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## **Opportunities and Constraints of Community Based Seed Production in Northern Ethiopia: The Case of Seed Producing Cooperatives in South Tigray**

**Hagos Kidane Mezgebo<sup>1\*</sup>**

<sup>1</sup>*Tigray Agricultural Research Institute, Alamata Agricultural Research Center, Alamata, Ethiopia.*

### **Author's contribution**

*The sole author designed, analyzed, interpreted and prepared the manuscript.*

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### **ABSTRACT**

Community-based seed production has a potential for improving farmers' access to quality seed of locally adapted and preferred varieties. Besides, Seed Producing Cooperatives (SPCs) are fully engaged in formal seed production as contract out-growers to public enterprises that benefit members economically. Hence, the research contributed to show the importance of community-based improved seeds production in the form of seed-producing cooperatives formed by smallholder farmers. It showed the main problems and opportunities for the production of seeds conducted in three districts of Southern Zone of Tigray, Northern Ethiopia. Three stage sampling technique was employed in this study. First, purposive sampling was employed to select the three districts. Secondly, simple random sampling was employed to select the seven from fourteen seed producing cooperatives in the zone. Finally, focused group discussion at each kebelles which consists 7-10 group members (district seed multiplication experts, development agents and SPCs committee members were included) to gather data. The collected data was analyzed using ranking index. The result of the study shows that availability of suitable agro ecology, timely availability of technology, suitable and fertile land for seed production for the candidate crops respectively, were the main opportunities whereas lack of working capital, violating the bylaw of the cooperatives by members

\*Corresponding author: E-mail: [hagoshiwot@gmail.com](mailto:hagoshiwot@gmail.com), [hagos.kalab@gmail.com](mailto:hagos.kalab@gmail.com)

and diversified interest of farmers within a cluster respectively, were the main constraints of SPCs to respond the local demand for quality seed and seed security in the area. Therefore, improving the facilities of SPCs, creating common awareness of members on their guiding stated bylaws and creating common interest among members is very important for future development of community based seed production in the form of SPCs in the study area and beyond.

*Keywords: Seed system; seed production; seed security.*

## 1. INTRODUCTION

Agriculture is the dominant sector in Ethiopia. It accounts for about 43% of the Domestic Product (GDP), 90% of the exports and 80% of the employment [1]. The sector is dominated by smallholder farmers which are responsible for about 90% of the total agricultural production of the Nation [2]. Seed security is closely linked with food security in Africa including Ethiopia, but many Africa farmers lack access to modern high-yield seed varieties [3]. Improving the quality of seed of any preferred variety is the basis for agricultural productivity improvement [4]. Increasing quality and usage of improved seed has the potential to increase Ethiopia's annual crop production [5].

The national seed system of Ethiopia was considered one of the key interventions in the transformation of the agricultural sector to ensure the target of doubling agricultural production by the end of 2015 [6]. Nationally, the seed demand is increasing due to the agricultural development interventions. The seed demand of the country is estimated to be over 700,000 tonnes each year. But, the formal or commercial sector supplies 20,000–30,000 tons of seed per year across all crops [7]. Using improved high yielding crop seed by smallholder farmers can be means of the difference between improved livelihoods and staying trapped in rural poverty [4; 8, 9]. However, the use of these improved seeds still remains very low and has not been widely practised by smallholder farmers [10]. Seed shortage in quantity and quality which result in farmers plant grains rather than seeds, sustaining yield reductions of at least 30% is common in Ethiopia. Many farmers still fail to access these improved seeds from the formal seed supplies as many of the released varieties have never been widely distributed and made available in time and affordable price [11]. The problem is more or less the same in Tigray region and the study area.

Nowadays, the community-based seed production approach is widely used to deliver

seeds to smallholder farmers in Africa including Ethiopia [12]. Their contribution to improving seed supply and seed security has received great recognition by policymakers and development practitioners [13]. Besides, seed-producing cooperatives (SPCs) are one of the community-based cooperatives organized by farmers at the local level for seed production and distribution in Ethiopia [14; 15]. Moreover, seed-producing cooperatives were considered as institutional options to narrow the gap between the demands for and supply of improved seeds in the region and the study area. Southern zone of Tigray especially the selected districts are identified by the regional government of Tigray as potential clusters of seed production mainly for the major crops like wheat, barley and faba beans. As a result, up to December 2016, there were 14 SPCs with 1520 members in the study area as to the annual report of the southern zone of Tigray development corridor cooperative promotion agency [16].

