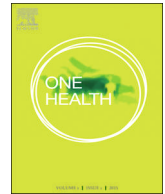




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Reaching for the low hanging fruits: One health benefits of joint crop–livestock services for small-scale farmers

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ABSTRACT

The benefits of joint health service delivery remain under-explored in One Health. Plant clinics are known to provide *ad hoc*, undocumented advice on animal health and production to farmers. To understand the scope of this activity, 180 plant doctors (extension workers) in Uganda, Kenya, Zambia, Peru and Costa Rica were surveyed and a workshop involving key stakeholders was organized in Uganda. Most (81%) plant doctors regularly received queries from farmers on livestock topics. This shows that the single sectoral approach to service delivery often does not match small-scale farmers' needs. There is growing interest among service providers, ministry officials and researchers to improve integration of farmer services to reduce operational costs and make better use of existing capacities. The workshop supported the proposal for the first 'crop-livestock clinics' to be trialled and evaluated in Uganda. This will inform other countries on the potential of joint services to mixed crop-livestock farming communities.

1. Introduction

Agriculture, being a vital provider of food, feed and income is an intrinsic part of 'One Health' (OH). Poor plant health management leads to crop losses, mycotoxins, pesticide residues, pathogen contamination and environmental pollution, thereby affecting the health of humans, animals and ecosystems [1]. Similarly, poor health among farmers, for example due to malnutrition or HIV/AIDS, negatively influences crop and livestock health through loss of labour and reallocation of resources for managing crop and animal health [2]. For most of the 2.6 billion people depending on smallholder farming systems, livestock are essential for maintaining soil fertility and providing draught power, transportation, income and nutrition [3].

Despite decades of appeals for integrated, interdisciplinary and transdisciplinary approaches to surveillance, prevention and health

interventions, the OH developments continue within compartmentalised structural governance and policy frameworks [4,5] and narrow OH concepts and practices dominated by zoonoses [6]. Little attention has been paid to integrating health services across sectors to improve health outcomes, particularly in low-income settings where these services are scarce and often of low quality [7].

Recent initiatives provide promising examples of integrated cross-sectoral approaches to health service delivery for plants, animals, humans and environment. These include the delivery of joint human and animal vaccination campaigns in remote and resource-poor areas [8]. Some countries have included nutrition into the curriculum of agricultural extension agents to address the causes of malnutrition [9]. A recent study from Uganda demonstrated the potential for integrating health services around 'village health teams' as a single point where human, animal and plant health issues can be referred [10]. Another

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example is the combination of public health and veterinary services to control rabies in India [11]. CABI's work with plant clinics¹ over the last 15 years has helped stimulate new ideas on the delivery of farmer services with health benefits beyond plants. By promoting integrated pest management, good postharvest practices and safe use of pesticides, the plant clinics contribute to the health of humans and the environment [12]. Inadvertently, plant clinics have also become a mechanism to establish farmers' demand for advice on animals. In some countries, plant doctors, on an informal basis, regularly answer farmers' queries on animals because often there is no one else to consult [13,14]. Such cross-sectoral health services are under-researched [15].

The purpose of this short communication is to make a case for the integrated crop and livestock service delivery given the governance and market failure problems in the provision of these health care services. The paper examines the current state of joint plant-animal health service delivery through plant clinics in mixed farming areas, to provide a clear understanding of farmers' needs for animal advice and the feasibility of integrating plant and animal health services. Using data from a plant doctor survey and stakeholder consultation, the paper suggests ways to investigate how agricultural support services can be more integrated across the plant, animal, and human divides to improve the health and livelihoods of rural communities.

2. Demand for animal health advice captured at plant clinics

A short survey on the need for advice on animal farming was conducted on 180 plant doctors in five countries (Kenya, Uganda, Zambia, Peru and Costa Rica), in 2016 and 2017. Plant doctors are extension workers, additionally trained on plant health diagnostics, plant healthcare and plant clinic operation. They were asked if they ever receive animal queries at the plant clinic and, if yes, how often and on what problems. They were also asked how they respond to such queries, whether they feel prepared to address them and if there are any animal experts in their organisation that they can consult. Of the 180 plant doctors, 146 (81%) had received animal queries from farmers during the 12 months before the interview, varying from 64% in Zambia to 90% in Kenya (Table 1). The following statement from a Zambian plant doctor represents a common opinion across countries: "Farmers that come to the plant clinic are mixed farmers; they ask anything that affects them."

