Productive Sanitation Successfully Links Toilets and Livelihoods

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Abstract

This paper looks at systems for productive sanitation being trialled in the Rural Village Water Resources Management Project (RVWRMP)[1], Nepal (funded by the Governments of Finland and Nepal). The purpose of RVWRMP Phase II is to achieve improved well-being and reduced poverty via the improved use of water resources – including work focused on improved nutrition, food security and livelihoods. The project works in the far west of the country, facing the challenges of remoteness, rugged terrain, food insecurity, water scarcity, climate change and the post-conflict legacy.

Optimizing the use of local resources, the project has supported mostly farm based livelihoods activities as a cross cutting theme in remote Village Development Committees (VDC). These improve food security, nutrition and income generation, making the users able to pay for operation and maintenance (O&M) of water supply and sanitation systems beyond the project implementation. The project piloted eco latrines in some VDCs to sensitize the users on the use of human urine on crops. Due to social barriers and maintenance problems, the eco-latrines have been used in only a few households.

More recently, the livelihoods and sanitation movement encouraged the use of human waste, mostly human urine, in place of expensive and usually unavailable artificial fertilizer, for market oriented production. Collection takes place simply, in bottles, and is applied mainly via drip irrigation systems. Application of human urine increased vegetable production and income in the project communities. Additional annual income per household from vegetables ranges from NRs 30,000-100,000 in intensive production areas.

Productive sanitation via urine use in the project is still at the early stage and changing attitudes takes time. An experimental trial was run at the Regional Soil Testing Centre, but even government staff found it difficult to change to urine collection and use. Composted faeces application is still a step too far for almost everyone. Farmers who were culturally reluctant to use human urine and unaware of its benefits have seen the good results and are stepping towards productive sanitation, adapting it in line with endogenous practices of using cow dung and urine. The number of users is increasing, mostly the female farmers who are driving the activities. Income levels of the project beneficiaries have risen and their livelihoods have improved, including the 25.16 % below the poverty line in the project communities. In turn, the improved incomes complete the cycle, supporting O&M and sustainability of water and sanitation infrastructure.

Key words: RVWRMP, livelihoods promotion, productive sanitation; food security; urine

1. Introduction

The Rural Village Water Resources Management Project Phase II (RVWRMP) is a bilateral development project implemented by the governments of Nepal and Finland. It works through District Development Committee (DDC) executed sub-projects in 113 remote Village Development Committees (VDCs) in 10 districts (Accham, Baitadi, Bajhang, Bajura, Dadeldhura, Dailekh,

[1] http://www.rvwrmp.org.np/

Darchula, Doti, Humla, and Kailali) in Far and Mid Western regions of Nepal. The overall objective of RVWRMP II is institutionalised capacity at local and regional levels to sustain and continuously improve *enhanced quality of life, better environmental conditions and increased opportunities in rural livelihoods* in the Project area. The project uses the principle of Integrated Water Resources Management to achieve the three result areas: Institutionalized community capacity in water supply and sanitation infrastructure and behaviour, improved and sustainable nutrition, food security and sustainable income at community level and institutionalized capacity at district level to support communities in the above. The Water Use Master Plan (WUMP) at the VDC level sets the five year vision for each VDC, providing the priorities also for RVWRMP-supported individual schemes and activities.

This paper has two parts: the first describes the challenging characteristics of the project area in terms of sanitation, poverty and food security and the second part describes the activities of productive sanitation that are undertaken by the project, contributing to food security solutions and the sustainability of drinking water and sanitation activities.

2. Water, sanitation, poverty and food security situation in project area

The project areas are the least developed regions in the Nepalese context. The ten Project districts have been ranked either as 'poor' or 'very poor'[2]. Agriculture, livestock and non-timber forestry products, particularly high value herb collection, are the main income sources for the people in the mountain districts. Almost all the districts in the project area have a food deficit for part of the year, and depend on external income sources. Seasonal migration for work has evolved as a coping strategy for poor communities in the project area.

Access to safe drinking water systems in the Project VDCs was on average 47% in 2007-2008, whereas the access to sanitation facilities was much lower: between 0.2% and 10.1% (an average of 3%). When measured in 2011, the access to water had improved to 72%, and access to household toilets had improved to an average of 45% (34-53%).[3]

As well as being least developed regions of Nepal, the Far and Mid Western Regions also have a high poverty rate ranging from 64.1% (Bajura) to 33.6% (Kailali) against the national average poverty rate of 25.16%.