However, despite the aggressive promotion of seed-producing cooperatives by governmental and non-governmental organisations, still, there is a huge gap between the demand for and supply of improved seeds in the region including the study area. However, there is the inadequate availability of research specifically which explore the opportunities and constraints of seed-producing cooperatives in a scientific way. Therefore, this study was initiated to assess the existing opportunities and constraints faced by seed producing cooperatives in the southern zone of Tigray, Ethiopia in which it can use as a springboard for further research in seed producing cooperatives and may contribute to strengthening sustainable seed production as well as seed security in the study area and beyond.

## 2. RESEARCH METHODOLOGY

### 2.1 Description of the Study Area

The study was conducted in three districts of Southern Zone of Tigray, Northern Ethiopia in

2016. Namely, the districts are Emba Alaje, Enda Mehoni and Ofra which are found in the highland agroecology of the zone. Geographically, the zone is located between 12°15' and 13°41' N latitude and 38°59' and 39°54' E longitude and with an altitudinal range of 1350 –3925 Meter above sea level (Fig 1). The zone covers a total area of 498,572 hectares and 143,326-hectare cultivable land. The average land holding size of households in the zone ranges from 0.25-1.25 hectare. However, the average landholding of the selected districts ranges from 0.25-0.75 hectare of land per household. Southern zone has experienced two rainfall seasons; the short rainy season locally known as "*Belgi*" that occurs usually from February to April and the main rain season locally described as "*kiremti*" that comes during June to September. On average, the area receives annually about 600 mm rainfall with a mean annual temperature of 25°C. Wheat, barley, faba bean, and field pea are major crops grown on the highland agro-ecology while teff, sorghum, maize and fruit crops are dominantly grown on the lowland agro-ecology of the area. Seed production is considered an important component of crop production in the three highland districts of the zone. Accordingly, fourteen seed SPCs have been involving in seed production dominantly in wheat and sometimes in barley and faba bean crops [16].

## 2.2 Sampling Technique and Size

The three-stage sampling procedure was employed to select the sample seed producing cooperatives. At the first stage, three districts (Emba-Alaje, Ofra and Enda-Mehoni) were selected purposively from the five districts of southern zone of Tigray on the basis of the fact that these districts have wider experience/exposure on seed production organizing in seed producing cooperatives. At the second stage, seven seed producing cooperatives (3 cooperatives from Enda-Mehoni, 2 cooperatives

from each Ofra and Emba-Alaje districts) were selected randomly based on proportion to their size from fourteen kebelles which have seed producing cooperatives. After selecting sample cooperatives, one focused group discussion was formulated within the composition of cooperative members, district experts and development agents of the respective kebelles. Finally, the study was conducted in selected cooperatives with 84 individuals (12 individuals \*7 kebelles).

## 2.3 Methods of Data Collection

The primary data for the study was mainly collected from focused group discussions (FGD) of all sampled kebelles. Each FGD was asked to mention the major opportunities and constraints of SPCs observed in doing in cooperatives. After having the lists of opportunities and constraints, the groups themselves were comparing each opportunity and constraints of seed-producing cooperatives through pairwise ranking method. Besides to this discussion with district experts of the agricultural office, cooperatives promotion office, input supply office and key informants were employed.

