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Role of Improved Seeds Technology to Increase Production and Crop Diversification in Nepal

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Abstract

This paper deals with the possibilities and challenges through the impact of using improved seeds technologies on crop production particularly in the case of the eastern hilly area of Nepal. The study applied household questionnaire survey, key informant survey and field observation to collect relevant information. The study conducted in 30 percent (180hss) in total (601hhs) of three altitude belts such as upper, middle and lower, ranging from 300 to 2,250 masl along the Koshi-highway. Secondary data were gathered from previous research journals, dissertations and official records.

This paper has revealed that improved seeds technology is known as well known and profitable technology for the promotion of both fruits and crops farming in the study area. More than 84 percent (152hhs) farmers have used this as a useful and profitable innovation. Despite various problems, the attraction of farmers is gradually increasing towards this technology. The maximum effort of the farmers seems to be use newly developed hybrid seeds in their agricultural works as far as possible. Although it was introduced through the inspiration of local research centers at first time, the role of neighbours, friends/ relatives and television programs seems to be significant respectively in its development and expansion of this technology in the study area. Less tasty, lack of proper knowledge to use this technology, high investment and lack of immunity are major identified problems associated with this technology.

Keywords: Adoption, improved seeds, hybrid seeds and necessary evils etc.

Introduction

In Nepalese situation, to increase production and crop diversification seems burning issue to supply the demand of foods and nutritants for increasing population of the country. National Planning Commission (1995) has mentioned that food security issues facing Nepal year on year, there is a sense of urgency underlying the

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need for improvements in both output and yields. A range of policies and investments have been pursued by the Nepalese government to boost agricultural production and productivity, particularly concerning the cereal and cash crops that are critical to reducing poverty in the country. In the context, in the case of developing countries Raikwar (2021) has indicated that the history of agricultural progress from the early days of man has been the history of seeds of new crops and crop varieties brought under cultivation. In the early days it was achieved through the cultivation of indigenous but useful plants and those taken through introductions. Later through the well known techniques of selection, hybridization, mutation, polyploidization and plant biotechnology the scientists made available many new and better varieties. However, to the farmer all this scientific research would be of little value unless he gets seeds, which are genetically pure, high germination percentage and vigour, high purity, sound health etc. When the farmers do not get seeds possessing these qualities the yields they obtain may not be as expected. The pace of progress in production therefore, will largely depend upon the speed with which we are able to multiply and market good quality seeds of high yielding varieties.

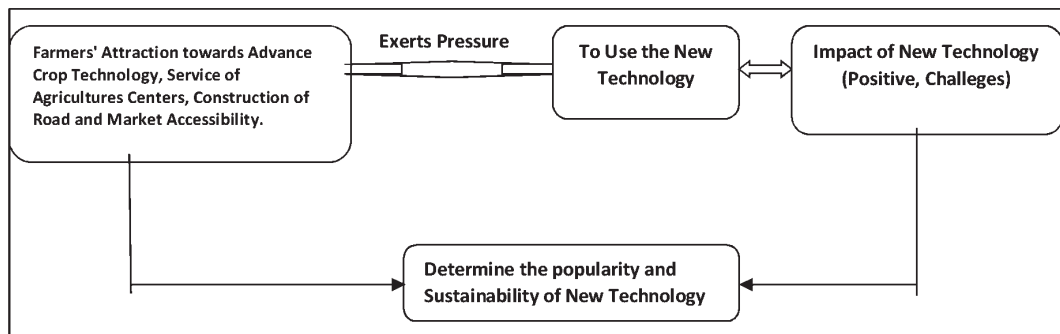
Wagle (2019) had studied on similar topic and identified that improved seed of crops is produced through the combination of several species of similar crops by using scientific method. They are renowned for the purpose of increasing productivity of crops in the short duration. The institutional support programs have also facilitated to commercial vegetable framings, off-season vegetable cropping and improved seed production programs. It is also known as hybrid seed and improved seed in the market. Farmers of the eastern hills are well known about improved seed technology and few farmers had started to use it before 1980 through the inspiration of the then Pakharibas Agriculture Centre (PAC). The major goal of seed technology is to increase agricultural production through the use of good quality seeds of high yielding varieties. Moreover, Khatiwada (2014) has remarked that the government's policy is to modernize agriculture by using advance technology in agriculture (GoN/ MoAD) but the progress has not achieved. In this context, farmers of the eastern hills have been using hybrid seed technology in their agricultural works for a long time but the the possibilities and challenges associated with it have not been studied analytically yet. Thus, this paper is basically related to the analysis this topic.

