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BENEFIT TO END USERS: APPRAISAL OF EXTENDING TECHNOLOGY AT FARM FIELDS FROM REGIONS OF HIMACHAL PRADESH, INDIA

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KEYWORDS

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ABSTRACT

Tick infestation is a major problem affecting farm animals and the problem is acute in hilly regions. Livestock owners who own small herd for their sustenance, food security find it difficult to seek alternative options. Demanding physical work and lack of interface with institutions hinders their imagination thereby any new measures of control. The collaborative work of National Innovation Foundation-India and Dr G C Negi, College of Veterinary and Animal Sciences, Palampur Himachal Pradesh resulted in sharing a model of exchanging technical know-how from research station/University system to farm field. The study had noticed that rate of infestation at predilection site was 10.90 ± 6.84 ($\bar{X} \pm \alpha$) number of ticks. The data were analyzed statistically using paired 't' test. The calculated value of $t_{0.05}$ for 20 d.f was 6.89 (at 24 hour); 5.78 (at 48 hour) intervals was more than 't' table value ($t_{0.05, 20} = 2.08$) confirming significant efficacy of indigenous medication. It was found that herbal medication had shown 75 percent efficacy over tick infestation upon second day of administration. These *in-situ* herbal preparations which can be prepared at farmers field needs to be diffused for benefit of livestock owners. Sustaining environment friendly technology is paramount and is more imminent in Hilly regions. The research work demonstrated importance of leveraging animal husbandry department for technology demonstrations.

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1 Introduction

Ectoparasitic infestations are detrimental to animal health and welfare. Synthetic acaricides had resulted in problems of resistance and concern over environmental contamination. The use of technologies, where majority of them were synthetic acaricides, these are harmful to surrounding, human being handling farmstead. It is compounded by the fact that in control of tick farmers did not possess adequate knowledge, poor quality veterinary service and lack of suitable drugs (Byaruhanga et al., 2015). These impacts are always multidimensional and difficult to frame with suitable policy response (Rich & Perry, 2011). It is an urgent step to identify and share cost-effective and environment friendly technologies to farmers. Growing concern for agricultural sustainability necessitates relooking farming systems (Papendiek et al., 2016). Majority of farmers in developing countries rely on subsistence farming, wherein they engage livestock as source of income and food security (Larsen & Lilleor, 2014).

Recent times for enabling inclusive growth, agriculture sector and women development has been noted with interest (Sraboni et al., 2014). Tendency of farmer to take up these measures depend on their knowledge (Diab, 2015). Several efforts were made to develop medication through herbal practices, however seldom these knowledge reach to farmers' field. Farmers did not perceive benefit of technology and unable to seek site specific requirements (Latynskiy & Berger, 2016). Ecological complexity of tick in farmers field need to be visualized while strategizing treatment (Porter et al., 2010). The movement of technology from lab to field has been a challenge and innovative ways have to be identified. One of such method is to locate ecosystem based approach for suitable adaptation (Vignola et al., 2015). These observations are pertinent as farmers' behaviour, norms of society and level of poverty influence in uptake of these activities (Meijer et al., 2015). Further, unsustainable practices in ecosystem limit production potential and farmers face difficulties (Baig et al., 2013). Strategies have to be developed for enhancing conservation agriculture between adopters and promoters (Bhan & Behera, 2014).

1.1 Transfer of technical knowhow at farmers' field

Social issues and technological challenges have to be addressed for effective program (Sambo et al., 2015). Farmers face negative consequence owing to incompatible technological alternatives that reduce their enthusiasm in livestock farming. Timely intervention by livestock service institutions encourages farmers for farming activities (Athilakshmy & Rao, 2013). On farm demonstrations creates a more relaxed, informal setting for dissemination and evaluation of knowledge. An eight step model for large scale on-farm experimentation was shared along with nature of response by society that moved from individual centric to group/community orientation (Ravikumar et al., 2016a). This hastens the progress in terms of transfer, application of

knowledge. Complex interaction at the locale of knowledge utilization has to be understood for suitable decision making process at farm level (Karali et al., 2011). Technologies led by farmers through demonstration at their locale may be derived based on understanding their strength, unearthing process at different stakeholders of implementation (Bellotti & Rochecouste, 2014). Peer group pressure innovation model in eliciting and sharing new knowledge during interactive meeting with knowledge holders were shared in livestock health system (Munda et al., 2016). Such measures of intervention have to be merged with health care system of livestock (Ravikumar et al., 2016).