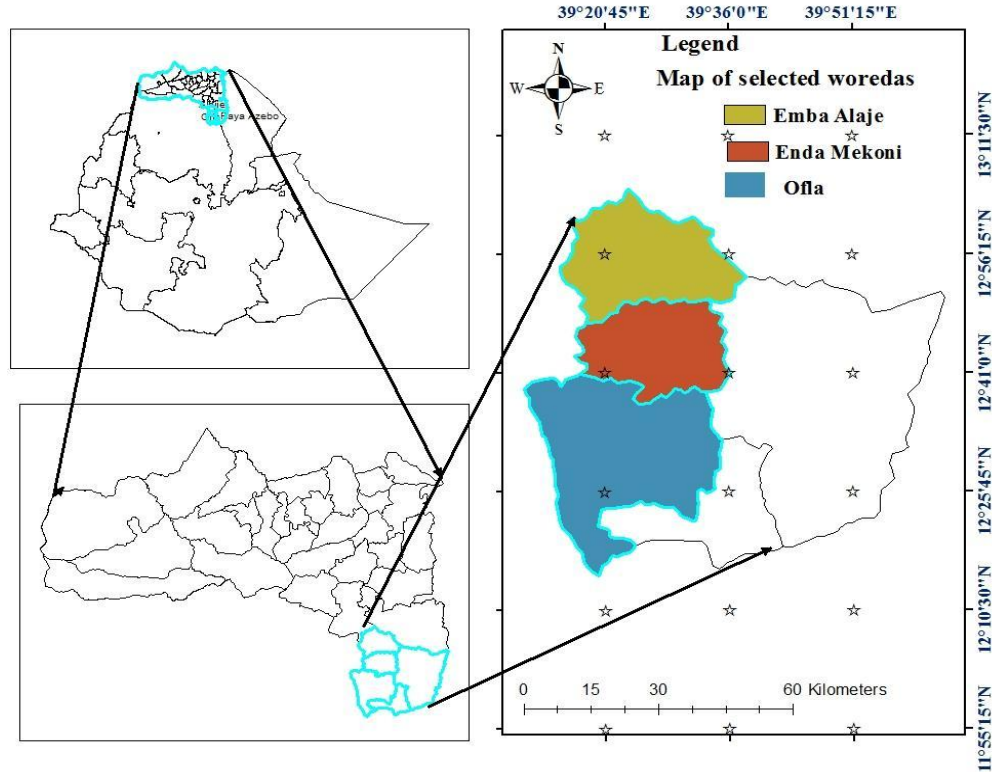
## 2.4 Methods of Data Analysis

The ranking analysis was used to analyse the opportunities and constraints of seed-producing cooperatives in the study area using the ranking index method [17]. Recently, this method was adopted by many authors, to quantify qualitative data in to the quantitative (for instance; analysis of Honey Bee Production Opportunities and Challenges in Central Zone of Tigray, Northern Ethiopia [18], and livestock herders' perception on the causes and effects *Senna obtusifolia* L. invasion in rangelands of Northern Ethiopia [19]. Hence, the index for this study was computed as:

**Rank index**=  $\text{Sum (number of FGD rank first} \times 8 + \text{number of FGD rank second} \times 7 + \text{number of FGD rank third} \times 6 + \dots \text{number of FGD ranked last} \times 1)$  for individual statements opportunity or constraint divided by  $\text{Sum (number of rank first} \times 8 + \text{number of rank second} \times 7 + \text{no rank 3} \times 6 + \dots \text{number of ranked last} \times 1)$  for all statements opportunity or constraints.

Value are assigned according to the ranking order, and highest value was given for the first rank and lowest value of one for the least rank.

Note: FGD= Focused Group discussion



**Fig. 1. Map of the study area**

### 3. RESULTS AND DISCUSSION

#### 3.1 Trends of Improved Seed Distribution in Tigray

As indicated in Fig. 2, the amount of improved seed distributed by the Regional Input-Output Marketing Agency (TIOMA) shows a decreasing trend over the three consecutive years. Besides the amount of improved seed distributed by seed producing cooperatives does not show significant improvement over the same years (Fig 2). But it is an evidence for the increasing demand for seed-producing cooperatives in the region including the study area which can address the local demand for improved seed. In line with this, 14 improved crop varieties (seven wheat, four barley, two faba bean and one field pea varieties) of basic seed were distributed to seed producing cooperatives to be multiplied as seeds on a total of 1036.5 hectares of land. During the survey year, a total of 4820 quintals of certified seed were multiplied and collected by the cooperatives [16]. The improved seed consumption of the southern zone of Tigray was about 4764 quintals in 2014 production season as to the report of Central Statistics Agency [10]. This implies that

the seed consumption in the study area is more or less covered by the seed producing cooperatives.

#### 3.2 Farmers Participation in Seed Producing Cooperatives in Southern Tigray

The history of legally recognised seed producing cooperatives in Southern Tigray has less than one decade. It was started the establishment of Hiritymekan primary seed producing cooperative in Mekan kebele, Enda-mekoni district with total memberships of 60 interested smallholder farmers. Starting from the establishment of this cooperative, promotion and mobilisation of farmers to participate in seed production and seed producing cooperatives was given a great emphasis by the governmental and non-governmental organisations to organise farmers in cooperatives to multiply seed. However, the establishment of other cooperatives has been flourished in 2013 in the study area (Fig 3). Up to February 2016, the total number of primary seed producing cooperatives has reached 14 with a total membership of 1520 smallholder farmers. The number of seed-producing cooperatives has

increased between 2010 and 2015 (January) from 1 to 14. Similarly, the membership size has increased from 60 smallholder farmers to 1520 over the same period. Moreover, female-headed household participation in SPCs in the study area was reached about 23.48% in 2015 as compared to in the beginning about 18 % in 2010 (Fig. 3).