Methods and Material

This study is basically based on field survey data collected through observation, focus group discussion and in-depth interview focused on feasibilities and threats related to the use of improved seed in the context of eastern hills of Nepal. For this purpose, the study area was determined around the buffer of 1.50 km of the Koshi Highway of Dhankuta district based on central place theory of Walter Christellar where the use of improved seeds has been increasing rapidly after the decade of 1980.

The study was conducted in three ecological belts of the district based agro-climatic classification of the then District Agriculture Development Office Dhankuta, 2016. Those were upper altitude (<2000masl), middle altitude (1001-2000masl) and Lower altitude (>1000masl) belts respectively. After that, almost 30 percent (180hhs) farm households were selected out of total 601 households from three ecological belts based on equal representation. Among them, more than 84 percent (152hhs) farmers are using some kinds of improved seeds now. Similarly, required secondary data were collected through various books, journals and official records. In addition, gathered data were tabulated as required. Simple stistical tool percentage is used for the analysis of collected data. On the basis of analyzing these data, a descriptive paper is prepared. The analysis and outcome of the study based on both quantitative and qualitative techniques. The whole study is guided through the *State- impact process* derived from Pradhan &Pradhan (2006).

Figure 2.1 : A Concept and Guideline Frame of the Analysis



Source: Field Survey, 2020.

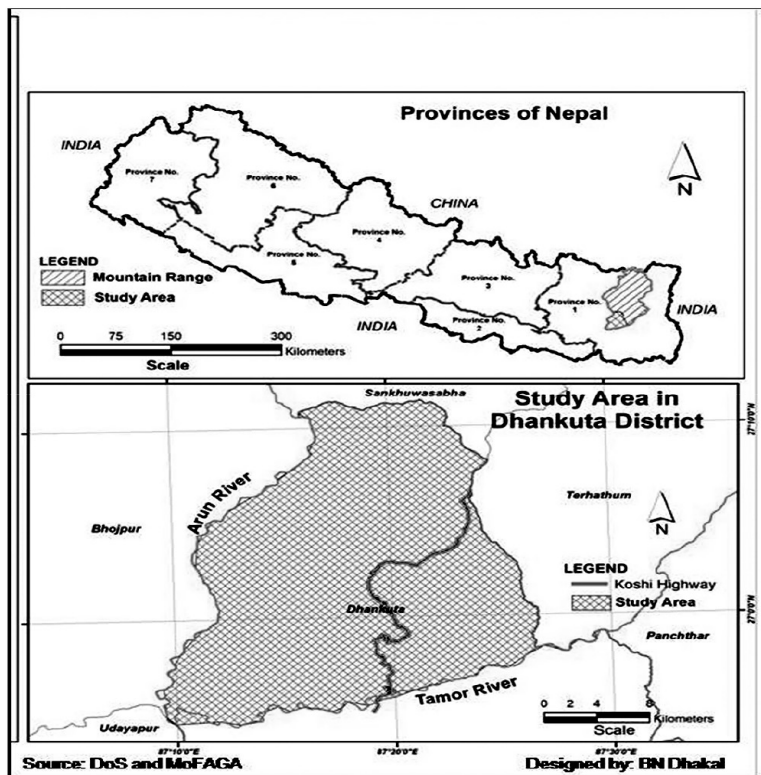
Study Area

The farming population of eastern hills of Nepal is still living in subsistence agricultural system. However, this area is full of specific characteristics in various ways, such as geographical, ecological, historical, socio-cultural and economic perspectives in comparision with other parts of Nepal (HMG/MoE, 1974).It is a region of great natural and social diversity, resulting from the tremendous geographical and climatic extremes. In this area, the altitude ranges from 300 to 2250masl and climates can be found sub-tropical to alpine types. The majority of the people who live in this region are subsistent farmers. Over the centuries, these people have developed strategies for survival that can be maintained independent of contact with the adjacent regions. Indeed, such conditions are found in the Hindu-Kush Himalayan Region (Ya & Tulachan, 2003).

