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Practice and Development of Agricultural Seed Management Technology in the Hilly Areas of Eastern Nepal

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Abstract

The use of new technologies in agricultural sector is the contemporary global concern issue. This study attempts to explore about the practice and development of seed management technology in the eastern hilly areas of Nepal including the analysis of major reasons and accociated problems. Moreover, it also seeks the perception of farmers towards this technology. In addition, the study applied household questionnaire survey, key informant survey and focus group discussion with local farmers in to collect relevant information. The household survey conducted in 20 percent (190hss) in total (601hhs) of the study area ranging from 250 to 1500 masl along the Koshi-highway.The relevant published and unpublished documents: previous research journals, books, dissertations and official records were also reviewed as secondary sources of information for this paper.

This paper has showed that the technology is well known for the protection and promotion of both crops and vegetables farming in the study area. More than 78 percent (150hhs) farmers are using this as a useful and profitable technique. Despite various problems, the practice of this technology is gradually increasing in this area and the maximum practice is concentrated with vegetable farming. Although it was introduced through the inspiration of local research centers at first time, the role of neighbours, friends and television programs seems to be significant respectively in its development and expansion in the study area. This technology is the choice of the farmers and the majority of the farmers are in fovor of the development and expansion of the technology.

Keywords:*, adoption, diffusion, emergence, practice, seed management*

Introduction

Seed treatment is a biological, physical and chemical technique which is used in agriculture to enhance the quality of seeds and seed germination test refers the maximum germination potential or viability of the particular seed. Both techniques are considered as the mainstay of good seed management. Apart from this, the use of such technologies depends on the technical knowledge of the farmers as well as economic condition (Wagle, 2019). Because of knowing the germination rate of particular seed lot is key to understanding how

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well that seed will perform in the real field. Farmers can use this information to decide whether the seed they have will produce a decent crop, calculate the best seeding rate, or whether the seed should be used at all. Beside this, the seed treatment is a chemical, typically antimicrobial or fungicidal, with which seeds are treated prior to planting (NPC, 1995).

Seed germination test can find out the quality or status of particular seed. If tested and qualitative seed is used in the farm, better harvest can be realized, input wastage can be minimized and more income can be generated from the investment (Pathak, 2010). Seed treatment protects the seeds from diseases and also improves the germination capacity. If seed is treated before use it may provide good harvest and less wastage of inputs. Most of the farmers in the eastern hilly areas of Nepal have been using already tesed improved seeds but they seem willing to produce improved seeds using new technologies at present. In addition, some farmers have used this technology in the production of local varieties of seeds (Wagle, 2019). Although this technology is very useful to get maximum output from the agricultural works, so far not much analysis has been done in this regard.Considering this fact, the paper attempts to analyze the practice, development and related problems of this technology in the context of the hilly region of eastern hills.

Materials and Methods

This study is basically based on primary data collected from the field survey from January 1st to 31 in 2020. Experience field surveyors including myself were involved in this work. Three focus group discussions (FGD) and the same number of key informant interviews (KII) were carried out at least one from each ecological belt out of two belts by representing various sectors of farmers i.e. age sex, ethnicity, education and occupation focused on knowledge, attitude and practice of the farmers related to this technology. There were five to eight farmers in each focus group discussion and long and open interviews were taken for key informant interviews. An interview guideline was prepared for the purpose of key informants' interviews. Moreover, an observation sheet was also used during the field survey observation so all tangible phenomena could be recorded by the researcher.