### 3.3 Opportunities and Constraints of Seed Producing Cooperatives

Based on the rank index result, there are 15 opportunities and 17 constraints of seed-producing cooperatives to respond to the demand for quality seed in Southern Tigray (Table 1 and 2). Availability of suitable agroecology is one of the first ranked

opportunities in all seed-producing cooperatives in the study area. This implies that the agroecology of the selected districts was mainly *Dega* which is suitable for seed production. A similar finding was reported by Gebremedhin [20], in the eastern zone of Tigray. Timely availability of technologies like basic seed and related inputs is ranked the second opportunity of SPCs in southern Tigray. Seed producer farmers have got the opportunity of getting basic seed year after a year sometimes for free. The previous study by Zewdie and Abdoul [21], indicated that community seed production has many tangible advantages for farmers which can serve as a demonstration site, improve adoption of new varieties and increases the timeliness of seed delivery.

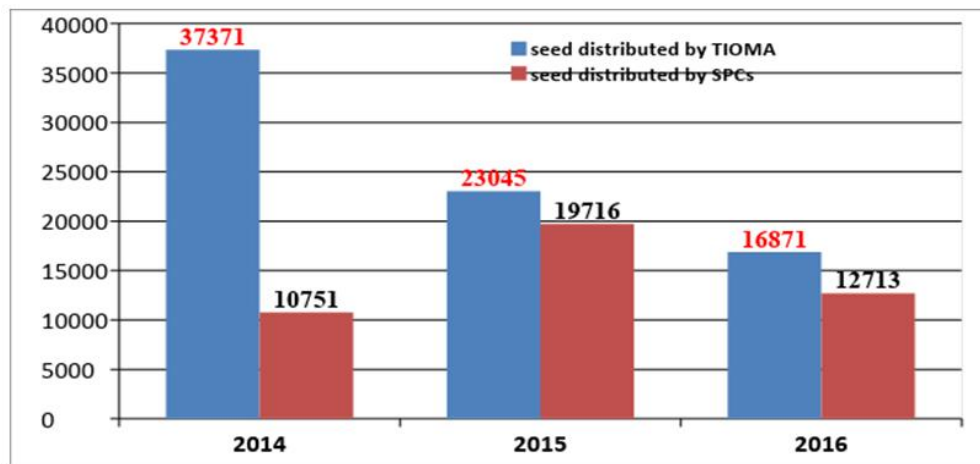


Fig. 2. Amount of seed distributed in Tigray (in quintals) in consecutive three years (2014-2016)



Fig. 3. Number of cooperatives and farmers' participation in seed producing cooperatives south Tigray

Availability of suitable and fertile land for seed production for the candidate crops (wheat, barley and beans) is the third-ranked opportunity of seed-producing cooperatives to produce and market seed. The highland districts of the zone are a potential area for seed production which received optimum rainfall with good distribution. Also, farmers perceived that their land is fertile and suitable to produce the major high land crops. Availability of non-governmental organisations supports is also the fourth-ranked opportunity of seed-producing cooperatives to produce and market seed. Group participants reported that some projects have been supporting community-based seed production in general and seed producing cooperatives in specific. Integrated Seed System Development (ISSD), Agricultural Growth Program (AGP) and Agricultural Transformation Agency (ATA) are some of the projects contribute to support seed producing cooperatives in the study area (Table 1). Previous studies in Ethiopia, confirms that availability of conducive ecology for various seed production, suitable land and water resources, conducive policy environment, available domestic markets, available seed proclamation and strong donor support for seed sector were some of the excellent opportunities for seed production in Ethiopia [22].

Seed producing cooperatives also faced many constraints while involving in seed production. The rank index value indicated that the lack of working capital is one of the first ranked

constraints of seed-producing cooperatives in the study area. This implies that seed cooperatives need initial capital to buy the basic seed from seed enterprises and also needs more capital to collect the seeds from producer farmers during harvesting. The previous study was confirmed that limited financial self-sustainability of cooperatives is the main constraint for seed production in Ethiopia [22]. Similarly, a recent study in Ethiopia also revealed that cooperatives face over-dependence on the government, weak internal governance, problems of leadership and low economic viability [13].