In exercising control over ectoparasite infestation farmers rely on animal husbandry department, which is constrained with budget, hence limited role has been provided (Ndhlov & Masika, 2013). Moyo & Masika (2009) referred that more than 94 percent of farmers in their study region referred medication provided by government were not effective in control of ticks (Moyo & Masika, 2009). Herbal therapeutic methods can offer cost effective, integrated tick management methods (Ghost et al., 2007). However, management of technologies like vaccination, chemical acaricides and other methods pose challenge to research for translating to actual practice (Willadsen, 2006). Industries and veterinarians did not recognize farmers experimentation and it is essential to look into such innovations for quality livestock health care (Mugabi et al., 2010). The major effort is to persuade planners, veterinarians and farmers towards adoption of site specific implementation steps in control of tick infestation (de Castro, 1997). Further, technology adoption depends on support, knowledge and to overcome difficulties at local needs, enhance investment in skill of livestock owners (Zander et al., 2013).

The study was proposed and conducted to demonstrate low or no cost locally available technological solutions with help of state animal husbandry department. Demonstration of such technical know-how emerged from research system has to be implemented for large scale diffusion, adoption of sustainable technologies. The study shared nature of impact of these medications at farmers' field and an implementation model to advance such solutions to end users.

2 Material and Methods

The study was conducted during rainy season at three different farms located at Kangra district of Himachal Pradesh, India during the year 2014. These three farms were identified and selected after consultation with veterinarians from state animal husbandry department of the region. These farms were selected in the regions of Bhawarna, Birand organic dairy farm, CSKHPKV Palampur at Kangra district of Himachal Pradesh State, India. Large ruminants of cattle species with heavy infestation as per information by livestock owners were taken up for experimentation. A total of eight animals clinically infested with tick infestation were purposively selected. General observations of these animals revealed

different predilection site for tick infestation. Live ectoparasite was randomly collected from selected animals for parasitic examination and confirmation at Dept of Veterinary Parasitology, College of Veterinary Science, Palampur. Ticks were collected by hand picking method from various animals and thoroughly searched to collect the larva, nymph, and adult ticks. Total of five minutes were spent in collection of ticks on each animal. Ticks collected were preserved in 70% alcohol and identified in the laboratory using standard identification keys. The nature of tick attachment was counted and percent efficacy was calculated as per Ravikumar et al. (2015). Animals were observed for two day duration by research team. The information were codified and statistically analyzed using 't' test (Gupta, 2000). The study also shared an implementation model for a technology from research system to farmers' field with help of state animal husbandry department.

2.1 Confirmation of tick infestation and preparation of polyherbal spray:

Examination of tick confirmed that animals in the high altitude regions were infested with *Rhipicephalus (Boophilus) Sp.*. The study confirms hard tick infestation among experimental animal population. Research team had shared method of preparation of aherbal medication to veterinary officers, livestock owners with help of trees that were known traditionally.

The tree used, namely neem (*Azadirachta indica A Juss*) had acaricide property against various stages of tick lifecycle (Abdel-Shafy and Zayed, 2002). Leaves of Monks pepper (*Vitexnegundo L.*) had shown effect on egg hatchability of ticks (Singh et al., 2014). The medication was prepared by collecting 2.5 kg fresh leaves of neem (*Azadirachta indica A Juss*) and 1.0 kg fresh leaves of monks pepper (*Vitexnegundo L.*). Each of these plant materials were kept in 4 litre and 2 litre lukewarm water overnight respectively so as to allow collection of crude extract.

