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Problem and factor determining the type of seed production (Cereal and Vegetable)

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Abstract

A study was conducted in 2022 in the Syangja and Nawalparasi (Bardaghat Susta East) districts to identify the major problem of seed production and to determine the factors that directly cause impact on the type of seed production (cereals and vegetable). Primary data was collected from 140 cereals and vegetable seed producers, three focus group discussions, and key informant interviews. Among various Participatory Rural Appraisal (PRA) tools, pair-wise ranking was performed to identify the major problem of seed production. The logistic regression model was used to identify factors that directly or indirectly affect in the production of cereal and vegetable seed. In the study area rice, maize and potato seeds were produced in huge amount. The result shows that the production of seed was affected by various factors; among them, the absence of technical support is the most challenging issue, followed by a lack of irrigation infrastructure. The logistic regression model results revealed that the production of cereal seed was determined positively with members of co-operatives, cultivated land, and number of households and negatively but significantly associated with education. There was significant supply-demand imbalance in the seed market. As a result, additional output is required to close the deficit. This seed production issue must be addressed to fulfill the demand of seed and factor affecting during selection of seed production (cereals and vegetable) farmers should select crop for seed production according to the knowledge.

Keywords: Seeds; Co-operative; logistic; Problem and Training

1. Introduction

Quality seed is at the core of the technical packages needed to boost agricultural productivity, nutrition, and rural well-being, as well as a starting point for reaching various development goals. Seed availability and quality are the two main concerns for farmers when it comes to crop performance. Despite the intense effort, market share estimates for enhanced maize are around 10% [1]. All other crops, including some that are important for food security and nutrition, such as cereal legumes, vegetables, millets, cassava, and sweet potatoes have a far lower percentage, and farmers must rely on unofficial seed sources [2].

The National Seed Vision (2013-2025) formulated by the Government of Nepal (GoN) has emphasized on self-sufficiency, import substitution, and export promotion of quality seeds. The National Seed Vision (NSV, 2013–2025) [3] projected that the country would need 190,353 Mt of seed to address its annual seed replacement rate (SRR) target by 2025 of 25% of self-pollinated crops, 33% of cross-pollinated crops and 100% of hybrid crops. In 2018/2019, Nepal produced 28,110 Mt seed domestically and imported 4,250 Mt of seed. The total transaction of Nepal's seed industry in 2019 amounted to 32,360 Mt with a value of US$27.6 million, with rice seed accounting for 58%, maize 37% and vegetables 5% of this [4].

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Important seed initiatives launched are District Seed Self-sufficiency Program(DISSPRO) in2012/13 implemented in different districts by District Agriculture Development Offices(DADOs) and at present AKC conduct this program in district, Community Based Seed Production Program (CBSP) launched by HMRP/CIMMYT in 2012/13, implementation guidelines of Community Seed Bank (CSB) 2012 in different districts, Community Seed Production Programs launched to support food security by GoN and donor agencies such as irrigation and water resource management program (IWRMP) and USAID seed production program and other programs[5].Following federalization, the central government implements seed production policies, while provincial governments distribute subsidies such as seed, machinery, and other inputs, as well as conduct certification and quality control processes, provide training, and provide inputs at the local level.

This study is primarily concerned with exploring the problem and identifying factors that directly or indirectly affect the type of seed production in the study area. In order to increase the production of cereal crop seed (rice and wheat) in the terai region and of maize and vegetable seed in the hilly and terai areas, the seed production problem of this area has to be identified, and in order to utilize the produced seed, the current status of formal seed must be known. The major objective of the study was to identify major problem of seed production and major factor that directly affects the type (cereals and vegetables) of seed production.

2. Materials and Methodology

Syangja and Nawalparasi (Bardhagat Susta East)district lies in mid hilly and terai region respectively, it is favorable for cereals such as rice, wheat, maize and vegetables such as potato, pumpkin, tomato etc for seed production [3].

