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FINANCIAL VIABILITY OF ADVANCING PAYMENT FOR CONTRACT GROWERS OF GROUND NUT SEEDS

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ABSTRACT

Delays in payment adversely affect the contract seed production program for other field crops (OFC) conducted by the Department of Agriculture (DOA) Sri Lanka. This study focuses on assessing the financial viability of advancing payments for contract farmers who produces groundnut (*Arachis hypogaea* L.) seeds. The average price payable to contract growers for the Seed and Planting Material Development Centre(SPMDC), to be break even between the current practices of paying after the processing is over and advancing payment, was estimated using an Expected Value Model (EVM). Proportions of grade I and grade II seed and the price payable for each seed lot were estimated incorporating parameter estimates of "A" reports in a regression model. The average price payable was estimated as Rs. 119.16/kg using EVM. The percentage of un-germinated seeds, and seeds with insect and mechanical damage were significantly related ($p<0.05$) with grade I and grade II seed percentages. A 1% increase in the un-germinated seeds increased the payable price by Rs 0.23/kg whereas, the same level of increase of insect and mechanical damages to the seed reduced the price by Rs 2.39/kg. The results revealed that either EVM or regression model could be used in decision making on early payments for the contract growers. The estimated premium for insurance per hectare estimated with the EVM (Rs 11,726/ha), decreased to Rs 4,920/ha in regression model.

KEYWORDS: Certified seed, Contract growing, Financial viability, Insurance premium

INTRODUCTION

The performance of Other Field Crops (OFC) sub-sector in Sri Lanka has been poor as compared to the paddy sub-sector, in terms of their cultivated extent, production, and productivity. Due to gradual decrease in domestic supply of OFCs, a substantial amount of foreign exchange is incurred on the imports of those food items to meet the domestic requirements. Sri Lanka has spent Rs. 12,581 million to import 294,370 mt of OFCs in the year 2007 (Sri Lanka Customs, 2007). In the year 2007, extent under OFCs was about 115,173 ha (AgStat, 2008) and 580,000 farm families have been involved in farming for their subsistence (DOA, 2006).

With the aims of achieving self sufficiency in major OFCs and saving foreign exchange on imports, the government has included OFC sub-sector also in the three-year food production drive of years 2007-2010. Low prices, pest and diseases incidence and poor yields have been identified as the major obstacles to enhance the performance of this sub-sector. Non-availability of quality OFC seed in adequate amounts in a sustainable manner is a main constraint for development of this sector (Central Bank, 2003; DOA, 2006). Thus, the Department of Agriculture (DOA) of Sri Lanka has to play a major role to produce quality OFC seed for fulfilling the national seed requirements. Accordingly, the DOA carries out a multiplication process of registered OFC seeds through private contract growers in different districts of Sri Lanka, in addition to the seed production in the DOA farms, to produce certified seed. The major share of certified seeds of OFC is generated through the contract growing program (DOA, 2007). The contract growing program is managed by the Seed and Planting Material Development Centre (SPMDC). The seed certification service to contract growers is provided by the Seed Certification and Plant Protection Centre (SCPPC) of the DOA. The DOA has spent Rs 48 million and Rs 42.6 million in the year 2006 and 2007, respectively through offices of the Assistant Directors' of Agriculture (ADA seed) of the SPMDC to ensure the production of quality seeds to achieve the annual seed production targets (DOA, 2006 ; 2007).

Under the existing method of payment to contract growers, the procedure takes about 2 months. Delays in payment have become a crucial factor for giving up seed production by the registered contract growers for the DOA, and also for the difficulty of persuading previously unregistered farmers to accept seed production contracts in the 'contract OFC seed production program'. Further, the tendency of contract seed growers to sell portions of their harvest in the open market to obtain a quick income has made it difficult to launch a successful OFC seed production program (DOA, 2006). The failure of the SPMDC to implement a successful OFC seed production program is generally reflected by shortage of quality OFC seeds in Sri Lanka. Further, the public expenditure spent on seed certification is wasted if the produce of seed sold in the open market is used for consumption purposes. Hence, there is a need to shorten the time lag taken for making payment after the farmer hands over the seed lot to the SPMDC.