Some reasons for poverty are land insecurity, limited access to services such as extension, and poor soils. 18.8% in Mid and 31.2% of the total households in Far Western Development Region are dependent on leasehold land for their basic food security.[4] There is always scarcity of chemical fertilizers in the regions, which directly affects crop production. Total chemical fertilizer available in the Far West Development Region in 2013/14 was 8763.2 mt out of the total 180140.6 mt distributed in the country (in itself, inadequate for needs) – i.e. 4.8% of total available fertilizer to cover 10% of the total population.[5] Even if fertilizer is available it is not easily affordable by poor farmers.

The area experiences different degrees of mostly seasonal food insecurity. As can be seen from the table[6] below, seven out of nine project hill districts are food deficit areas.

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[2] Human Development Index Nepal, UN, 2011
[3] RVWRMP Baseline survey 2007
[4] Nepal Living Standard Survey 2011
[5] Ministry of Agricultural Development (MoAD), http://www.moad.gov.np/content.php?id=297
[6] MoAD, GoN (Statistical information 2012/13)

Table 1: District-wise Food Availability and Requirement in 2012/13 (project hill districts)

District/ Region	EDIBLE PRODUCTION (metric tons - mt)						Total edible Production (mt.)	Requir e-ment (mt)	Balance (+,-)
	Rice	Maize	Wheat	Millet	Barley	Buck-wheat			
Bajura	4119	933	5173	2115	414	9	12762	27169	-14407
Bajhang	11171	3366	17327	1662	761	3	34291	38813	-4522
Darchula	5976	7741	10820	627	462	64	25690	25973	-283
Far West mountain	21265	12040	33319	4404	1637	77	72743	91955	-19212
Achham	16878	4951	19196	2680	154	0	43858	53068	-9210
Doti	12298	680	27475	4707	65	7	45232	42773	2459
Baitadi	7715	11858	19388	741	444	0	40146	51443	-11297
Dadeldhura	8911	4211	15411	210	57	0	28800	29148	-348
Far West hills	45802	21700	81470	8338	720	7	158036	176432	-18396
Humla	489	87	224	1038	233	487	2559	10249	-7690
Dailekh	14134	27772	21681	2145	72	16	65821	54866	10955
Western Region	604780	454600	275166	86328	1309	0	1424899	969791	455108

3. Livelihoods Intervention in the Project Area

The above alarming food deficit situation gave the impetus to support farm-based livelihoods, optimising the use and reuse of water resources and sanitation facilities available in the village. The priority of the project is drinking water, but once these needs are satisfied, any additional water can be used for home gardens, micro-hydro or irrigation. The project piloted the livelihood activities in Phase I in eight VDCs, benefiting 1098 households. In the second phase, livelihoods became a component in its own right. The first focus was home gardens for improved nutrition and food security. In communities with potential market links, more commercial agriculture was supported. It became a priority of the communities to be reflected in the Water Use Master Plans (WUMP), especially for the most disadvantaged groups (very poor, dalit, ethnic minorities and women).

4. Stepping Towards Productive Sanitation

Food security and the access to safe water and sanitation are fundamental human rights that for many people remain a promise unfulfilled. Globally still some estimated 2.6 billion people do not use improved sanitation facilities (WHO/UNICEF, 2010) and around 925 million worldwide are chronically undernourished (FAO, 2010). To meet the dietary demands from a growing world population, projected to reach 9 billion by 2050, the world food production in 2050 would need to increase by 70% (FAO, 2009). A great deal of the population growth will take place in urban areas leading to a substantial increase in urban food demand and a corresponding increase in the amount of

organic waste, human excreta and wastewater from cities to be managed in a safe and productive way. Even in rural areas, the efficiency of food production should be increased. The safe recycling of sanitation products can contribute to improved resource management, reduced environmental impact and improved health and nutrition.[7]

Considering the number of people to be fed and the existing resource limitations, the food security issue should be approached with resource preservation and recovery in mind. Here, productive sanitation systems play a key role.

Many farmers face high prices for fertilisers, due to increasing demands, higher energy and transport costs as well as rising production costs (IWMI, 2011). Food and fertiliser prices have been particularly unstable since the beginning of 2008. When fertiliser prices rise, developing countries which are dependent on fertiliser imports for agricultural production are particularly vulnerable. Poor infrastructure and high costs of transport, particularly to remote areas, adds to the problem and further increases the local market prices for synthetic fertilisers.