In the present context, most of the farmers living in this area seem to have gradually changed their socio-economic conditions after the use of new technologies

through the inspiration of different governmental and non-governmental organizations in their agricultural works. Among these organizations, Koshi Hill Area Rural Development Project (KHARDEP) is one of the Integrated Rural Development Program (IRDP) approach launched in the eastern hills of Nepal. Koshi Highway had constructed through the inspiration of the KHARDEP. It has been able to transfer technology through hybrid seeds, technical knowledge for the protection and promotion of crops, farmer training, exposure visits and field demonstration etc. Apart from this, the contribution of District Agriculture Development Office (DADO, Dhankuta) and other non-governmental organizations also seem very important to diffuse new technologies in this area. With all these efforts, the Koshi Highway seems to have brought major changes in the agricultural development of this area since the mid 1980s (Wagle, 2019).

Figure 2.1 : Location Map of Study Area



Results and Discussion

Development and Expansion of Improved Seeds Technology

The facts obtained from the study area show that the farmers had started to use improved seeds technology in different date for various crops. In general, all farmers of this area are well informed about this technology now. However, few farmers had

started to use it before 1980 through the inspiration of the then Pakharibas Agriculture Centre (ARSP) (Table3.1)

Table 3.1: Trend of Using Improved seeds Technology before 1980 - 2020 (in hhs)

| Years | Ecological Belts | | | | | | | |
|--------------|------------------|--------------|-----------------|--------------|----------------|--------------|------------|------------|
| | Upper Altitude | | Middle Altitude | | Lower Altitude | | Total | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| <= 1980 | 0 | 0 | 7 | 4.62 | 0 | 0 | 7 | 4.61 |
| 1981 - 1990 | 4 | 2.80 | 1 | 0.70 | 1 | 0.70 | 6 | 4.20 |
| 1991 - 2000 | 33 | 21.71 | 25 | 14.45 | 12 | 7.90 | 70 | 46.10 |
| 2001 - 2010 | 14 | 9.21 | 26 | 17.11 | 12 | 7.90 | 52 | 34.21 |
| 2011 -2020 | 2 | 1.32 | 12 | 7.90 | 3 | 1.96 | 17 | 11.18 |
| Total | 53 | 34.87 | 71 | 46.71 | 28 | 18.42 | 152 | 100 |

Source: Field survey, 2020.

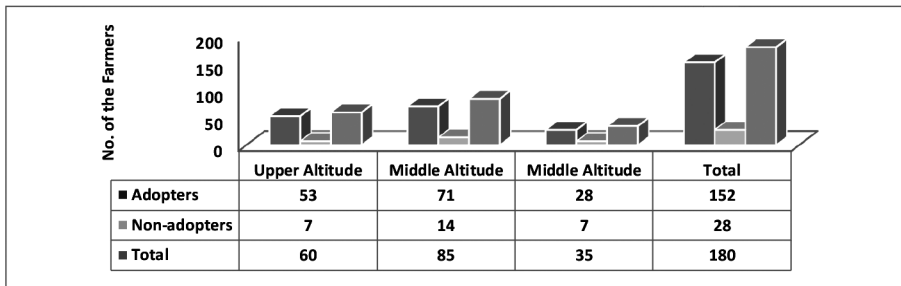
The figure of the table indicates that only around 5 percent (7hhs) farmers used improved seeds before 1980. After that, almost 4 percent (6hhs) farmers adopted this technology at first time during the period of 1981 to 1990. Similarly, more than 46 percent (70hhs) farmers added as the users of the hybrid seeds in their off-season vegetables during the years of 1991 to 2000. The diffusion trend seemed in the climax at that period. Moreover, the diffusion has been gradually reducing from the beginning of the 21th century to now. More than 34 percent (53hhs) farmers had involved in vegetable farming by using improved seeds in the period of 2001-2010. After that, almost 11 percent (17hhs) farmers had also used it in their off-season vegetable. Now around 92 percent (152hhs) farmers have involved in their agricultural works by using such seeds in different corps.