Table 1 Efficacy testing- Insitu Herbal medication to minimize tick infestation

SN	Animal	Site	Day 0 (Before Medication)	After 24 hours	After 48 hours
1	C-1:BHA:Right side- Jersey crossbred	Dewlap Top	11	8	3
2	C-1:BHA:Right side	Dewlap Middle	15	12	3
3	C-1:BHA:Right side	Dewlap Bottom	30	19	7
4	C-1:BHA:Left side	Middle Jugular	11	9	3
5	C-1:BHA:Left side	Rear Udder	10	5	2
6	C-2:BHA:Right Side- Jersey Cross bred	Dewlap	25	13	5
7	C-2:BHA:Left Side	Dewlap	9	5	2
8	C-2:BHA:Left Side	Rear Udder	10	6	2
9	C-3:BIR:Holstein Calf: Male	Perineal area	11	4	3
10	C-4:BIR:Holstein Cow-Heifer	Left hind thigh	7	5	2
11	C-5:BIR:Jersey-Heifer	Left Thigh	13	9	3
12	C-5:BIR:Jersey-Heifer	Perineal region	4	2	1
13	C-5:BIR:Jersey-Heifer	Right Thigh	5	3	1
14	C-6:BIR:Black-Cow-NIA-24902	Rear Udder	10	7	3
15	C-6:BIR:Black-Cow-NIA-24902	Perineal	12	8	4
16	C-6:BIR:Black-Cow-NIA-24902	Right Dewlap	12	7	3
17	C-6:BIR:Black-Cow-NIA-24902	Right Neck	5	4	2
18	C-6:BIR:Black-Cow-NIA-24902	Left Neck	18	12	6
19	C-7:Organic farm-csk-Darkbrown	Right Dewlap	3	1	1
20	C-8:Organic farm-light brown	Right Hind limb	3	0	0
21	C-8:Organic farm-light brown	Left Dewlap	5	1	1
Sum(Σ)			229	140	57
Mean $\pm$ Standard deviation ($\bar{X} \pm \alpha$)			10.90 $\pm$ 6.84	6.67 $\pm$ 4.64	2.71 $\pm$ 1.71
Standard error			1.49	1.01	0.37
% efficacy				38.81	75.14

This supernatant fluid has to be collected, stored in normal temperature. About 300 ml from neem crude extract, 100ml of monks pepper crude extract need to be mixed in 3600 ml of normal water (3:1 ratio) to make 4 litre preparation. The prepared medication was topically applied over affected site of animal two times daily and observed for impact.

3 Results and Discussion

3.1 Efficacy testing- Insitu Herbal medication to minimize tick infestation

The study found that selected animals were infested at each predilection site with 10.90 ± 6.84 ($\bar{X} \pm \alpha$) number of ticks (Table 1). Tick burden above 10 and up to 50 in number on an animal were classified as moderate by Byaruhanga et al. (2015a). These observations infer that tick infestation is a major problem and cause huge animal welfare constraints in the study region. This is in concurrence with the findings of Thakur et al.

(2012). Raza et al. (2014) share that pastoralists use several plant based medications as they find it difficult to afford conventional medications. Hence studies call for alternative approach wherein farmers can assess and use medications for large scale adoption (Ravikumar et al., 2016). Technologies need to be integrated in farming system and experience of earlier intervention have to be taken into account while sharing technology with farmer (Fitzpatrick, 2013). Further, these parasites develop resistance and strategies to control these developments were gaining attention (Cruz et al., 2015). It was also noted that allopathic medications that had shown effective in adult immersion technique did not exhibited same therapeutic efficacy in field (Correa et al., 2015). It was found that medication had provided relief and shown up to 75 percent efficacy by 48 hours of topical application. Recurrent infestation of tick has been a concern hence it is appropriate to take up medications which are suitable to use and develop less resistance in field.