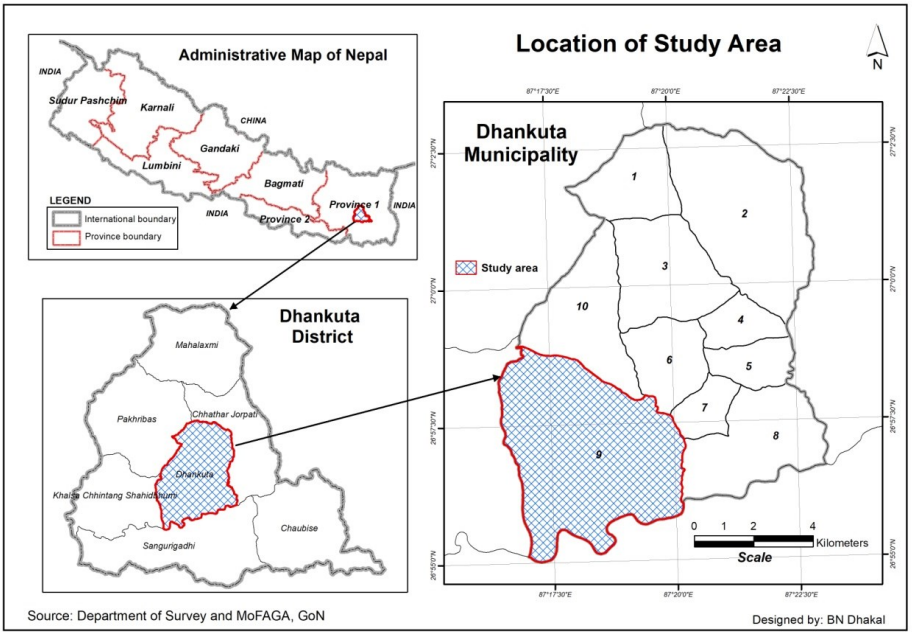
Household survey was conducted using pre-structured questionnnare sheet. Seven study centers Mulghat, Belahara, Guthitar, Rudrabari, Belhara Besi, Sawabari and Mahang were selected respectively as samples purposively which are known as the major settlements of this area. Nearly, 20 percent (190hhs) farm households were selected from those settlements out of the total 943 numbers having more than 0.50 hectare land by using stratified random sampling method.

Among the total sample farmers, more than 78 percent (150hhs) are using this technology for their agricultural works at present. Required secondary data were collected through various books, journals, dissertations and official records. Simple stistical tool percentage is used for the analysis of collected data. A descriptive paper is prepared through the help both quantitave and qualitative analysis of the relevant data. The whole study of this paper is based on the *State- impact process* derived from Pradhan &Pradhan (2006).

Study Area

Dhankuta municipality is a hillly town located in the Mahabharat range of eastern Nepal. It is bounded by Chhathar Ruralmunicipality on the east, sahid Bhumi Rural municipality on the west, Pakharibas Munucipality on the north and Sangurigadhi Ruralmunicipality on the south. It is situated in the central part of Dhankuta district which is one of the major local bodies among the seven local bodies of the district. Geographically, the municipality covers an area of 26^0 55' 4.8" to 27^0 2' 56.4" north latitude and 87^0 16' 16.5" to 87^0 22' 58.5" east longitude, with a total area of 110.80 square kilomerers. It is extended at an altitude of 250 meters to 2144 meters above the sea level. Although most of the area of this municipality is covered by sloppy land, there is also the existence of flat land in the southern part which is called *'Besi'*. *Belahara Besi* is known as the famous basin of this municipality. The temperate monsoon climate is found in most parts of the municipality but sub-tropical climate is also existed in some parts of the southern belts. The maximum temperature of this area recheas 32^0 in June and the minimum temperature is found around 3^0 in January. Similarly, the average rainfall in this area ranges from 1000 millimeters to to 1200 millimeters. This municipality is known as a settlement of various casts and religions. Ksaetri, Athapariya, Rai, Brahmin, Newar, Tamang, Magar, Limbu, Thakuri, Sherpa, Gurung and dalits etc are the main inhabitants of this area and their main occupation is agriculture. Mainly the Koshi Highway connects Dhankuta with other areas of the country while the agricultural areas are linked by various agricultural roads network with main road. The total population of this municipality is 36619 in which 17167are male and 19452 are female. (Dhankuta Municipality, 2018).