Figure 3.1 : Trend of Using Improved Seeds Technology before 1980-2020 (in hhs)



Source:Field Survey, 2016.

The analysis of data indicates that the trend of adoption is not constant. The using trend seems lower at first, rapid in the middle and after that gradually decreasing. The local agricultural technicians have reported that due to the growth in acceptableness of this technology in the study area, an existent traditional agriculture system gradually steps forward towards professional agricultural system. Besides, the regional variation in adoption rate also seems in the study area (Table 3.2).

Figure 3.2 : The Use of Improved Seeds Technology at Present

Source:Field Survey, 2020.

The figure shows that more than 88 percent (53hhs) farmers of the upper altitude, nearly 89 percent (71hhs) of the middle altitude and exactly 80 percent (28hhs) of the lower altitude are using hybrid seeds for their agricultural works. The local agricultural experts have reported that the main focus of the farmers has centered on the improved seeds of the vegetables at first and then maize in the second but the users of improved seed of paddy can rarely be found. However, the highest rate of adoption is perceptible in wheat growing area in national level. The latest figures indicate that around 96 percent of wheat cropping area is under improved seeds whereas almost 86 percent maize farming area and 80 percent paddy production area are under such seeds respectively (GoN/, MoAD, 2014).

Similarly, the effect of distance can also be seen in the adoption of the improved seeds especially from the road rather than innovation centers and altitude belts (Table 3.2).

Table 3.2 : The Relationship between the use of Improved Seeds and the Distance from the Headway Links

| Distance (in Meters) | Adopters | | Non-adopters | | Total |
|----------------------|------------|--------------|--------------|--------------|------------|
| 0 -500 | 55 | 91.67 | 5 | 8.33 | 60 |
| 501 - 1000 | 50 | 81.97 | 11 | 18.03 | 61 |
| 1001 - 1500 | 47 | 79.66 | 12 | 20.34 | 59 |
| Total | 152 | 84.44 | 28 | 15.55 | 180 |

Source: Field Survey, 2020.

According to the data obtained from the table, the adoption of improved seeds technology is found to be gradually declining in the area far away from the headway link. The figure depicts that more than 92 percent (55hhs) farmers around the distance of up to 500 meters of the highway are using this technology in the present context. Likewise, around 82 percent (50hhs) farmers between the span of 500-1000 meters from the highway have been cultivating through the use of hybrid seeds. In this

way, almost 80 percent (47hhs) farmers of the up to 1000-1500 meters away from the highway seem as the adopter of this technology now. However, the variation has seen in narrow gap. The local intellectual Mrs. Anupa Bhandari remarks that the problem of transportation in rainy season and the facility of storage for the perishable vegetables are responsible to create this situation. The similar studies of Khatiwada (2014) and wagle (2019) in the case of eastern hills and Pathak (2010) in the study of Dhading district also support this result. Pathak has found that the farmers residing along the metalled roads are quicker adopters of improved seeds in comparison to the farmers living away from the roads.

In this context, Wilbank (1972) suggests that road transport accessibility affect developmental process especially adoption of new crops in northern India (p. 427). Jodha (2000) argues that these changes related to resource base, production flows, resource use practices and options (p.75). Bencherifa (1988) discusses the demography of mountains in relation to the resources in which traditional production systems interact with the comparative potential resources and options in the western High Atlas and its surrounding low lands (p. 312).

Major Sources of Inspiration to Use Improved Seeds

In the beginning of any new agricultural works, various sources of motivation play an important role along with self efforts of the farmers. Farmers' self efforts as well as various media have played a significant role to spread hybrid seeds in eastern hills of Nepal (Wagle, 2019). The role of neighbors, research centers, friends, television programs and farmers themselves seems decisive respectively among these sources in the study area (Table 3.3).