Productive sanitation is a general term used for the variety of sanitation systems that make productive use of the nutrient, organic matter, water and energy content of human excreta and wastewater in agricultural production and aquaculture. These systems enable the recovery of nutrients and/or energy in household wastewater, minimise consumption and pollution of water resources and support the conservation of soil fertility as well as agricultural productivity and thereby contribute to food security [8]

The situation in Nepal is not different than other development countries. Nepalese soil is very deficient in Nitrogen, low to medium in Phosphorus content, and medium to rich in potassium[9]. Hence Nitrogenous fertilizer is the most necessary supplement for soil in order to increase the productivity of the country. About 15458 tons of chemical fertilizer (mostly urea) was imported to Nepal in the fiscal year 2008/09[10]. It is estimated that an adult excretes about 550 litres of urine per year[11]. 550 litres of urine are calculated to contain 4.0 kg of nitrogen, 365 g of phosphorus and 1 kg of potash (Vinneras and Jonson 2002). Nepal's total population in the year 2009 was 27,504,280. If only 50 % of the total population of Nepal started to collect urine, it would be equivalent to about 120:11:23 thousand tons of urea, triple super phosphate, and Muriate of potash respectively, which could totally fulfil the demand for chemical fertilizer in Nepal and also save the foreign currency needed for imports[12]. Experiments in other countries have proved that nutrients in urine are easily accessible to plants and as effective as chemical fertilizers.

In Nepal very little research has been carried out on the use and effect of human urine as a source of plant nutrients, partly for cultural and religious reasons. The importance of the nutrient content in human waste had never been realized as an alternative source of fertilizer for crop production. The introduction of ecological sanitation (Ecosan) toilets in Nepal in 2002 by the Department of Water Supply and Sewerage created opportunities for safer sanitation and recycling of human waste as fertilizer. A total of 517 were constructed within 5 years and a survey found that: 71% of the users were excited, 19% satisfied, 9% needed improvement and 1% were unsatisfied with the use of Ecosan (Water Aid, 2008).

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[7] Sustainable sanitation alliance, SuSanA factsheet, Productive sanitation and the link to food security April 2012

[8] ibid

[9] Jushi U., 2000. Ensuring food security in Kathmandu valley.

[10] MoAC, 2009

[11] Esrey, S et al.,1998. Ecological Sanitation, Sida, Stockholm

[12] http://www.nepjol.info/index.php/AJN/article/view/7532/6118

4.1 Ecosan and the sanitation movement in the project

To make the community socially, economically and ecologically sustainable, RVWRMP piloted Ecosan toilets and the eco-village concept in selected project VDCs. A total of 136 Ecosan toilets were piloted in phase I together with double pit water seal toilets. The main objective of the Ecosan toilets was to take advantage of the productive / economic value of human faeces and urine. Some of the users took the option of using the products as effective fertilizer. Similarly the project piloted the eco-village concept in 5 project VDCs with a complete set of water supply, sanitation with demonstration of eco-san toilets, utensil drying rack, waste disposal pit, vegetable production and

> Jayaram Saud, 49, of Sirsha, Dadeldhura had never heard about Ecosan before, but saw some Ecosan sets demonstrated in another project VDC in Mastamandu. He learnt about it and was encouraged to use the Ecosan pan in his house to collect especially urine. "I started cucumber cultivation simply in barren land, on the river side of Rangun River for the first time after I was trained by the project. I collected human urine from my seven family members in the plastic jar through the Ecosan toilet and used it on vegetables on a weekly basis. I earned net NRs. 90, 000 ($900) within 6 months from around 0.33 hectares of barren land on the river side," said Jayaram.

liquid fertilizers, as well as an awareness campaign and skill development activities. However, when the stage of operation and maintenance came, communities' interest to continue with Ecosan toilets declined, limiting the intervention to only few cases. Handling human urine and particularly faeces was considered a taboo and it was difficult to convince community people that it could be of a great value. Those remaining few households who were interested, used the urine and composted faeces as fertilizer, with a good impact on their production and incomes.