For determination of sample size Taro Yamane Formula was used.

$$n= N/(1 + Ne^2)$$

Where

- n=sample size
- N= Population size
- e = level of precision always set the value of 0.05

Eighty respondents from Syangja and sixty responded from Nawalparasi (Bardhagat Susta East) were taken by simple random sampling. Altogether, 140 farmers were taken for the personal interview.

Table 1 Sample size

S.N	District	Seed producer	No of sample
1	Syangja	123	80
2	Nawalparasi (Bardhagat Susta East)	93	60
	Total	216	140

The study involved 140 seed producers, conducting interviews, group discussions, and rural appraisals. Secondary data was gathered from various sources. The major problem of seed production was identified through a pair-wise ranking process.

2.1.1. Description of logistic regression model

The logistic regression model estimation outcomes for the factor determining the production of vegetable and cereal crop seeds. The model included the farmers' choice to produce vegetable and cereal crop seeds as a binary dependent variable, with "1" signifying the production of cereal crop seeds and "0" denoting the production of vegetable crop seeds. The logistic regression model was conducted using thirteen variables of table 2.

The dependent variables for this study were the farmer which produces seeds with a value of 1 (if the farmer is cereals crop seed producer) and/or 0 (for a vegetable crop seed producer). The logistic regression model predicts the response

variable (production of seeds) from the independent variable(s). The likelihood of the farmer being a seed producer is predicted by odds (Y = 1); that is, the ratio of the probability that Y = 1 to the probability that Y ≠ 1:

$$\text{Odd Y} = \frac{P(Y=1)}{(1-P(Y=1))} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The binary logistic regression model is specified as follows (Equation (2))

The logit (Y) is given by the natural log of Odds;

$$\text{In } \left(\frac{p(Y_i=1)}{(1-p(Y_i=1))}\right) = \log \text{Odds} = \text{Logit(Y)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

This can be expanded as

$$\text{Logit(Y)} = a + \sum\beta_1 X_1 + \sum\beta_2 X_2 + \sum\beta_3 X_3 + \ldots. + \sum\beta_n X_n + \varepsilon_i$$

Where Y = dependent variable (seed production) with 1 = cereals seed production and 0 otherwise; α = intercept; β1,...., βn = coefficients of the independent variables; X1, ..., Xn = the independent variables; P (p) = probability of producing cereals crop seed production; 1 − P = probability that a farmer produces vegetable seed production; and ln = natural log. With the independent variables of this model (X_1 = age, X_2 = gender, and so on), logistic regression for 'SEED PRODUCTION' in the study is expressed in the following form:

$$\text{logit(Seed production)} = \ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1 \text{age} + \beta_2 \text{gender} + \beta_3 \text{edu} + \beta_4 \text{land} + \beta_5 \text{member} + \ldots \beta_n$$

Independent variables and their expected outcomes

The independent variables that were used in the study are given in Table 2. Table shows the independent (explanatory) variables, their description and the expected outcome in relation to the dependent variable.

Table 2 Explanatory variables, description and the expected outcome

Variables	**Description and Measurement Type**	**Variable Type**	**Expected outcomes (+/-)**
Age	Age of the farmers (years)	Continuous	-
Gender	Gender of farmer (1=male 0=female)	Categorical	+
Education	Number of Years of formal education (1= Primary education (1-8), 2= Secondary level education (9-12), 3= High School level education, 4= If other Specify (master/PhD)	Continuous	+
Experience in seed production	Experience in seed production(1-4 years=0, 5-10 years=2, 11-20 year =3 and above 21=3)	Continuous	+
Training	Training received related to seed production from PMAMP, ADRC,AKC or other organization 1 = Yes received, 0 = otherwise) (Dummy)	Categorical	+
Member of co-operative	Have membership of co-operatives of seed production (1 = Yes received, 0 = otherwise) (Dummy)	Categorical	+
Seed Marketing Agreement	Farmers having seed agreement (1= having agreement ,other=0)	Categorical	+
Main occupation	Main occupation of farmers (1=Agriculture, 0= others)	Categorical	-/+
Land Holding	Land size of arable land (Ha)	Continuous	-/+

