



# Impact of contracts in high yielding varieties seed production on profits and yield: The case of Nepal



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## ABSTRACT

Nepal's population continues to grow, but the agricultural sector's performance remains almost stagnant. This has led to a decline in the per capita availability of food. Increasing agricultural productivity is the key to agricultural growth, and one strategy for increasing agricultural productivity is to use improved seeds. This study investigates the impact of contract farming (CF) in high yielding varieties (HYV) of paddy seed production on costs, yield, and profits of smallholder farms in Nepal. Using farm-level data and a non-parametric propensity score matching estimator, the study finds a significant positive impact of contract HYV seed farming on revenues, profits, and yield, and a significant negative impact on total costs of production. Additionally, very small farms ( $\leq 0.43$  ha) with CF in HYV paddy seeds tend to gain the most when it comes to yield per hectare. Our estimates reveal that the average smallholder household in Nepal engaged in CF with input conditions receives higher profits. However, farmers engaged in CF with output conditions tend to have higher yields but smaller profits. Finally, farmers engaged in CF in HYV paddy seeds with both input and output conditions have the highest yield gains and significantly higher profits.

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## 1. Introduction

Agriculture is one of Nepal's largest economic sectors, contributing about 33% of the nation's gross domestic product (GDP) and employing 65% of its population. A key observation is that the population continues to increase while the agricultural sector's performance remains almost stagnant, leading to a decline in the per capita availability of food (Joshi et al., 2012). Per capita agricultural landholdings average  $>0.8$  ha, enabling farmers to produce only about six months' worth of food consumption in low-production environments, and about 42 of the country's 75 districts face food deficiency every year (Joshi et al., 2012). Recent data from the World Bank (2015) reveals that 24% of the population lives in poverty and about 77% of the population earns  $>\$2$  a day. Additionally, 78% of agricultural-sector workers (67% farmers and 11% agricultural laborers) live in poverty. Most (64%) of agricultural holdings can be classified as subsistence family farms, and only 3.1% as commercial farming operations. Therefore, the agricultural

sector's role in developing the national economy and reducing poverty is paramount.

Growth in the agricultural sector, which is a source of livelihood for majority of the population, was undermined by low public and private investment, un-remunerative prices, and poor access to credit (Sharma, 2009). Slow growth in agricultural productivity may lead to food insecurity and political instability in the country. As growth in productivity is the key to growth in the agricultural sector, one method to increase agricultural productivity is the use of improved and better-quality seeds alone can increase crop yields by 20–30% and will contribute significantly to Nepal's sustainable economic growth and food security (Upadhyaya, 1999a, 1999b; Sah et al., 2015). Additionally, farmers perceive that knowledge and skills in improved farming – such as the selection of crop varieties, seed and nursery management, proper use of chemical fertilizers, off-season vegetable production, soil fertility management techniques, and post-harvest technologies – are the key to increasing crop yields. Seed is the most important determinant of agricultural production's potential (Maredia and Howard, 1998; Awotide and Tontsa, 2011); seeds of appropriate characteristics are required to meet the demand of diverse agro-climatic conditions and intensive cropping systems in a country like Nepal.

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Finally, a recent report by Wang et al. (2015) concludes that increasing agricultural production and productivity largely depends on the development of new and improved varieties of crops, specifically, cereal crops like rice, maize, and wheat.

To this end, Table 1 reports the quantity of seeds required, quantity of seeds supplied and the quantity of seed replaced in Nepal for cereal crops, and the differences are alarming. However, the Government of Nepal (GoN) commissioned the National Seed Board under the leadership of the Ministry of Agricultural Development to develop a comprehensive National Seed Vision (2013–2025), also known as “Seed Vision.” The report envisions that improved seed production would increase threefold and that seed replacement by farmers would increase by 25% for cereal crops (including rice, wheat, and maize) and rice yields would increase to 3.8 metric tons (*mt*). Rice, maize, wheat, and millets are the main cereal crops in Nepal. Rice is the primary crop (1.6 million ha), cultivated predominantly in the plains and at lower elevations; wheat (0.7 million ha) is grown in the Terai and the valleys of the Himalayas; and maize (0.87 million ha) is the principal crop of the hilly regions. Further, Thomson (1979) reports that the use of improved, better-quality seeds increases crop yield by 20–30%. As one of the strategies<sup>1</sup> for achieving this goal, “Seed Vision” wants to strengthen varietal development by supporting public and private enterprises in the multiplication, processing, and conditioning of seeds.