4.2 Approach to urine and human urine in project area

Cow urine is considered holy water, which has healing powers and used in all religious occasions of Hindus for purity. So-called impure persons drink it to purify them before starting the holy event. The farmers themselves have also been using cow urine as one of the ingredients for liquid manure ('singing manure') for the crops, which produces multiple benefits - i.e pesticides, fertilizers and irrigation. On the other hand, human urine is regarded as impure and untouchable in general. When its benefit was explained to be the same as cow urine, farmers started being attracted towards its use, but handling is seen still to be a problem. Even service providers and scientists were found to be reluctant simply to handle human urine.

4.3 Human urine use in training

RVWRMP, in coordination with the Regional Agriculture Training Centre (RATC) of the project area, included 'human urine application' in the training contents taught to the farmers. The RATC is responsible to train farmers and front line facilitators in farming technology. This was new content for the centre and it was proposed to be included in all agriculture related training conducted at the regional level - i.e. training for Village Level Extension Workers, Organic Farming, Low Cost Technologies, etc. Urine application was also included in the different trainings given by project staff directly, regarding Home Gardens, Leader Farmers, manure management, liquid manure and pesticides, etc. The application has been discussed as a topic in the meetings with farmers, livelihood promoters, field staff, and at policy level review and coordination meetings. Thus human urine is becoming a priority everywhere in the project activities, as it needs to be massively introduced as an alternative solution for fertilizers in poor communities to make them food secure.

4.4 Human urine application on school gardens

Application of human urine has been demonstrated in school gardens with support from the project. Currently 10 schools are collecting human urine though a separate urinal system. Stored urine is

used by the students on the vegetables at the school at intervals. Early results have shown that on the one hand it has covered the operation and maintenance cost of the school toilet, via increasing production; and on the other hand it has raised awareness about home gardens and human urine use among students and parents.

4.5 Collection and application methodology

Human urine is being collected via simple methods. Where Ecosan toilets exist, it is collected as designed, either in a plastic or cement tank through a urine separator. If there is no specific Ecosan toilet available, men and boys simply urinate in bottles or plastic jars. Women can urinate more easily in half cut plastic jars. The collection is then secured in an airtight plastic tank or small jar for at least two weeks to one month (summer: two weeks and winter: 3 to 4 weeks) before use, to reduce the (very minimal) risk from microbiological contamination.

The urine is mixed with the drip irrigation system where available at 1:3-10 ratio, based on the life of plants on a weekly basis. Currently there are 484 farmers growing vegetables in poly houses (size: 12x5 metres) using human urine through drip irrigation. In other cases, it is used on the root surface with the same ratio. Farmers report that human urine using through drip has a better impact than on the surface. In addition there is less risk of unpleasant smell.

4.6 Communication for behavioural impact on human urine

Mobilization of Health Promoters and Livelihood Promoters

Health promoters and livelihood promoters facilitate the use of human urine for home garden and commercial production. They monitor the application via observation and via the monitoring card given to the farmers, and encourage them to use urine in the future.

Mobilization of Local Resources Persons from one village to the other

The project developed Local Resource Persons who work on a paid basis with the local government units, and are used to facilitate the training (including regarding urine application) in different VDCs.

Demonstration in agriculture festivals with drip irrigation

The project has been demonstrating the use of human urine application via occasional agriculture festivals, when discussing drip irrigation systems, among other technologies. Such occasions organized in religious places have more impact than in other festivals.

Experiments carried out by farmers simply at their own farm with control plots

The experiment is underway in 12 farmers' fields, with simple technology. As mentioned below, farmers have been observing just two things - i.e growth rate of plants and total production in experimented area.

Communication though local FM Radio

As a part of communication for behavioural impact on sustainable sanitation and livelihoods, there are FM radios running weekly programmes on sustainable sanitation and livelihoods. Interaction with successful farmers using productive sanitation on their home garden, as well as drama and jingles, are being aired through FM radio.

4.7 Productive sanitation experiment in Soil centre

RVWRMP supported a study carried out by the Regional Soil Centre, Far Western Development Region, in 2013/14, regarding the effectiveness of biochar and human urine on soil properties and crop production. It was hoped that data produced from a scientific experimental design could then be used to train Village Level Extension Workers at regional level and produce extension materials.