Figure 1



The main study area ward no 9 is located in the south-western part of this municipality. This ward has two types of land: *Sloppy and Basin* with an area of 29.99 square kilometer. The basin area of this ward has a sub-tropical climate while the steep area has a

temperate climate. Mulghat, Belahara, Guthitar, Rudrabari, Belhara Besi, Sawabari and Mahang are known as the major settlements of this area. Likewise, Patle Khola, Dhankuta Khola, Ruduwa Khola, Fongsuwa Khola and Tamor River are the main sources water. This area is connected to the Koshi Highway through the various agricultural roads.There are 2149 male and 2097 population out of the total 2149 inhibitants of this ward (Dhankuta Municipality, 2018).

Results and Discussion

Emergence, Development and Practice

Considering the historical development of this thechnolgy in eastern hill of Nepal, the technology was first introduced in the region around 1972 under the leadership of the then Pakhribas Agriculture Development Center. The technology was introduced through this center with the objective of making the then ex-Gurkha soldiers self-reliant. After that, the technology has been gradually expanding into the Dhankuta Municipality area in the 1990s (Wagle, 2019). Moreover, data from the field survey (2020) show that this technology has expanded extensively in this area after 1990s (Table, 1).

Table 1: *The Development and Practice of Seed Management Technology in the Study Area (in hhs)*

Years	Number	Major Settlements							Total
		Mulghat	Belahara	Belhara Besi	Rudrabari	Guthitar	Sawabari	Mahang	
1981 - 1990	Number	4	4	4	4	4	4	5	**29**
	Percent	2.67	2.67	2.67	2.67	2.67	2.67	3.33	**19.33**
1991 - 2000	Number	8	20	5	14	16	9	2	**74**
	Percent	5.33	13.33	3.33	9.33	10.67	6.0	1.33	**49.33**
2001 - 2010	Number	10	4	8	4	4	4	4	**38**
	Percent	6.67	2.67	5.33	2.67	2.67	2.67	2.67	**25.33**
2011-2020	Number	1	1	2	0	0	4	1	**9**
	Percent	0.66	0.66	1.33	0	0	2.67	0.66	**6.0**
Total	**Number**	**23**	**29**	**19**	**22**	**24**	**21**	**12**	**150**
	Percent	**15.33**	**19.33**	**12.67**	**14.67**	**16.00**	**14.00**	**8.00**	**100**

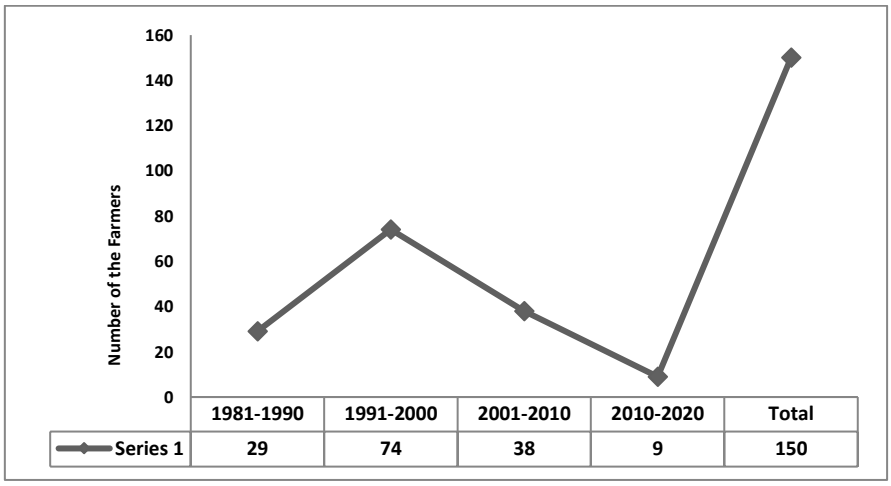
Source: Field Survey, 2020.

In addition, the field survey data (2020) has made it clear that almost all the farmers of this area are familier with this technology including non- adopters. Moreover, it also

indicates that more than 80 percent (121hhs) farmers are using this technology in their off-season vegetables and only 40 percent (60hhs) farmers are used it for maize cultivation but it does not seem to be used in paddy farming. The local elder farmers have reported that few farmers had used this technology in this area before 1981 through the inspiration of the then Pakharibas Agriculture Center (PAC).