Table 3.3: Major Sources of Inspiration to Use Improved Seeds (in hhs)

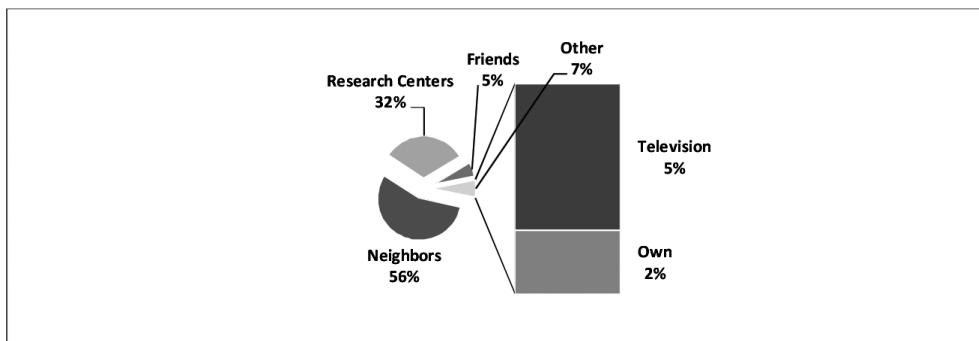
| Ecological Belts | Number | Sources of Inspiration | | | | | Total |
|------------------|---------|------------------------|-------|---------|------------|------|-------|
| | | Neighbours | RC | Friends | Television | Own | |
| Upper | Number | 41 | 9 | 2 | 1 | 0 | 53 |
| | Percent | 77.36 | 16.98 | 3.77 | 1.89 | 0 | 100 |
| Middle | Number | 19 | 39 | 4 | 6 | 3 | 71 |
| | Percent | 26.76 | 54.93 | 5.63 | 8.45 | 4.23 | 100 |
| Lower | Number | 25 | 1 | 2 | 0 | 0 | 28 |
| | Percent | 89.28 | 3.58 | 7.14 | 0 | 0 | 100 |
| Total | Number | 85 | 49 | 8 | 7 | 3 | 152 |
| | Percent | 55.92 | 32.24 | 5.26 | 4.61 | 1.97 | 100 |

Source: Field Survey, 2020.

Table 3.3 indicates that neighborhood effects put forwarded by Hagerstrand is the most effective sources among the all sources. The figure of the table shows around, 56 percent (85hhs) adopter farmers are benefited from the help of their neighbors to make their agricultural works profitable. It is followed by the research centers and almost, 33 percent (49hhs) adopter farmers move towards the adoption through the counseling and participation of the research centers. Likewise, more than 5 percent (8hhs) farmers have started to use hybrid seeds to the contact of their friends and relatives for increase their crop production and crop divesification. In the same way, television programs seem as next important sources of motivation i.e. around 5 percent (7hhs) farmers have been made adopters through the inspiration of such programs. Besides, nearly 2 percent (3hhs) farmers have become adopters of hybrid seeds through their own inspiration. Thus, nearly 85 percent (152hhs) farmers are currently using improved seeds technology in the study area. Moreover, more than 15 percent (28hhs) farmers of this area depend on local seeds for their agricultural works.

Similar studies made by Pathak (2010), Khatiwada (2014) support this result partially. Pathak has found the most effective role of neighbors for the diffusion of improved seeds in Dhading district. Similarly, Khatiwada has seen decisive role of neighbors for the diffusion of high-valued crops in the eastern hills of Nepal. But, the study of Wagle (2019) fully supports this conclusion who has found the most signifiant role of the neighbors to diffuse this technology in the same area. In addition, the local agricultural scientists and farmers remark that the research centers reached with key farmers to communicate about this technology, at first and after that it was widely diffused through the help of other sources respectively in this area.

Figure 3.3 : Major Sources of Inspiration to Use Improved Seeds Technology



Source: Field Survey, 2020.