Around 84% of farmers' animal queries were on poultry, cattle and goats. The rest covered pigs, rabbits and guinea pigs (data not shown). Of the 232 reported animal queries, half were on production, e.g. husbandry, breeding and nutrition, and half on diseases (Table 2, Fig. 1). Of the specific diseases that advice was sought, ticks and tick-borne diseases, Newcastle disease, worms and various parasites were commonest. None of them were specifically zoonoses, although Newcastle disease is a minor zoonosis that can cause conjunctivitis, and potentially worms (particularly tapeworms) and some tick-borne diseases are zoonotic.

The plant doctors were asked how they respond when farmers ask about animals. The answers were almost equally divided between those who refer to someone else and those who provided advice (Table 3). In about half of the cases (52%) the plant doctors referred the farmer to a veterinarian, or an animal health or livestock officer. In 44% of the cases they provided the advice requested or, as some said, 'did their best'. Some did both, as stated by a Kenyan plant doctor: "I gave some basic advice on hygiene and fodder production but in most cases I refer them to veterinary and livestock officers."

¹ Plant clinics are simple rural services with local agricultural extension workers ('plant doctors') offering actionable plant health advice to farmers based on diseased samples brought to the clinic. CABI's Plantwise programme has established networks of plant clinics in over 30 countries in Africa, Asia and the Americas (www.plantwise.org)

Table 1

Responses from plant doctors' on whether they have received animal queries from farmers at their plant clinic.

Country			%	
	No	Yes	No	Yes
Kenya (n = 86)	9	77	10	90
Uganda (n = 51)	12	39	24	76
Zambia (n = 22)	8	14	36	64
Peru (n = 11)	2	9	18	82
Costa Rica (n = 10)	3	7	30	70
Total (n = 180)	34	146	19	81

Source: Plant doctor survey, 2016–2017.

Table 2

Types and frequency of animal queries presented at plant clinics in five countries.

Types of animal queries	# queries (n = 232) ^a	% of all queries
Management/husbandry	48	21
Breeding/reproduction	45	19
Nutrition/feed	22	10
Sub-total, animal management:	115	50
Diseases/health (unspecified)	13	5
Diseases/health (specified) ^b	104	45
Sub-total, animal health/diseases:	117	50

Source: Plant doctor survey in Kenya, Uganda, Zambia, Peru and Costa Rica, 2016–2017.

^a Some plant doctors referred to more than one animal query.

^b Specific queries on animal health problems included: Ticks/tick-borne diseases (20); Newcastle disease (16); worms (15); various parasites (8); mastitis (7); vaccination (7); pox (6); east coast fever (6); diarrhoea (5); foot and mouth disease (5); swine fever (3); bloating (2); flies (2); anaemia (1); bovine tuberculosis (1).



Fig. 1. A farmer (left) asks a plant doctor (right) for advice about poultry. Katine plant clinic, Soroti District, Uganda. (Photo: Solveig Danielsen).

Table 3

How plant doctors responded to animal queries presented by farmers at the plant clinics.

Response	% plant doctors (n = 140)
I referred to a vet/animal health/livestock officer	52
I gave the advice requested/did my best	44
I consulted/programmed a talk with a specialist	4

Source: Plant doctor survey in Kenya, Uganda, Zambia, Peru and Costa Rica, 2016–2017.

Table 4
Plant doctors' responses on their and their organisation's preparedness to address animal problems ($n = 180$).

Question	Responses (%)		
	Yes	No	Somehow
Do you feel prepared to attend animal queries?	20	24	56
Is there someone in your organisation with professional knowledge on animals?	86	14	–

Source: Plant doctor survey in Kenya, Uganda, Zambia, Peru and Costa Rica, 2016–2017.