The experimental design was conducted in Latin square design with four treatments - i.e. four rows and four columns as follows of plots, comparing biochar alone, biochar and human urine; human urine

alone; and a control plot. The plot size was 2.0 m long and 3.0 m wide and the net plot area was 116 m^2

Soil parameters were measured before planting crops and after harvesting. The soil parameters of Nitrogen (N), Phosphorous (P), Potash (K), organic matter (OM) and pH were measured. The instructions were that the human urine was to be collected in plastic jars kept inside the toilets and applied in soil surface at 1:6 ratio every week after the cultivation and stopped one week before harvesting. The experiment was conducted in three sequential crops of the same plot, trialling maize, rice and cabbage.

Unfortunately the results were unclear. There were some difficulties with ensuring that the instructions were followed, in particular with regard to the urine application. Even within a scientific facility, it was difficult to overcome cultural beliefs among the staff. As a consequence, RVWRMP decided to move to field testing.

4.8 Piloting in the field as low cost technology

Farmers have been sensitised to use human urine in place of expensive and usually unavailable artificial fertilizer, for basic home gardens and market-based production. Livelihood Promoters and Health Promoters of the project have raised awareness on the safety and benefits of the use of human urine through a step by step mass campaign. The use of composted human faeces, while considered highly beneficial as a fertilizer by project staff, is associated with too many taboos, so currently is not the main focus of training and awareness-raising.

Farm based livelihood activities of the project are implemented with low cost technologies that include micro-irrigation, urine application (both livestock and human), farm yard manure handling, pheromone traps, and mulching, among others that are locally available and do-able. Urine (both livestock and human) is also used to make 'singing manure'[13] and liquid pesticides.

Until now the application of urine and measuring of results has been ad hoc, and while the general observations were very positive, there were no controls. Now the human urine use has been piloted in some leader farmers' fields in three VDCs, comparing the effect in two treatment plots. One plot receives traditional farmyard manure (FYM) only, and the other is treated with human urine mixed with FYM. It is hoped that they will find differences in the production yield and then adopt it on a massive scale. The quantity of FYM and Human urine in both the treatments were facilitated by the livelihood promoters. Due to the remoteness and unavailability of laboratory testing, changes in soil properties due to FYM and FYM and human urine cannot be properly observed. Farmers are simply facilitated to observe the growth rate and the production in both the plots. Different crops like tomato, cucumber, bottle gourd, cabbage and cauliflower are being tested. Results are yet to come.[14]

4.9 Recent trend on productive sanitation and the results

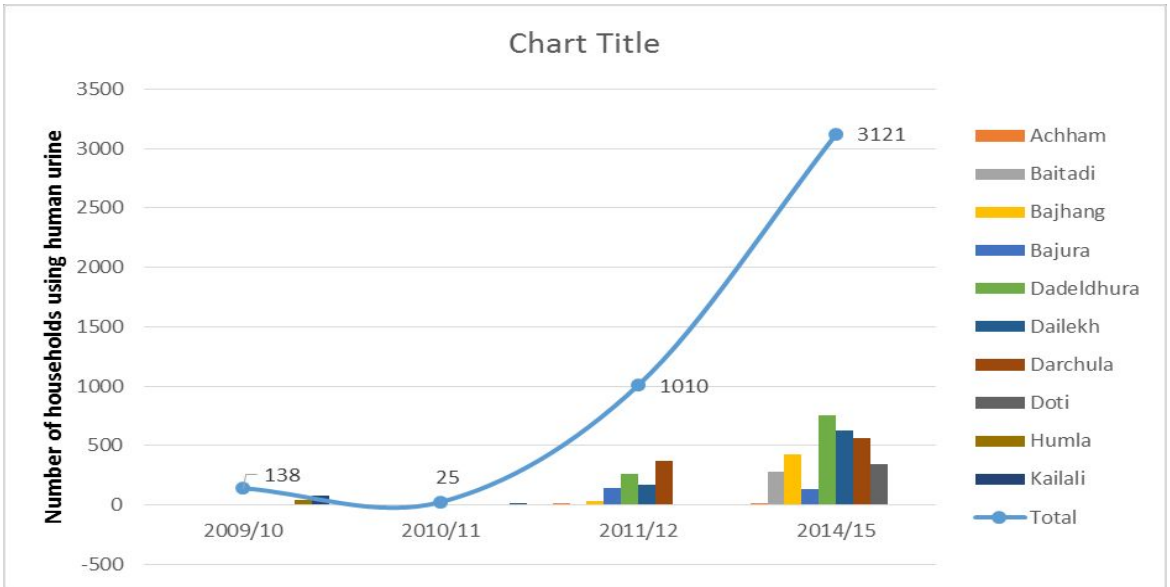
At the beginning of the project's second phase, farmers considered the idea of using human urine for their vegetable crops to be ridiculous (despite their being some positive examples from the Ecosan use in Phase I). Gradually the application of human urine has increased, as can be seen in the graph below, though it is yet to be massively adopted in the project community. Rather, it is notable that geographically nearby farmers see the positive example of their neighbours. In particular, amongst commercially oriented vegetable growers it has been received positively. There has been a sense of competition developed among the farmers, in both using human urine and cultivating more vegetables. Even farmers with very limited land are able to generate income with the application. However, it has been interesting that some urine users don't consume their own production, but instead have targeted only the market. Farmers who were behaviourally and culturally reluctant to use