Seed source	Seed source (Public=1,otherwise=0)	Categorical	-/+
Storage house	Available of storage house (1= Present, 0=others)	Categorical	+
Area	Seed production district (1=Syangja, 0=Bardaghat Susta East)	Categorical	-/+
Size of household	Less than 4=0, More than 4=1	Categorical	-/+

Note: (+/−) indicates a positive or negative relationship with the dependent variable.

3. Result and Discussion

In this section, the study's findings from descriptive analysis, a pair-wise ranking and a logistic regression model are presented in accordance with the objectives. For the socio-demographic and economic characteristics of the sample of households, descriptive analysis was used.

3.1. Number of farmers that grow cereals and vegetable seeds

Compared to vegetable seeds, a greater number of farmers were involved in the production of cereal crop seeds.

Table 3 Number of seed producer farmer

S.N	Type of seed production	Number of farmers	Remarks
1	Cereals crop seed	82	rice, wheat and maize
2	Vegetable crop seed	58	Potato
	Total	140	

3.2. The major problem of seed production

PRA's pair-wise ranking tool was used to examine the problems of seed producers. The difficulties were discovered through group discussions, focused group discussion and key informants interview. The main issues highlighted were technical assistance, a poor irrigation system, a lack of machinery, inadequate training facilities, government support (insurance, subsidy), and disease and pest prevalence. The pair-wise ranking of problems is provided in table 4 based on farmer preferences.

Table 4 Pair-wise ranking of seed producing farmers of Syangja and Nawalparasi(Bardaghat Susta East) district

ProblemProblems	Technical assistant	Trainingfacilities	Diseases and pests	Machinery	Irrigation facilities	Subsidies	Marketing	Rankofproblem
Technical assistant		Training facilities	Technical assistant	Technical assistant	Technical assistant	Technical assistant	Technical assistant	1st
Training facilities			Diseasesand pest	Training facilities	Irrigation facilities	Subsidies	Marketing	5th
Diseases and pests				Diseasesand pest	Irrigation facilities	Diseasesand pest	Diseasesand pest	2nd
Machineries					Irrigation facilities	Subsidies	Machineries	7th
Irrigation facilities						Irrigation Facilities	Marketing	2nd
Subsidies							Subsidies	4th
Marketing								6th

(Source: Field survey, 2022)

Farmers rank problems based on their preference, with technical assistants ranking first, followed by insufficient irrigation and seed subsidies. Training and market facilities rank third, followed by machineries. Disease and pest problems score least. Despite various methods, villagers cannot completely eradicate the problem.The major problem in maize seed production was identified as lack of technical assistance, followed by inadequate irrigation facilities, high cost of seed, low seed quality, low price of agricultural products, and lack of machinery [6]. The availability of technical assistance and adequate irrigation facilities in an area assist in adopting maize seed production to increase maize production and income [7,8]. Irrigation is one of the major agricultural inputs for crop production. The lack of agricultural inputs is the main bottleneck in maize production and productivity [9]. The low use of quality seeds of high-yielding crop varieties along with other inputs (e.g., fertilizer, farm machinery) leads to low productivity [10].

3.3. Factors determining the type of production of seeds (Cereals and Vegetable)

At a level of less than 1%, the Wald test for the model demonstrated respectable explanatory power (LR Chi^2 =42.85). The Pseudo R^2 (0.225) was fit in model. A higher P value indicates greater data sufficiency and fitting, while the Pearson chi^2 (117) goodness of fit test score was 135.23 Area under the Receiver Operating Characteristic (ROC) curve for the regression shows that the model's discrimination is adequate at 0.7976. The interpretation of a logistic regression model with marginal effects that displays a linear regression of the z-score of decision probability on the independent variables may be problematic. Therefore, marginal impact determined marginal probability.