Proposed strategy for advancing payment for seed

The OFC seeds produced by contract growers under contract-growing program are purchased by the SPMDC through ADA (seed) offices. The contract grower, who has registered under certified seed production program, has to submit a seed sample to Seed Certification Service (SCS) of the DOA to test the seed quality. The seed sample, which is drawn by a technical officer of the SCS at the farmers' premises, is identified as the "A" sample. After testing the A sample, a report is issued by SCS, and that is termed as the "A"

report. Acceptance or rejection of the seed lot for further processing depends on whether the samples meet seed testing standards (SCS, 1984) according to the 'A' report, or not. If the "A" sample is accepted, such a seed lot is qualified to be collected by the ADA (seed) in the region.

The seed lot collected by ADA (seed) is subjected to further mechanical processing. After processing, the portion of the seed lot to be certified (grade I seed) is retained at the stores of ADA (seed) and the farmer is entitled to receive payment from SPMDC for the said portion. The portion that is not acceptable to be certified (grade II seed) is returned to the farmer. The farmer can sell grade II seed for consumption purposes.

The average time needed for completion of various steps in seed testing and purchasing procedure is illustrated in Figure 1. If payment is made based on "A" report, the steps starting from 7 and ending in 11 can be by-passed as depicted by the figure1. Accordingly, the payment can be advanced by one month since the time spent on mechanical processing and seed testing does not influence the time lag of making payment.

Non availability of seed of improved groundnut (*Arachis hypogaea* L) varieties is a major constraint in most of the ground nut growing-countries. Generally, the private sector has little interest in groundnut seed production due to low seed multiplication ratio, bulky nature, quick loss of seed viability, high cost of transportation and low profit margin (Ntrare *et al*. 2008). Considering these specific attributes and the ensuing importance needs to be placed on ground nut seed production by the public sector, this study focuses on assessing the financial viability of advancing payment to contract growers of ground nut by making payment based on 'A' report.

The main objectives of the were to (a) ascertain the average financial viability and the risk of payments to DOA by making payments to contract seed producers of ground nut based on 'A' report, (b) use characters contained in the "A" report to predict the receivable percentages of grade-I and grade-II seed yields and the percentage of wastage that could occur after mechanical seed processing, and (c) estimate the expected cost of insurance to farmers to cover the possible loss to SPMDC by proposed system of early payment.