On some occasions, animal advice was delivered by livestock specialists participating in the plant clinic sessions, as reported by a plant doctor from Zambia: *“Sometimes we have a vet or an animal specialist accompanying during consultations.”*

Over half of the plant doctors (56%) answered ‘somehow’ when asked if they feel prepared to deal with animal queries (Table 4). Plant doctors generally felt better equipped to advise on animal husbandry than on health. A plant doctor from Kenya gave his reason: *“I am trained in general agriculture, animal production included.”* Most (86%) respondents said that there was someone in their organisation with professional knowledge of animals (Table 4).

A quarter of the plant doctors found it challenging to meet the farmers' demand for advice, as illustrated by a Kenyan respondent: *“Farmers think the plant doctors know everything”*. Another Kenyan plant doctor expressed his frustration as follows: *“At times because of the costs of travelling to seek professional advice, farmers feel disappointed when you tell them you can't help them.”*

Most plant doctors (70%) approved of the integration of animal advisory services into the plant clinics (i.e. plant-animal or crop-livestock clinics). They recommended the following actions to make it happen: 1) train plant doctors in animal husbandry and health, 2) provide plant doctors with factsheets and photo sheets on animal health and management, 3) integrate livestock officers/veterinarians/animal health workers into the operation of the clinics, and 4) provide expert support including laboratory referrals.

3. Towards more integration of health services

The survey demonstrated a large unmet demand for advice on livestock in the selected countries. This agrees with the findings of the Platform for Agricultural Risk Management (PARM), which identified livestock pests and diseases among the most severe agricultural risks in Uganda [16], yet animal health services are understaffed, particularly in remote areas, and of insufficient quality [17]. Only few queries were on zoonoses in our survey, despite that endemic zoonotic diseases (such as leptospirosis, cysticercosis, tuberculosis, rabies, leishmaniasis, brucellosis) are estimated to cause more than 2.2 million human deaths globally and 2.4 billion cases of illness annually, and disproportionately affecting the poor in the Global South [18]. This suggests a limited awareness on zoonotic diseases among farmers and possibly among extension workers. Improving advisory services on animal disease prevention and control (vaccination, parasite and tick control, and hygiene) and on animal production (nutrition, breeding, and husbandry) would improve not only productivity and household incomes, but also human health, directly benefiting farming communities and consumers of animal products.

Joint delivery of plant and animal health advice is currently happening at plant clinics, but is under-documented. In Peru, there are examples where joint delivery of animal and plant advice has become a normal part of plant clinic operations [19]. In Kenya and Uganda, several plant doctors reported that they were also trained in animal

health and production extension, enabling them to answer livestock questions, to some extent. The fact that most plant doctors would like animal advisory services integrated into the plant clinic to better respond to farmers' needs shows that for extension workers, the crop-livestock connection is obvious and already part of their work. The survey shows that the existing individual and institutional knowledge and capacity on animal production and health is probably underused (Tables 3 and 4).

3.1. Setting up and evaluating crop-livestock clinics

A number of aspects need critical consideration before including livestock health and production advice into ‘crop-livestock clinics’: 1) re-aligning existing animal and crop advisory systems and taking into account their roles and modes of operation; 2) legal and regulatory frameworks; 3) capacity (technical, organisational); 4) data/information management; and 5) quality assurance. The specific country contexts vary greatly. For example, in some countries community animal health workers (CAHW, sometimes referred to as para-veterinarians) are a formal part of the extension system, while in others such a cadre of staff is illegal. In some countries extension workers are trained to give advice on both crops and animals, while in others, livestock and agricultural advisors have distinct roles. These organisational and structural challenges need to be addressed first in each country.

The practical aspects of the crop-livestock clinic operations should also be considered. Due to considerations of animal welfare and spread of disease, it would probably not be appropriate for sick animals to be brought to the clinics in the way that plants specimens are, to mention one example. The boundaries of the crop-livestock clinics would need to be clearly defined: What would be expected of the extension workers (crops and livestock) in a particular setting? Where to draw the line between animal production and animal health advice? What capacities (including laboratory) are needed? What are the referral options in case the extension worker cannot manage a query? How could crop-livestock clinics contribute to existing disease surveillance networks for plants and livestock animals? Are there also synergies with human health services and systems that could be explored? And finally, do integrated crop-livestock clinics serve rural communities better compared to single sector approaches?