Seed producer cooperatives were made binding bylaw how much seed to produce an amount of seed returned after harvest to their cooperatives with members. Mostly the agreement is to return 90% of their produced seed by leaving 10% for seed purpose for the individual producers. However, the study revealed that violating the bylaws made by members with their cooperatives is a second-ranked constraint of seed production in the study area. Consequently, the cooperatives collect and sell below their estimated/ planned (Table 2). Returning less than 50 percent of the expected seed result by some growers was reported as the main constraints of Ethiopian seed systems [5; 23]. In addition, previous findings on cooperatives in developing countries reported that low member participation, weak leadership, dependence on supporting organisations and a lack of working capital are the common problems [24].

**Table 1. Opportunities of SPCs to respond to the local demand for quality seed production**

Opportunities for SPCs to produce seed	Rank index			
	NGD	N	Index	Rank
Availability suitable agro-ecology	7	45	0.141	1 <sup>st</sup>
Timely availability of inputs (like basic seed...)	7	44	0.138	2 <sup>nd</sup>
Fertile land for seed production for the candidate crops (wheat, barley and faba beans)	7	43	0.134	3 <sup>rd</sup>
Availability of NGO supports	7	34	0.106	4 <sup>th</sup>
Improved community awareness on seed production	5	29	0.091	5 <sup>th</sup>
Availability of supports from agricultural research institutes	5	22	0.069	6 <sup>th</sup>
Technical supports from agricultural experts	4	19	0.059	7 <sup>th</sup>
Accessibility of the Kebeles to the main road	5	17	0.053	8 <sup>th</sup>
Attractive market price for seed	5	16	0.050	9 <sup>th</sup>
Availabilities of facilities (store, cleaning machine, packing.....)	4	16	0.050	9 <sup>th</sup>
Availabilities support from University	3	12	0.038	11 <sup>th</sup>
Certification of seed supply and distribution	1	7	0.022	12 <sup>th</sup>
Access to supplementary irrigation	2	6	0.019	13 <sup>th</sup>
Electric city accessibility	3	6	0.019	13 <sup>th</sup>
On-farm quality seed inspection	3	4	0.013	15 <sup>th</sup>
<b>Total</b>		<b>320</b>	<b>1.00</b>	

NGD= number of focused group discussion in which the opportunities were mentioned

Source data: Organised from seven focused group discussions, 2016

The diversified interest of farmers within a cluster is ranked as the third constraint of SPCs to produce quantity and quality seed in the study area. This implies that if the seed is not produced in a clustered based it may lead to rejection of the produced seed by seed quality assurance agency and it may also serve as a means of variety mixing. A study on community-based seed multiplication in Benishangul Gumuz, Metekel zone, were faced challenges like selling of produced seed immediately after harvest as grain, managing of seed multiplication plots does not differ from normal grain production and difficulty to monitors every plot seed multiplication [25].

Low capacity building activities related to seed production and seed producing cooperatives and lack of facilities (store, weighing balance, cleaning machine, packing machine, offices) were the main constraints faced by SPCs (Table 2). low-quality seed due to lack of access to formal quality control structures, poor seed recovery from participating farmers, over-dependence on technical and infrastructural support from public institutions and development partners, and limited financial self-sustainability [21]. Lack of sound seed demand study outputs, lack of integrated seed production planning both by public and private seed growers, lack of integrated seed supply system (marketing) both

by public and private seed growers, lack of early generation seeds of some crops, lack of certified seeds of some crops and lack of efficient extension and seed regulatory services are the main challenges of community based seed production [22].

Having clustered farmers with similar soil characteristics, the isolated nature of farmer-based seed multiplication sites that create difficulty in supervision and quality control; the unwillingness of farmers to sell seed to the public seed enterprises once the seed is produced; the limited ability of farmers to sell the seed to the enterprises as per the set schedule; the limited financial capacity of the enterprises to undertake timely planned purchases from farmers; the limited facilities of the regional seed enterprises, especially seed cleaning facilities and storage warehouses, thereby increasing their overall cost of production are the challenges faced to farmer-based seed multiplication schemes in Ethiopia [26]. In addition, difficulty in accessing quality source seed; limited capacity in ensuring quality seed production and purchase from participating farmers; difficulty of clustering farmers and unclear links with the formal seed system under the current central distribution system were the major challenges of seed production and marketing by farmers' cooperative union in East Shewa and Arsi Zone of Oromiya region [26].

