42	67	28	71	36	54	21	43
Improved animal husbandry practices	14	93	06	88	12	38	04	45
Awareness on eligibility for social entitlements and the facilitation of application process	47	86	39	94	8	13	02	07
Availed benefits through social welfare programmes	-	-	-	-	-	04	-	03
Value addition to millets (for increased household consumption)	06	24	17	83	0	09	09	28
Value addition to millets (for entrepreneurship) *	0	05	0	19	0	0	0	08
Mechanical decortications of tamarind to reduce drudgery (for household consumption)*	0	12	0	82	0	03	0	36
Value addition to millets (for entrepreneurship)*	0	04	0	14	0	0	0	12

Sample size: male and female participants from 2004 households including 734 landless households.

*denotes participatory management of facilities by FCs and CSCs through a not-for-profit approach

˟denotes practices because of experience and indigenous knowledge, but not due to scientific validation

Conclusion

Attaining food and nutrition security in challenging agroclimatic zones is a tough goal inlow-yielding agricultural systems. Lost harvest and food waste further reduce food availability making this objective even more challenging. Knowledge empowerment of the community through capacity-building training programmes, technology demonstrations, social mobilization, the reinforcement of market linkages, the strengthening of community institutions and the promotion of collective action have resulted in a significant reduction offood loss. Despite the financial constraints presentinintroducing arefrigeration facility, modern infrastructure for efficient storage of agricultural produce, state-of-the art packaging provisions and a temperature-controlled food transport system, simple technologies and practices could help in lowering the food losses by 45.15%, 24.03% and 18.75% on average for grains, vegetables and fruits, respectively. The package of practices and their adoption, which led to a significant decrease in food loss in the food-scarce undulating terrain of eastern India is an exemplary piece of applied research for replication in similar agro-climatic zones.

The contribution of the mix of information and communication technology tools towards awareness creation, skill up-gradation, knowledge empowerment and the adoption of scientific practices by indigenous communities is noteworthy. This not only proved theimportance of employing an efficient mix of ICT tools but also stressed the selection and development of suitable contents based on the target population. Collective action by the tribal communities organized through Community Based Organizations led not only to entrepreneurship development but also acted as a convenient medium for knowledge dissemination. Co-operative movement acted as an effective and economic service provider for extension activity and knowledge empowerment of disadvantaged communities within a shorter duration of time. Information and communication tools and need-based capacity building with motivation for the gradual adoption of scientific practices among tribal communities will certainly aid in minimizing food losses and ensuregreater food security in the mountainous tract of Koraput.

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References

FAO (2012).“Traditional Agriculture Systems, Koraput,” Available athttp://www.fao.org/giahs/giahs-sites/south-east-asia/traditional-agriculture-systems-koraputindia/detailed-information/en/.

Gustavsson, J.C. Cederberg, U. Sonesson, R. Van Otterdijk and A. Meybeck (2011). “Global foodlosses and food waste: Extent, causes and prevention,” Food and Agriculture Organization of the United Nations, Rome, Italy.

Katan, J. (2009).“Mineral Nutrient Management and Plant Disease, Research Findings,” e-ifc, no. 21, September 2009. Available at http://www.ipipotash.org/en/eifc/2009/21/3.

Long, D.H., F.N. Lee and D.O. TeBeest (2000). “Effect of nitrogen fertilizer on disease progress on susceptible and resistant cultivars,” Plant Disease, vol. 84, p. 403-409.

Murray, B.I., K. Opender, L. Anna and K. Jerzy (1990).“Insecticidal and antifeedant bioactivities of neem oils and their relationship to azadirachtin content,” Journal of Agricultural Food Chemistry, vol. 38, no.6, pp. 1406-1411.

National Family Health Survey India (NFHS-3) (2005-2006). International Institute for Population Sciences, Mumbai, India, vol.1.

Parfitt, J, M. Barthel and S. Macnaughton (2010).“Food waste within food supply chains: quantification and potential for change to 2050,” Philosophical Transitions of The Royal Society, vol. 365, p. 3065-3081.

Prabhu, A.S., N. D. Fageria, D. M. Huber and F. A. Rodrigues (2007).“Potassium and plant disease,”in: Datnoff, Elmer and Huber (eds.). 2007, Mineral Nutrition and Plant Disease, St. Paul, APS Press, pp.57-78.

Termorshuizen, A. J. (2002). Cultural control, Plant pathologist’s pocketbook, 3rd ed, Wallingford, Oxon, CABI Publishing, CAB International, p. 318-327.

Notes

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