Table 2 Paired 't' test: Before vs 24 hour interval after application of natural medication

SN	Animal	Site	Day 0 (Before Medication)	After 24 hours	2nd -1st (d)	d*d
1	C-1:BHA:Right side- Jersey crossbred	Dewlap Top	11	8	-3	9
2	C-1:BHA:Right side	Dewlap Middle	15	12	-3	9
3	C-1:BHA:Right side	Dewlap Bottom	30	19	-11	121
4	C-1:BHA:Left side	Middle Jugular	11	9	-2	4
5	C-1:BHA:Left side	Rear Udder	10	5	-5	25
6	C-2:BHA:Right Side- Jersey Cross bred	Dewlap	25	13	-12	144
7	C-2:BHA:Left Side	Dewlap	9	5	-4	16
8	C-2:BHA:Left Side	Rear Udder	10	6	-4	16
9	C-3:BIR:Holstein Calf: Male	Perineal area	11	4	-7	49
10	C-4:BIR:Holstein Cow-Heifer	Left hind thigh	7	5	-2	4
11	C-5:BIR:Jersey-Heifer	Left Thigh	13	9	-4	16
12	C-5:BIR:Jersey-Heifer	Perineal region	4	2	-2	4
13	C-5:BIR:Jersey-Heifer	Right Thigh	5	3	-2	4
14	C-6:BIR:Black-Cow-NIA-24902	Rear Udder	10	7	-3	9
15	C-6:BIR:Black-Cow-NIA-24902	Perineal	12	8	-4	16
16	C-6:BIR:Black-Cow-NIA-24902	Right Dewlap	12	7	-5	25
17	C-6:BIR:Black-Cow-NIA-24902	Right Neck	5	4	-1	1
18	C-6:BIR:Black-Cow-NIA-24902	Left Neck	18	12	-6	36
19	C-7:Organic farm-csk-Darkbrown	Right Dewlap	3	1	-2	4
20	C-8:Organic farm-light brown	Right Hind limb	3	0	-3	9
21	C-8:Organic farm-light brown	Left Dewlap	5	1	-4	16
Sum (Σ)			229	140	-89	537
t value= 6.89 at n-1= 20; t table value = 2.086 5 percent level of significance						

Table 3 Paired t test: 24 hr vs 48 hour interval after application of natural medication

SN	Animal	Site	After 24 hours	After 48 hours	2nd-1st (d)	d*d
1	C-1:BHA:Right side- Jersey crossbred	Dewlap Top	8	3	-5	25
2	C-1:BHA:Right side	Dewlap Middle	12	3	-9	81
3	C-1:BHA:Right side	Dewlap Bottom	19	7	-12	144
4	C-1:BHA:Left side	Middle Jugular	9	3	-6	36
5	C-1:BHA:Left side	Rear Udder	5	2	-3	9
6	C-2:BHA:Right Side- Jersey Cross bred	Dewlap	13	5	-8	64
7	C-2:BHA:Left Side	Dewlap	5	2	-3	9
8	C-2:BHA:Left Side	Rear Udder	6	2	-4	16
9	C-3:BIR:Holstein Calf: Male	Perineal area	4	3	-1	1
10	C-4:BIR:Holstein Cow-Heifer	Left hind thigh	5	2	-3	9
11	C-5:BIR:Jersey-Heifer	Left Thigh	9	3	-6	36
12	C-5:BIR:Jersey-Heifer	Perineal region	2	1	-1	1
13	C-5:BIR:Jersey-Heifer	Right Thigh	3	1	-2	4
14	C-6:BIR:Black-Cow-NIA-24902	Rear Udder	7	3	-4	16
15	C-6:BIR:Black-Cow-NIA-24902	Perineal	8	4	-4	16
16	C-6:BIR:Black-Cow-NIA-24902	Right Dewlap	7	3	-4	16
17	C-6:BIR:Black-Cow-NIA-24902	Right Neck	4	2	-2	4
18	C-6:BIR:Black-Cow-NIA-24902	Left Neck	12	6	-6	36
19	C-7:Organic farm-csk-Darkbrown	Right Dewlap	1	1	0	0
20	C-8:Organic farm-light brown	Right Hind limb	0	0	0	0
21	C-8:Organic farm-light brown	Left Dewlap	1	1	0	0
Sum (Σ)			140	57	-83	523
t value= 5.789 at n-1= 20; t table value = 2.086 5 percent level of significance						