Major Causes to Use Improved seeds Technology

No one does anything without a definite objectives and reason. Thus, there are some major reasons behind the use of new technology in the eastern hills of Nepal (Wagle, 2019). Some of the existing main reasons are given in the table among the various regions (Table 3.4).

Table 3.4: Major Causes of Using Improved Seeds Technolgy (In hhs)

| Reasons | Number | Percent |
|---|------------|------------|
| To makemaximum profit | 70 | 46.52 |
| Crop diversification and increase in Production | 58 | 38.16 |
| Easy to Sale due to global identity | 14 | 9.21 |
| Short production Period | 10 | 6.58 |
| Total | 152 | 100 |

Source: Field Survey, 2020.

The statistical presentation of table 3.4 reveals that farmers are mostly attracted to the new seeds technology for the purpose maximizing their profits. The figure shows that around 46 percent (70hhs) adopter farmers have put this cause at the top position among these four major causes. Similarly, to make maximum profit by increasing production through crop diversification seems to be a second major goal of the farmers. More than 38 percent (58hhs) adopter farmers seems to agree with this view. Moreover, easy to sale due to global identity seems to be as third major cause of using this technology. More than 9 percent (14hhs) adopter farmers have expressed their support for this reason. In this way, the short production period is another factor in using this technology and approximately 7 percent (10hhs) adopter farmers give top priority to this concept.

Problems of Using Improved Seeds Technology

The cultivation of improved seeds is more profitable rather than other local seeds. However, the farmers have to face several problems due to the nature of this technology (Wagle, 2012). This technology demands high investment, more technical knowledge, more nutrition and sufficient irrigation facility in comparison with local seeds. Similary, it has a lower resistance capacity to diseases than local native seeds. Moreover, People say that the production of hybrid seeds is less tasty than other local seeds production. Due to these existing problems, the cultivation of improved seeds is not easy (Wagle, 2019). The major problems identified in the field survey are mentioned in the table (Table 3.5).

Table 3.5: Major Problems of Using Improved Seeds Technology (In hhs)

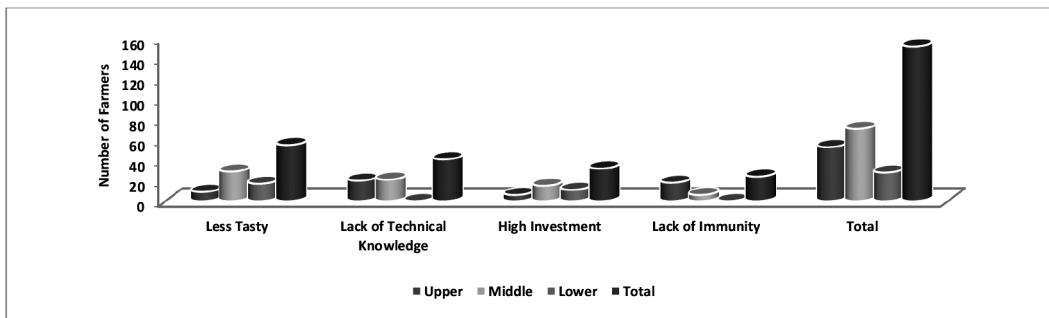
| Major Problems | Ecological Belts | Ecological Belts | | | Total |
|-----------------------------|------------------|------------------|--------|-------|--------------|
| | | Upper | Middle | Lower | |
| Less Tasty | Number | 9 | 29 | 17 | 55 |
| | Percent | 16.98 | 40.85 | 60.71 | 36.18 |
| Lack of Technical Knowledge | Number | 20 | 21 | 0 | 41 |
| | Percent | 37.74 | 29.58 | 0 | 26.96 |
| High Investment | Number | 6 | 15 | 11 | 32 |
| | Percent | 11.32 | 21.13 | 39.29 | 21.05 |

| | | | | | |
|------------------|----------------|------------|------------|------------|------------|
| Lack of Immunity | Number | 18 | 6 | 0 | 24 |
| | Percent | 33.96 | 8.45 | 0 | 15.79 |
| Total | Number | 53 | 71 | 28 | 152 |
| | Percent | 100 | 100 | 100 | 100 |

Source: Field Survey, 2020.