One way to increase seed production, especially with the help of the private sector, is the use of contract farming, or CF (Winters et al., 2005; Simmons et al., 2005). In both studies, the authors argue that CF, an institutional innovation, can reduce transaction costs and solve market imperfections (e.g., credit constraints, information gathering, infrastructure, storage, etc.) in linking smallholder farmers to market. We believe that CF can increase agricultural production, productivity and food security for Nepal’s population in general and can increase the incomes of smallholder farm households in particular. Herein lays the objective of this study. This study provides an empirical analysis of the impact of CF of high yielding varieties (HYV) in paddy seed production on *outcome variables* like profits, yield and total costs of smallholder farms in Nepal. More specifically, the paper addresses three inter-related questions: First, does CF raise profits per hectare? Second, does CF increase yield per hectare? Third, does CF reduce the total cost of production? We also investigate the impact of CF in HYV paddy seeds for farmers who have CF with input conditions (CFIC), CF in HYV paddy seeds with output conditions (CFOC), and CF in HYV seeds with both input and output conditions (CFBC). Details on these input and output conditions are provided in the data Section 2.

## 2. Seed sector in Nepal

Nepal has two types of seed supply systems in place: the informal farmers’ seed system and the formal system. The informal system supplies >90% of seeds for rice, wheat, and maize (see Table 2). This social seed system is recognized as a vital process for maintaining local crop diversity. The informal seed system developed early, when farmers produced and preserved their own seeds for subsequent planting. This system led to lower output in subsequent years and lower productivity. Challenges in the current seed supply system in Nepal include the dominance of informal seed systems, the lack of well-equipped laboratories and trained personnel, a weak seed certification system, the

**Table 1**

The requirements, supplies and seed replacement rates of improved seeds for various crops in Nepal during 2012–13. *Source:* National Seed Balance Sheet (2014), Seed Quality Control Centre, Ministry of Agricultural Development, Government of Nepal.

| Crop    | Quantity of seed required ('000 tons) | Quantity of seed supplied ('000 tons) | Seed replacement rate (%) |
|---------|---------------------------------------|---------------------------------------|---------------------------|
| Paddy   | 76.57                                 | 8.03                                  | 10.5                      |
| Maize   | 21.78                                 | 2.47                                  | 11.3                      |
| Wheat   | 87.74                                 | 9.55                                  | 10.4                      |
| Lentil  | 6.83                                  | 0.11                                  | 1.5                       |
| Mustard | 1.99                                  | 0.14                                  | 7.3                       |

**Table 2**

Cereal seed suppliers in Nepal, 2010. *Source:* National Seed Balance Sheet (2011), Ministry of Agricultural Development, Government of Nepal.

| Variable                                     | Seed supply |       |       |
|--|-------------|-------|-------|
|  | Paddy       | Wheat | Maize |
| Area (million hectares)                      | 1.55        | 0.82  | 0.73  |
| Supply by National Seed Company Ltd. (%)     | 0.0         | 0.0   | 4.0   |
| Supply by 11 private seed companies (%)      | 2.0         | 2.0   | 2.0   |
| Supply by cooperatives and farmer groups (%) | 3.0         | 7.0   | 2.0   |
| Farmers’ own seed (%)                        | 96          | 92    | 92    |

limited involvement of the private sector, the lack of proper storage and maintenance structures, and inadequate seed buffer stocks. There are also gaps in the maintenance of seed stocks and their release immediately after weather-related emergencies.

On the other hand, the formal seed production and distribution system did not emerge until the early 1960s. The formal system, operated by public and private organizations is a vertically organized production and distribution of tested and released/registered varieties. The formal system currently accounts for >10% of seed production in Nepal, but it plays an important role on several fronts, including deploying new varieties and enforcing seed quality control. In Nepal, the formal seed system comprises seed production by farms and stations of the Nepal Agricultural Research Council<sup>2</sup> (NARC) and several other entities, including the Department of Agriculture, and contract seed production by National Seed Company Private Limited (NSCL). NSCL works with contract farmers for certified seed production from foundation seeds it receives from NARC. NSCL processes, grades and treats the seeds produced by contract seed growers and distributes them to farmers through dealers (Shrestha and Wulff, 2007). Seed production also is done by the non-governmental organizations (NGOs) Local Initiatives for Biodiversity, Research and Development (LIBIRD), the Forum for Rural Welfare and Agricultural Reform for Development (FORWARD), Community Based Seed Production (CBSP), District Level Seed Self Sufficiency Programme (DISSPRO), and by seed imports. Note that DISSPRO was established with the support of the District Level Development Office (DADO) to spread improved seeds through farmer-to-farmer exchanges.

Seed marketing is one of the most vital components of the seed system. New seed varieties can be disseminated and deployed at the farm level through both market and non-market channels. Market channels help market, disseminate and deploy seeds produced mainly by formal organized seed systems. Seeds produced and used by informal seed systems, however, require non-market channels to reach a large number of subsistence farmers in marginal regions. Non-market channels dominant in rural and remote hills, mountains and some interior parts of the

<sup>1</sup> Other strategies include: (1) strengthening varietal development; (2) enhancing marketing skills of seed entrepreneurs; (3) investing in seed infrastructure; (4) promoting use of quality seed; (5) developing efficient and effective public community and private seed organizations.

<sup>2</sup> NARC is responsible for producing breeder seeds and foundation seeds by developing high-yielding crop varieties, and supplying source seeds for the production of certified seeds by NSC, DOA, private seed companies and farmers’ groups.

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