Table 1 shows the historical process of this technology diffusion. The figure indicates that around 20 percent (29hhs) farmers have started to practice of this technology in the period of 1981 to 1991 for their agricultural works. This practice has reached a peak point from 1991 to 2000. More than 49 percent (74hhs) new farmers have started to use this technology at this period. Since then, the growth rate of the adopter farmers has been gradually declining. Only around 25 percent (38hhs) new farmers are added during the years of 2001 to 2010. Similarly, the data shows that only 6 percent (9hhs) new farmers have started using this technology from 2011 to till now. Thus, 150 household farmers are continuining this technology at present out of the total 190 farmers of the study area. In this way, the adoption trend of this technology seems slow at first, rapid in the middle and after that gradually decreasing (Figure, 2).

Figure 2; *Practice of Seed Management Technology (in hhs)*



Source: Field Survey, 2020.

In addition, the road network plays an important role in the practice and expansion of new technologies (Wagle, 2019). Taking this fact into mind, the study also attempts to analyze the relationship between the use of this technology and distance from the Koshi highway network (Table, 2).

The Koshi Highway, known as the lifeline of eastern Nepal, passes through the eastern part of this area. Moreover, the area is also connected to the Koshi Highway through various agricultural roads' network but these roads are not able to provide reliable service during the rainy season (Wagle, 2019). As a result, the practice of this technology seems to be declining as the distance increases from the main road.The degree of variation in practice of this technology in terms of distance from the main road is shown in the Table 3.2. The figure shows that more than 35 percent (53hhs) adopter farmers reside along the distance of 500 meters from the headway links. Similarly, almost 33 percent (50hhs) farmers settle in

the distance of 500 to 1000 meters away from form the main road. Likewise, around 32 percent (47hhs) users live beyond the distance of 1000 meters.

Table 2:*Practice of Seed Management Technology from the Distance of Highway Links (in hhs)*

Distance (In meters)	Number	Years				Total
		1981 - 1990	1991 - 2000	2001 - 2010	2011+	
<= 500	Number	13	20	16	4	**53**
	Percent	8.67	13.33	10.67	2.67	**35.33**
501 - 1000	Number	8	32	5	5	**50**
	Percent	5.33	21.33	3.33	3.33	**33.33**
1001+	Number	8	22	17	0	**47**
	Percent	5.33	14.67	11.33	0	**31.33**
Total	**Number**	**29**	**74**	**38**	**9**	**150**
	Percent	**19.33**	**49.33**	**25.33**	**6**	**100**

Source: Field Survey, 2020.

Key Sources of Practice and Development

The role of media is important for the spread of new knowledge in any particular political or geographical area (Wagle, 2019). Various media play an important role in the development and expansion of new technology (Pathak, 2010). The local key informants and elite farmers have informed that this technology is broadly accepted and widely diffused in this atrea through the help of various print and electronic media, persons and institutions. The joint effort of the neighbors, research centers, friends and television programs seems remarkable to make this technology broadly acceptable in this area (Table, 3).

According to the local elite farmers, the technology originated in the study area from Agricultural Research Station, Pakharibas (ARSP) at first but, the data acquired from the field survey indicates that the role of neighbors is decisive in its development and expansion. The data of the Table 3 shows that more than 56 percent (85hhs) farmers have moved towards the use of this technique through the communication of their neighbors. Similarly, from the numerical point of view, the contribution of local research centers is seen in second position to expand this technology in this area. The figure indicates that around 33 percent (50hhs) farmers have motivated towards this through the efforts of these centers. Likewise,