3.2. Uganda – a good place to start

In December 2017, CABI and the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) of Uganda organized a multi-stakeholder workshop to explore opportunities for joint plant-animal health service delivery. The participants, consisting of academia, public, private and civil society representatives from the agriculture and livestock sectors, identified Uganda as a suitable place for piloting ‘crop-livestock clinics’ as an innovative approach.

There are several reasons why Uganda is considered a ‘low hanging fruit’ for this trial: 1) The unmet demand for animal health services is high [16]. Mixed farming systems are prevalent among Ugandan small-scale farmers and in some areas, livestock is a vital high-priority commodity. However, veterinary and livestock husbandry and extension services are scarce and often without adequate regulation and supervision [20]; 2) Uganda's National Agricultural Extension Policy from 2016 promotes a unified, pluralistic approach to extension to address the limited human resource at sub-county level and enable the diverse needs of farmers (crops, livestock and fisheries) to be addressed at once. The current organisational structure of the Ugandan extension system, with a crop and a livestock officer assigned to each sub-county, is conducive for developing joint crop-livestock services. Moreover, every sub-county has a health unit for humans [21]; 3) Approximately 90 of the 131 District Local Governments in Uganda have operational plant

clinics that run from time to time (mostly one clinic per district but can be as many as five in some districts).² Some of them already have experience with informal provision of animal advice at plant clinics and want to formalise it [22]; 4) Uganda hosts the One Health Central and Eastern Africa (OHCEA³) initiative, thus providing a supportive platform for experimentation, discussion and analysis. In some districts, e.g. Hoima, OHCEA has facilitated cross-sectoral human and animal health actions to address the serious problems with zoonoses.

The stakeholder workshop emphasised the need for the pilot study to address the longstanding governance challenges in agricultural and veterinary service delivery [23,24]. The joint service should not be seen to compete with private veterinary practices, where they exist, and must comply with the Veterinary Surgeons Act (1958). Recent studies highlight the considerable potential of enhancing the quality and coverage of animal health services by strengthened co-operation between veterinarians and para-professionals [20,23] and provide valuable guidance for further evaluation.

Although the structure of the Ugandan extension system is favourable to innovation, the workshop participants strongly recommended that the new clinic models should be aligned with the national extension policy and the legal and institutional framework for crop and animal production and health. One Health interventions are often obstructed by institutional barriers and disciplinary silos, both at central and local levels: this could also occur when integrating crop and livestock services.

We plan for wider consultation with stakeholders, for their perspectives and ideas on how to develop plant clinics into 'crop-livestock clinics' in selected districts, including how they should relate to public health services. Finally, when trialling the 'crop-livestock clinics' it will be important to assess, qualitatively and quantitatively, the performance of the integrated services against single sector approaches.

4. Conclusion

It has been known for some time that plant clinics, at least in some countries, frequently receive queries about animal production and health. The results of this survey show the potential of using synergies between plant and livestock health services. The sectoral approach to service delivery often does not match farmers' diverse needs.

Therefore, development partners, policy makers, service providers, and researchers should focus on testing and developing models for the integration of farmer services to reduce operational costs and make better use of existing capacities to support farmers with a 'one stop clinic'. The trialling of crop-livestock clinics in Uganda would require training needs assessment and capacity building of extension workers, development of operational guidelines, information support, links to experts and referral systems, adjustments of work flows, and, most importantly, organisational capacity and leadership to take on the new role.

The human health sector should also be brought on board to streamline the intervention towards maximising human health outcomes through better zoonoses control, food safety and security, nutrition and biosecurity and -safety. The evaluation of the performance would serve to show that integrated service delivery is also important to One Health.

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Conflict of interest statement

None.

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² The system for recording plant clinic activity is under development, hence the exact number of plant clinics is not known.

³ One Health Central and Eastern Africa: <http://ohcea.org/>

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