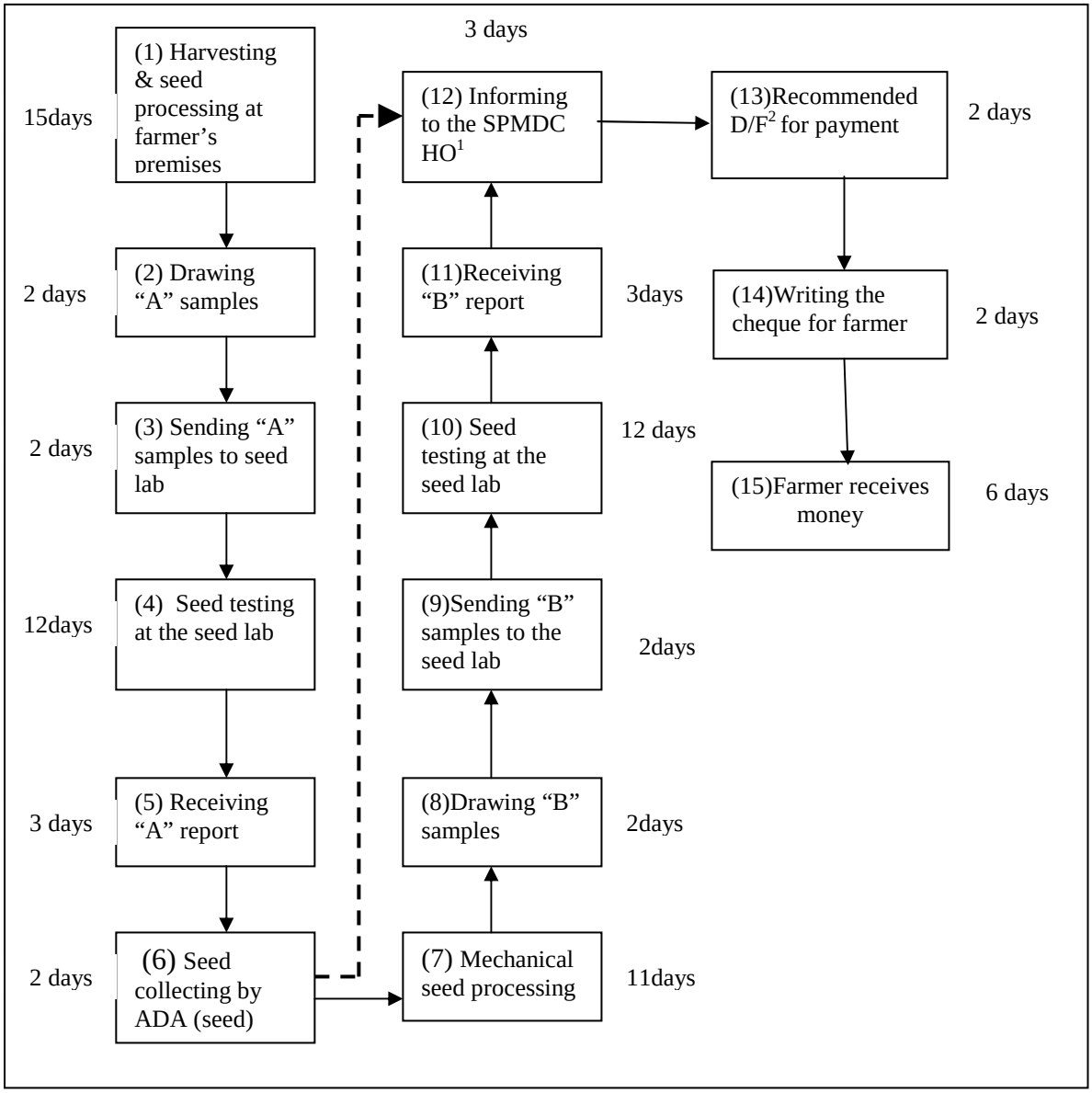

Figure-1. Average time spent for seed testing and purchasing procedure

MATERIALS AND METHODS

Conceptual Model

(1) Expected value model

The unprocessed amount of ground nut (*Arachis hypogaea* L) seed (Q_{0j}) submitted to SPMDC by farmers, is separated to grade I seed (Q_{1j}), grade II seed (Q_{2j}) and wastage (Q_{3j}) during the processing. Accordingly the following equality holds (Equation 1).

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$$Q_{1j} + Q_{2j} + Q_{3j} = Q_{0j} \quad \text{(Eq. 1)}$$

(1)

If payment is based on "A" report, the j^{th} farmer receives payment for Q_{0j} quantity where as if payment is based on quantity $Q_{1j,}$ which is received after seed processing. The farmer can fetch farm gate price for quantity Q_{2j} which is returned to him by the ADA (seed) and dispose Q_{3j} without receiving any payments. The mean observed frequency of 'n' sample units is expressed as expected probability value. Therefore, as given in Equation 3,

$$\sum_{j=1}^{n}\left(\frac{Y_{1j}}{n}\right) + \sum_{j=1}^{n}\left(\frac{Y_{2j}}{n}\right) + \sum_{j=1}^{n}\left(\frac{Y_{3j}}{n}\right) = 1 \quad \text{(Eq. 2)}$$

Where, $Y_{1j} = Q_{1j}/Q_{0j}$, $Y_{2j} = Q_{2j}/Q_{0j}$ and $Y_{3j} = Q_{3j}/Q_{0j}$ are grade I seed, grade II seed, and wastage percentages, respectively of seed lot j. The first, second and third term of equation 3 are the probability values of receiving grade I seed, grade II seed and wastage, respectively. The prices of grade-I seed (P_1), grade II seed (P_2) and wastage (P_3=0) should be weighted by probabilities of receiving each category in order to compute the average price received for whole seed lot j.

