Essays on Agri-processing Supply Chains

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Abstract

Contract farming has been gaining popularity among farmers and processors due to reasons such as increasing demand for high-quality crops, increasing consciousness about safety and quality of processed food among rising middle-class population in developing countries. Small farmers are showing a growing interest in moving from subsistence production of low-value (in terms of income generation) staple crops to production of high-value crops (such as gherkins, zucchini, broccoli, etc.) through contract farming as it helps to increase their income by providing access to a wider market. Though contract farming protects both the farmers and the processors from price and supply risks to some extent, there are still certain production risks (for example weather related, biological, crop diversification, loss of control, asset and investment risks) and market risks (for example single-buyer and multiple-seller, financial risks and counter-party issues such as non-delivery, sub-standard quality delivery, non-payment) that both the parties need to be endured with. This research focuses on studying issue of crop shortages due to yield uncertainty and cross-selling behavior of the farmers in contract farming.

In the first essay, we study the short-supplying behavior (a situation where the farmer supplies lesser quantity than the committed quantity due to low-yield realization) of the farmer under yield uncertainty. We investigate the advantage of implementation of penalty mechanism in addressing the issue of shortages and analyze the impact of yield uncertainty on quantity, penalty and profits. We demonstrate that, with the penalty framework, farmer tries to cover up for as much shortage quantity as possible by procuring from the other farmer in case of low-yield realization, and thus leading to a reduction in crop shortages.

In the second essay, we study the short-supplying behavior of the farmer due to cross-selling (a situation where the farmer tries to sell his produce to a third-party outside the contract). We develop a penalty framework and demonstrate that there exists a range of thresholds on penalty in which the farmer cross-sells lesser quantity of crop outside the contract and thus leading to a reduction in cross-selling behavior.

In the third essay, we study the short supplying behavior due to yield uncertainty and cross-selling behavior of the farmers, together. We investigate the interactions among farmers and processors by developing a penalty framework and analyze the impact of yield uncertainty on commitment quantities, cross-selling quantity, price and penalty. We demonstrate that implementing penalty by both the processors, on one hand helps one processor to minimize the losses due to shortage created by yield uncertainty and on the other hand helps the other processor to minimize the losses due to shortage created by cross-selling by their respective contract farmers.

Overall, this thesis focuses on implementation of penalty mechanisms to address the issue of crop shortages due to yield uncertainty and cross-selling in contract farming.

Keywords: contract-farming, cross-selling, game theory, yield uncertainty, short-supplying

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