[13] Liquid manure made with a combination of cow faeces, urine, and various plants and herbs. Songs are sung while spraying the manure on the field.

[14] Results should be available by the time of the Dry Toilet Conference

human urine at first, unaware of its benefits have seen good result and are stepping towards productive sanitation, adopting it in line with endogenous practices of using cow dung and urine including consuming their own produce. Farmers have realized that human urine is available free of cost at their own house and produces better yield even than unaffordable and unavailable chemical fertilizer.

Chart I: Trend Analysis of Human Urine Use in RVWRMP



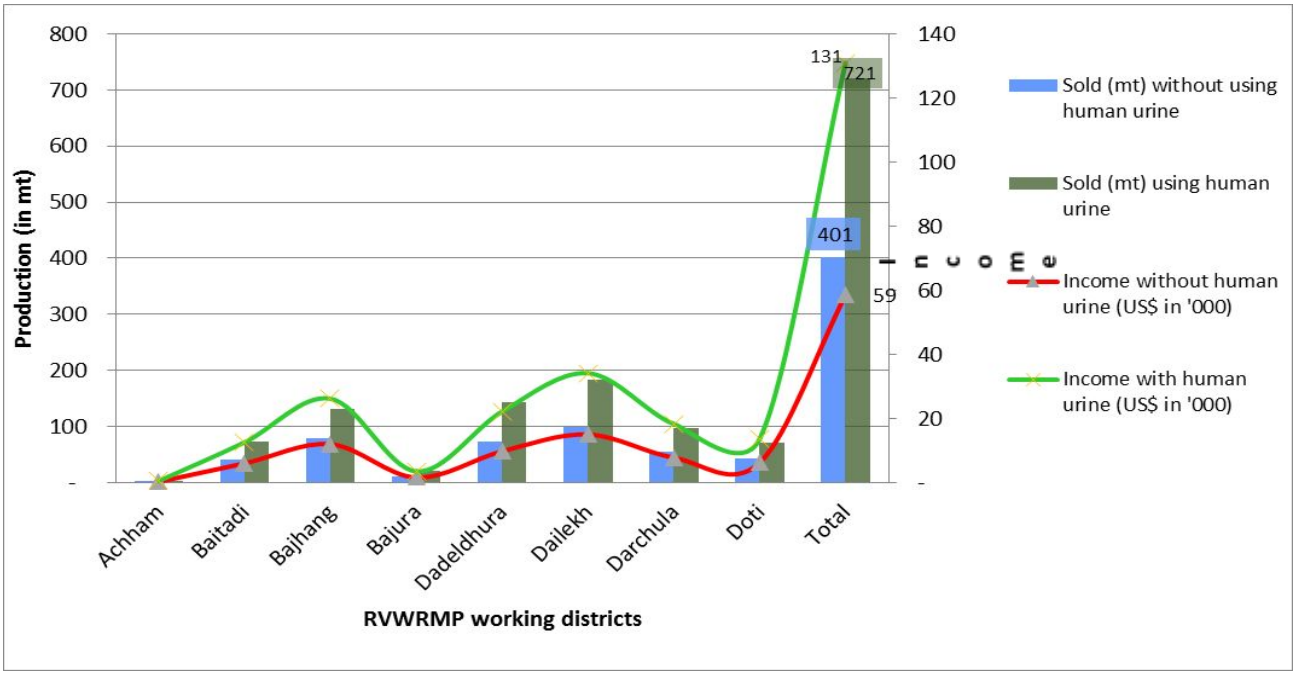
By the agricultural season 2014/15, 10% of the total households with a home garden (29 910) were using human urine application, and 36% of the total households engaged in commercial production (8654) were using urine. [15]

4.10 General observation due to human urine

Although scientifically controlled studies have not yet been finalised, managed by the same household with control plots at similar altitudes and location, RVWRMP does have data from farm level production. RVWRMP Livelihood Promoters working in each VDC collected the data for one year from those using human urine together with farmyard manure (FYM), and those simply cultivating their vegetables with traditional FYM. The district-wise production, sale and income recorded by the farmers are as follows:

Chart 2: Effect of Human Urine in Income and Production Yield

[15] Livelihood card, Jan 015, RVWRMP



The chart shows that household income and production are increased by 122% and 80% respectively due to the use of human urine.