Table 3.5 exhibits that farmers of the eastern hills are mainly affected by the four major problems during the period of using hybrid seeds in their agricultural works. The problem of test seems to be at the forefront among the identified these problems. More than 36 percent (55hhs) adopter farmers believe that the crops produced from improved seeds are less tasty than the production of local indigenous seeds. Similarly, the problem of not being able to use this technology properly seems to be as the second painful problem of the eastern hills. Nearly 27 percent (41hhs) adopter farmers express their views in favor of this problem as the major problem. Likewise, the problem of high investment remains as the third miserable problem among the listed problems. More than 21 percent (32hhs) adopter farmers have put this problem in the top priority. In addition these three major problems, lack of immunity in improved seeds is another painful problem of this area. Nearly 16 percent (24hhs) adopter farmers have identified this problem as a main problem.

Figure 3.4 : Major Problems of Using Seeds Technology (in hhs)

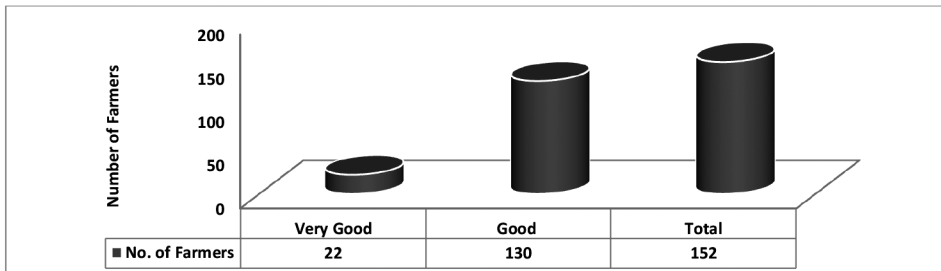


Source: Field Survey, 2020.

In addition, there are other existing problems such as lack of timely availability of chemical fertilizes, improved seeds, pesticides and insecticides, irrigation and cold storage facilities etc but the main emphasis if the farmers seems to be on the four problems which are mentioned above.

Perception of the Farmers towards Improved Seeds

The improved seed farming can be considered as a combination of both desire and compulsion of the farmers. However, almost all farmers are found to be satisfied with this farming but the level of sttisfaction does not seem to be the same (Figure 3.5).

Figure 3.5 : Perception of the Farmers towards the Use of Improved Seeds (in hhs)

Source: Field Survey, 2020.

According to the data displayed in the figure 3.6, approximately 14 percent (22hhs) have a very good opinion about this technology. They have expressed their view with the word 'very good'. Besides, the rest of the farmers are also positive about the use of such new technology. More than 85 percent (130hhs) adopter farmers have used the term 'good' to express their view for this technology but no one has expressed a negative opinion about this technology. Moreover, the field survey statistics also show that more than 51 percent (78hhs) adopter farmers of this area use this technology only to produce food crops. Their focus seems to be only on producing and selling food crops. While, remaining 49 percent (74hhs) farmers want produce food crops as well as improved seeds but they have not been able to get good success in this area till now. In addition, exactly 50 percent (76hhs) such farmers want to expand their farming area and remaining farmers want to give regularity constantly.

Conclusion

Improved seeds technology of various crops is broadly adopted and widely diffused in the study area. The use of this technology seems rapid at first, and reached in the highest point from 1991 to 2000 decade. After that, it seems gradually decline till now. Despite various problems, its current use seems satisfactory. However, the sustainability of this technology is questionable due to the unscientific use of other technologies i.e. chemical fertilizers, pesticides and insecticides etc. The technology was first introduced in this area through the initiation of local research centers. Later, it spread through the communication of other various sources over the whole area. Among such sources, the role of neighbour is paramount. Then, the role of other sources like research centers, friend/ relatives and television programs seems to be decisive respectively. In conclusion, farmers can be self-reliant by benefiting from all technologies if these are used in a balanced way along with improved seeds technology.

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