3.2 Efficacy testing of formulation

The calculated value of $t_{0.05}$ for 20 d.f was 6.89 at 24 hour after administration of medication (Table 2). Further upon examination of these affected sites at 48 hour interval, $t_{0.05}$ for 20 d.f was found 5.78 (Table 3). This was more than table value ($t_{0.05, 20}=2.08$) thereby confirming efficacy of indigenous medication at farmers' field. The indigenous medication comprising neem and nagod ingredients which commonly used for controlling tick infestation. These preparation made in a desired composition had shown relief to naturally affected animals with hard tick. Such program were of strategic important as legislation enacted, awareness led to reduced use of pesticide, adding to more occurrence of ectoparasite (Taylor, 2012).

3.3 Framework for implementation of technical-knowhow in livestock science

Agriculture including livestock sector has been compounded with adoption of technological practices over period of time. Field trials and networking between various stakeholders can promote demand driven and need based technology trials.

Identification of village units of demonstration was enabled with help of veterinary department in the study region. This had reflected the requirement of service provider in seeking other forms of medication so as to meet challenges faced by community in front of them. There is minimum alternative available to line departments to experiment and to be part of technology generation system. The study had reiterated relevance of close coordination between research/university systems with service provider which helps in effective utilization of site specific technologies. Location specific technological alternatives have to be shared with farmers and animal husbandry department has to be critical component of such demonstration program. This will enhance the scope of farming system in addressing imminent disease threats thereby food security in sustainable manner. Veterinary drugs were referred to cause environmental pollution (Bartikova et al., 2016) and it is essential to reinforce medications that are non-toxic, natural.

In this respect, line departments have advantage of familiarity and trust with society of their jurisdiction. Their support in mobilization of community during technology utilization can be significant. Moreover, it helps large network of animal

husbandry institutions to be actively involved in research system. Further, communities recognize technologies which are suitable to their adaptation primarily reflecting “ecosystem based locale approach”. Technologies originated elsewhere increase unsustainability and pose severe challenge to farmers. Thus farmers have to be presented with necessary options for which state animal husbandry department is better positioned. University research system need to recognize it and efforts need to be advocated for development of social skills among resource personnel's. Participatory research with farming community need to be strengthened for scaling up of low cost locally available indigenous technologies (Ghorai et al., 2016). There is also a wider perception that conventional medications can work faster than indigenous system which threatens adoption and utilization of indigenous system. The asymmetric model of technology provision only from outside resulted in insurmountable challenge at farmers' field. Under such circumstances, the present model may be a way forward to establish nature of linkage among different actors. This will essentially help in generation as well as diffusion of livestock technologies that work on a mass scale.

Conclusion

The study illustrated importance of dialogue between livestock research institutions and livestock owners for enhancing scope of technological alternatives. These low or no cost indigenous technologies had proved to be significantly effective to minimize tick infestation. The study also demonstrated an “insitu incubation model” for technology transfer and such capabilities needs to be strengthened for meaningful, sustainable welfare at farm field. Natural ingredients whose properties were known by community did not receive much attention in mainstreaming them through established line departments.

The study also reiterates that in tick control, technologies need to reflect self-sustenance method at farmers' field. These natural medications derived from indigenous knowledge system can minimize risks, cost effective and limit tick recurrence to ecologically acceptable level. The experimentation share an alternative model for technology generation and provided valuable insights in disease control strategies.

Conflict of interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

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