5. Case studies

There are many successful case studies in the project area. Some examples are presented in the boxes below:

Tara Ojha, 29, from Koiralakot, Bajhang says "Application of human urine has opened up new possibilities which were never expected before." He has been cultivating vegetables on leased land (0.15 hectare) with productive sanitation, using an eco-san toilet. He collects urine from his 19 family members and uses it on the farm. He says "I have very big family with 9 children studying in the school. Including family consumption, I have been able to maintain all household expenditures from the sale of vegetables for the last couple of years. In addition, I saved NRs 110,000 last year. For six months I have been paid NRs 6000 a month as a local resource person for the VDC. I also facilitate agriculture trainings in other VDCs, trying to get farmers to understand the value of human urine for their crops.

Kalawati Kunwar, of Chhapari VDC, Darchula has 5 poly houses now. She started vegetable cultivation two years ago with one poly house. She used human urine as a fertilizer, which she learned about during the project training and earned NRs. 55000. From three poly houses she earned NRs. 140,000 within the last 9 months, and now has added a fifth. "We don't use any chemical fertilizer now" said the 33-year old Kunwar. "The result, as you see, is unbelievable" she said, pointing toward her tomatoes. Her husband has quit his government job, and is helping her in the farm, feeding their two children and another two family members staying with them.

6. Limitations

Some limitations to productive sanitation still exist, the most significant being cultural/religious beliefs of farmers. No IEC materials are available to educate farmers, extensionists and government staff on both its benefits and on appropriate handling.

Application of human urine is yet to be addressed at a policy level in Nepal. Inclusion of this topic at policy level could have a great impact on productive sanitation and livelihoods.

No information is available in the market and the community about the value of organic products, consequently there is no price differential between organic and non-organic vegetables in the market. In practice, there is a risk of consumers not buying the products if they hear they are produced with human urine.

7. Conclusion

Collection and use of human urine to materialize the concept of productive sanitation as practiced by RVWRMP in western Nepal is found to be an effective method to increase productivity of vegetable crops by small scale growers, and subsequently improved food and nutrition security. We have found a 122% increase in household incomes and 80% increase in annual cash crop production, when compared with the traditional practice of only FYM application. Farmers don't need to spend money on chemical fertilizer, resulting in decreased costs. With the large scale production of vegetables, vegetable consumption in the community has increased, with resultant positive impacts on the health of children and women and strengthened food security.

97% of the users' committees of water and sanitation have a regular operation and maintenance fund, with paid Village Level Maintenance Workers in each scheme[16]. Increased incomes via productive sanitation allow farmers to cover the maintenance costs, and thus contribute to the sustainability of water schemes.

Some farmers have realised that human urine offers an accessible alternative in place of unaffordable and limited mineral fertilizer. However there is lot of reluctance regarding wide scale promotion and adoption of this practice, for cultural reasons. Localized modification in collection techniques and use of strong communication tools for behavioural change are important to make this practice more widely spread and acceptable. The low level of awareness among extension workers about the safety and importance of human urine as a fertilizer, and the lack of sufficient IEC materials and policy back-up to promote this practice, are some of the problems encountered.

Promotion of human urine as a fertilizer would benefit from its inclusion in agriculture policy at central level. In addition, development of a farmer-friendly working manual with an introduction of the value of the reuse-oriented productive sanitation approach, the link between sanitation and agriculture and thereby food security support, is critical to promote this practice. Coordination among development actors working in sanitation and agriculture is also important; there should be a consistent message on productive sanitation.

At a field level, further promotion of human urine use is needed, via demonstrations and integration in training programs, as well as continued promotion by schools. RVWRMP will continue to support this highly promising work on productive sanitation, as part of its support to livelihoods in far west Nepal.

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