**Table 2. Constraints of SPCs to respond to the local demand for quality seed in the southern zone of Tigray**

Constraints	Rank Index			
	NG	N	Index	Rank
Lack of working capital	7	57	0.141	1 <sup>st</sup>
Violating the bylaw of the cooperatives	7	55	0.136	2 <sup>nd</sup>
The diversified interest of farmers within a cluster	7	47	0.116	3 <sup>rd</sup>
Low capacity building to SPCs and seed production	7	45	0.111	4 <sup>th</sup>
Lack of facilities (store, machines, office etc...)	6	30	0.074	5 <sup>th</sup>
Low market price for seed	6	19	0.067	6 <sup>th</sup>
Occurrence of different diseases	4	27	0.067	6 <sup>th</sup>
Low sense of cooperative ownership	3	27	0.064	8 <sup>th</sup>
Low awareness on community based seed production	4	26	0.047	9 <sup>th</sup>
Low participation of farmers in SPCs	3	15	0.037	10 <sup>th</sup>
High price of basic seed	3	14	0.035	11 <sup>th</sup>
Lack of electric city to operate machines	2	8	0.025	12 <sup>th</sup>
Low agronomic management practices by farmers	1	8	0.020	13 <sup>th</sup>
Low marketing promotion for seed	1	7	0.020	13 <sup>th</sup>
Supply of mixed seeds by some cooperative members	1	7	0.017	15 <sup>th</sup>
Dependency on project supports	1	10	0.017	15 <sup>th</sup>
Lack of certificate of seed distribution	1	2	0.005	17 <sup>th</sup>
		<b>404</b>	<b>1.00</b>	

**Note:** NGD= number of focused group discussion in which the constraints were mentioned

Source data: Organised from seven focused group discussions, 2016



Diseases and insect pests, limited understanding amongst stakeholders on the importance of adhering to standards in seed production and seed multiplication business, lack of market for seed, very low preparation for market linkage of cooperatives, expectation of farmers for free inputs and Scattered fields are major challenges faced by farmers based seed multiplication in the Eastern Zone of Tigray [20].

#### 4. CONCLUSION AND RECOMMENDATIONS

Seed producing cooperatives is one of government focus which acknowledged in the national strategy for improving the food security of the country. Access to quality seed is one of the key inputs for improving the food security of smallholder farmers. Smallholder farmers participated in seed producing cooperatives have got a dual chance for self-seed security and common benefits coming from their own organisation by selling to other farmers, organisation seed enterprises and NGOs working with seed related activities. According to the result of the study, the author realises that almost all of the seed producing cooperatives in the study area had common opportunities and constraints. However, the weight of the opportunities and constraints was not equal across the cooperatives. Availability of suitable agroecology, timely availability of inputs (like basic seed), suitable and fertile land for seed production of the candidate crops (wheat, barley and faba beans) and availability of NGO supports were reported as their main opportunities of community based seed production in the form of seed-producing cooperatives to respond the quality seed for the local demand in the study area. Also, there were also cooperative specific opportunities; for instance, availability of certification of seed distribution, stores and different machine and electric city were some of the cooperative specific opportunities of seed-producing cooperatives.

On the other hand, lack of working capital for variety of operations, violating the bylaw of the cooperatives approved by their general assembly related to the seed multiplication and amount of seed return to their cooperatives, diversity of farmers interest within a cluster; which this leads disagreement on the crop type multiplied and causes variety mixing as well as the purity of the seed and low capacity activities were indicated as their main constraints of seed-producing cooperatives while involving in seed production.

The occurrence of diseases, lack of store and low sense of ownership of members, lack of access to the electric city to operate machine were also some of the important constraints reported by specific cooperatives.

This study concludes that suitable agro-ecology, fertile land and timely availability of inputs are the top three opportunities to exploit for further development of community-based seed production, whereas limited working capital, the difference in commitment and interest of smallholder farmers are top three challenges yet to be solved for sustainable community seed production. Hence, the study forwarded the following recommendations;

- ❖ It could be recommended that the concerned governmental and non-governmental body should be able to work on awareness of the farmers about the importance of village-based clusters of seed production for the development of seed producing cooperatives and to have better quality and quantity seed at the community level.
- ❖ It should better if concerned governmental and nongovernmental organisations provide training on seed production for seed-producing cooperative members and non-members which can serve as out-growers for sustainable seed production in quality and quantity and can be protected from mixing of different crops at a time.
- ❖ There is a need to search revolving fund approaches to address the lack of working capital of seed-producing cooperatives especially during seed collection and seed distribution.
- ❖ Actionable and integrated support by concerned government and stakeholders is needed to exploit the existing opportunities and to solve the constraints of SPCs systematically to develop a successful cooperative based seed production, marketing scheme and responding the local demand for quality seed.

#### COMPETING INTERESTS

Author has declared that no competing interests exist.

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