Table 3: *Key Sources of Practice and Development of the Techchnology (in hhs)*

Sources		Major Settlements							Total
		Mulghat	**Belahara**	**Belahara Besi**	**Rudrabari**	**Guthitar**	**Sawabari**	**Mahang**	
Neighbors	Number	9	13	10	12	20	11	10	**85**
	Percent	6.0	8.67	6.67	8.0	13.33	7.33	6.67	**56.67**
Research Centers	Number	8	9	9	10	4	8	2	**50**
	Percent	5.33	6.0	6.0	6.67	2.67	5.33	1.33	**33.33**
Friends	Number	4	4	0	0	0		0	**8**
	Percent	2.67	2.67	0	0	0		0	**5.33**
TV	Number	2	3	0	0	0	2	0	**7**
	Percent	1.33	2.0	0	0	0	1.33	0	**4.67**
Total	**Number**	**23**	**29**	**19**	**22**	**24**	**21**	**12**	**150**
	Percent	**15.33**	**19.33**	**12.67**	**14.67**	**16.00**	**14.00**	**8.00**	**100**

Source: Field Survey, 2020.

the role of friends/relatives seems to be in the third position to make this technology acceptable among the farmers of the study area. According to the data obtained from the table, more than 5 percent farmers have used this technology through the inspiration of their friend and relatives. Moreover, the role of television programs seems to be equally important to make this technology popular among the farmers of eastern hills. The figures depicts that almost 5 percent (7hhs) farmers have motivated towards it through the television programs.

The result of a study conducted by Wagle (2019) is also support to this outcome. He found that the role of neighbors and local research centers was important in the development and expansion of this technology in the the hilly areas of eastern Nepal.

Major Reasons of Practice and Dvelopment

Various factors are responsible for the increasing popularity of this technology among the farmers of eastern hills (Wagle, 2019). According to the information of the local farmers, the main purpose of using this technology is to get maximum output at low cost through the use of quality seeds. This study also tries to identify the reasons why the technology is becoming so popular in the study area. Although various factors are responsible behind the

diffusion of this technology, the main reason is to identify the germination capacity of the seeds among these factors. Similarly, to get maximum output form the crops seems as the second major factor and the saving of the seeds is the third reason respectively. In addition, the next important cause is to save extra expenditure to lead the farmer towards the use of this technology (Table, 4).

Table 4: *Major Reasons of Practice and Development*

		Major Settlements							
Causes		**Mulghat**	**Belahara**	**Belhara Besi**	**Rudrabari**	**Guthitar**	**Sawabari**	**Mahang**	**Total**
TIGC	Number	10	7	7	9	9	10	3	**55**
	Percent	6.67	4.67	4.67	6.0	6.0	6.67	2.0	**36.67**
TGGP	Number	5	9	4	9	8	3	2	**40**
	Percent	3.33	6.0	2.67	6.0	5.33	2.0	1.33	**26.67**
NWS	Number	6	8	5	4	7	4	4	**38**
	Percent	4.0	5.33	3.33	2.67	4.67	2.67	2.67	**25.33**
TRC	Number	2	5	3	0	0	4	3	**17**
	Percent	1.33	3.33	2.0	0	0	2.67	2.0	**11.33**
Total	**Number**	**23**	**29**	**19**	**22**	**24**	**21**	**12**	**150**
	Percent	**15.33**	**19.33**	**12.67**	**14.67**	**16.00**	**14.00**	**8.00**	**100**

Source: Field Survey, (2020).

Note: TIGC -To identify germination capacity TGGP- To get a good production NWS- No Wastage of Seeds TRC- To reduce costs

The figure of the table reveals that more than 36 percent (55hhs) farmers are using this technique to identify seed germination capacity of various crops. Similarly, around 27 percent (40hhs) farmers test and treat their seeds for the purpose of increasing productivity. Likewise, more than 25 percent (38hhs) farmers said that the main reason for using this technology is to prevent unnecessary wastage of seeds. And remaining, almost 11 percent (17hhs) farmers are using this technique in their agricultural works for the purpose of saving extra expenditure (Figure, 4).

In addition, the local farmers remark that if this technology is adopted widely before the planting, farmers can find out quality of seeds. If better quality and tested seeds are adopted, better output can be released and input can be minimized.