According to a logistic regression analysis age, sex, training, seed source, storage house, agreement, main occupation, and land holding were found to be statistically insignificant in predicting the production of cereals and vegetable seed. This logistic regression analysis showed education significantly associated with the seed production at 10 % level of significance, whereas land holding and size of household was positively associated with the seed production with statistical significance at 5% level and member of co-operative was positively associated with the seed production at 1% level of significant at ceteris paribus.

The result showed that the member of co-operatives and production of cereal crop seed were positive and significant (Table 5). If the farmers become the member of co-operatives the likelihood of adoption of cereals crop production increases by 0.46 times. The probability of production of cereal crop seeds increases when the farmers become the member of co-operatives.

The result showed that the association of education and adoption of cereals crop seed production were significant, but the coefficient was negative (Table 5). If the education level of farmers' changes from illiterate to literate the likelihood of adoption decreases by0.17 times. The probability of adoption of cereals crop seed production decreases with the higher level of education.

Land holding of farmers appeared to be positive and significant (Table 5). The farmers who had more land holding, the likelihood of adoption of cereals crop seed production would increase by 0.23 times higher as compared to less land holding farmers.

Size of household appeared to be positive and significant (Table 5).The farmers who have high size of household, the likelihood of adoption of cereals crop seed production would increase by 0.34 times higher than less size of household.

Table 5 Factors determining the production of seed using logistic regression model (2022)

Variable[a]	**Coefficients**	**S.E**	**Robust S.E**	**P>|z|**	**dy/dx[b]**
District	0.66	0.48	0.94	0.16	0.15
Sex	-0.19	0.46	0.37	0.67	-0.04
Member of co-operative	1.94***	0.59	3.95	0.001	0.46
Education	-0.73*	0.31	0.66	0.02	0.17
Training	-0.57	0.46	0.26	0.21	-0.13
Seed source	0.17	0.41	0.33	0.66	-0.41
Storage house	-0.85	1.41	0.64	0.54	-0.2
Agreement	0.93	0.75	2.09	0.21	0.22

Main occupation	-0.13	0.41	0.37	0.73	-0.03
Experience in seed production	0.57	1.26	2.48	0.65	0.13
Land holding	0.97**	0.36	1.04	0.007	0.23
Age	0.4	0.38	0.54	0.294	0.09
Size of household	1.43**	0.48	2.1	0.003	0.34
CONSTANT	-4.76	1.4	0.12	0.001	
Summery statistics					
Number of observation (n)			140		
Log likelihood			-73.54		
LR Chi^2 (13)			42.85(Prob > chi2=0.001)		
Pseudo R^2			0.225		
Goodness of fit test			Pearson chi2 (117) =135.23 (Prob >chi2=0.119)		
Area under the ROC curve			0.7976		

There were significant differences in the production of cereals crop seeds among farmers which are member of cooperative and not [11]. Farmers with higher education produce vegetable seed [12]. The education has a positive impact on the adoption of vegetable seed production technology [13, 14, 15]. The number of household members directs impact on cereals crop seed production [16].

4. Conclusion

The primary issue or challenge faced in seed production is a deficiency in the technical assistance and guidance required for successful seed production processes. It implies that improving and increasing technical support in seed production could be a crucial step in addressing and overcoming the challenges faced by the seed sector. For cereals seed production, the key determinant is the size of landholding and member of co-operatives. This implies that farmers with larger landholdings are more likely to engage in cereals seed production. In contrast, for vegetable seed production, the level of education plays a more critical role. This implies that farmers with higher levels of education are more likely to be involved in vegetable seed production, possibly because it requires a certain level of knowledge and expertise in cultivation practices and seed-saving techniques.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that they have no conflict of interests.

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