Problems Related to the Use of the Technology

Farmers have been facing several problems related to this issue while using this technology in the eastern hilly areas of Nepal (Wagle, 2019). The local experienced farmers of the study area have mentioned that lack of sufficient technical knowledge, scarcity of technical equipments, high investment to manage the necessary accessories are major existing problems of this study area (Table 5)

Table 5: *Problems Related with the Use of the Technology (In hhs)*

Problems		Major Settlements							Total
		Mulghat	**Belahara**	**Belhara Besi**	**Rudrabari**	**Guthiar**	**Sawabari**	**Mahang**	
Lack of Technical Knowledge	Number	10	11	7	8	12	9	6	**63**
	Percent	6.67	7.33	4.67	5.33	8.0	6.0	4.0	**42**
Scarcity of Technical Equipment	Number	9	10	6	6	8	7	3	**49**
	Percent	6.0	6.67	4.0	4.0	5.33	4.67	2.0	**32.67**
High Investment	Number	4	8	6	8	4	5	3	**38**
	Percent	2.67	5.33	4.0	5.33	2.67	3.33	2.0	**25.33**
Total	**Number**	**23**	**29**	**19**	**22**	**24**	**21**	**12**	**150**
	Percent	**15.33**	**19.33**	**12.67**	**14.67**	**16.00**	**14.00**	**8.00**	**100**

Source: Field Survey, 2020.

Table 5 shows that there are four major existing problems intensively faced by the farmers of the study area during the using period. Lack of the technical knowledge seems the most extreme among these problems. The figure of the table reveals that 42 percent (63hhs) farmers are suffered this problem out of the total adopter farmers. Similarly, the scarcity of necessary equipment seems as the other vicious burning problem of this area. More than 32 percent (49hhs) have mentioned this as a major problem. Likewise, the problem of high investment to manage the necessary equipments and technical man power is seen as other extreme problem respectively. At the time of field survey (2020), around, 25 percent (38hhs) farmers have put this problem in the top priority (Figure, 5).

Perception of the Farmers towards the Technology

The local research centers and elite farmers remark that almost all farmers have a positive attitude towards this technology. In addition, the local intellectuals have stated that farmers have taken this as an important technology to make their agriculture healthy and productive. The field survey data also support their view (Table, 6).

Table 6: *Perception of the Farmers towards the Technology (In hhs)*

Perceptions		Major Settlements							
	Number	**Mulghat**	**Belahara**	**Belhara Besi**	**Rudrabari**	**Guthitar**	**Sawabari**	**Mahang**	**Total**
Keep the use intact	Number	18	20	10	14	16	11	9	**98**
	Percent	12.0	13.33	6.0	9.33	10.67	7.33	6.0	**65.33**
Increasing usage	Number	5	9	9	8	8	10	3	**52**
	Percent	3.33	6.0	6.0	5.33	5.33	6.67	2.0	**34.67**
Total	**Number**	**23**	**29**	**19**	**22**	**24**	**21**	**12**	**150**
	Percent	**15.33**	**19.33**	**12.67**	**14.67**	**16.00**	**14.00**	**8.00**	**100**

Source: Field Survey, 2020.

The figure of the table shows that more than 65 percent (98hhs) adopter farmers are using this technology for a long time and they want to continue it constantly. But, around 35 percent (52hhs) farmers are of the opinion that the technology should be extended to new local and hybrid seeds both. Thus, the overall farmes are committed to modernize their agricultural works through the development and expansion of the technology.

Conclusion

Agricultural seed management is the latest technology preferred and used by most of the farmers in eastern hills of Nepal. This technology has proved useful to get maximum benefit from agricultural work. Although farmers have been using this technology in both cereal and cash crops, its effectiveness is more evident in cash crops. Around 79 percent (150hhs) farmers of this area are using this as a new technology at present. In addition, farmers have to face with various problems while using this technology which has been started with the objective of making maximum profit by timely improvement of their agriculture system. Lack of technical knowledge, scarcity of technical equipments and high investment seem to be the main among these existing problems. Although this technology has been introduced in eastern Nepal at the initative of the local research centers, the role of the neighbors is found to be important in its development and expansion. After this, the friends and relatives can also be found remarkable in its development and expansion respectively. Besides, all the farmers are positive towards this technology so it can be said that its future is bright in the eastern hilly areas of Nepal.

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