The following relationship(Equation 3) should hold for SPMDC to be financially break even on making payments based on either 'A' report or on recommending for payment after processing (current method of payment).

$$\sum_{j=1}^{n}\left(\frac{Y_{ij}}{n}\right).P_1 + \sum_{j=1}^{n}\left(\frac{Y_{ij}}{n}\right).P_2 + \sum_{j=1}^{n}\left(\frac{Y_{ij}}{n}\right).P_3 = P_4 \quad \text{(Eq. 3)}$$

Where,

P_1 – Current price (Rs/kg) paid for grade-I (certified) seed
P_2 – Farm gate price (Rs/kg) of grade-II (consumption) seed

P_3 – Price of wastage (zero in the case of ground nut)
P_4 – Price(Rs/kg.) to be paid by SPMDC for whole seed lot based on 'A' report

Accordingly, P_4 is the maximum price payable to a seed lot accepted on 'A' report by SPMDC to be breake even in average with current method of payment.

(2) Regression model

The major bottleneck in making payments based on 'A' report is that the SPMDC has to bear a loss if proportions higher than observed

probability estimates of seed in the lot are to be graded as grade II and/or disposed after processing. On the other hand, if the actual percentage of grade I seed is higher than the observed probability estimate of grade I seed, the producer will be loosing by receiving payment based on "A" report. Therefore, an attempt is made to predict these proportions from seed quality parameter estimates in 'A' report in order to reduce the risk for both parties of the contract. The estimated percentage seed yield of grade I or grade II is expressed by the linear relationships.

$$y_{1j} = \alpha_1 + \sum \delta_{1i} X_{ij} + \varepsilon_{ij} \qquad \text{(Eq. 4)}$$

$$y_{2j} = \alpha_2 + \sum \delta_{2i} X_{ij} + \varepsilon_{ij} \qquad \text{(Eq. 5)}$$

Where, y_{1j} and y_{2j} are the proportions of grade I seed and grade II seeds of j^{th} farmer and $X_{i,}$ i =1…8 are % of pure seed (X_{1j}), % of inert material (X_{2j}), % of normal seedlings (X_{3j}), % of abnormal seedlings (X_{4j}), % of un-germinated seed (X_{5j}), % of dead seed (X_{6j}), % of insect & mechanical damage to seeds (X_{7j}) and % of moisture content (X_{8j}), respectively. Prices to be paid for each seed lot based on 'A' report was re-estimated by substituting estimated percentages of grade I and grade II seeds for each seed lot in equation 3.

Estimating compensation needed for insuring better performers in to not to loose

Two methods of forecasting the proportion of grade I and grade II seeds, and wastage to be received after processing, were estimated in this study. The EVM estimates and average price for all seed producers, whereas the regression model computes the price to be made based on parameter estimates based on 'A' report. Irrespective of the model used for predicting price to be paid, the estimates for a seed lot is likely to be different from the proportion weighted average by price paid for grade I seed and price received for grade II seed. Therefore, actual good performers may loose where as poor performers may gain when the payment is based on estimates. Therefore, the registered seed farmers whose actual value of grade I and grade II seed are above values estimated by models used could be made to receive payments equal to the current method of payment by insuring them against incurring losses due to obtaining payments under proposed system. After making payment based on 'A' report, if the actual grade I seed is higher than the average, the difference between the current method of payment and estimate based on proposed method of payment using EVM or regression could be paid by a separate cheque. The insurance premium needed to be collected is represented by the Equation 6 and 7.

$$PR_{100} = \frac{\sum_{j=1}^{m} d_j}{n.K} \quad \text{(Eq. 6)}$$

$$PR_{hec} = \frac{\sum_{j=1}^{m} d_j}{n.K.100}.Y_{hec} \quad \text{(Eq. 7)}$$

Where, ' PR_{100}', and 'PR_{hec}' are insurance premium for 100 kg of seed and per ha, respectively; 'd_j' is the loss for 100 seed kilo grams for j^{th} sampling unit from proposed payment (j=1..m represents losers from payment based on probabilities of payment, and j=m+1…n' represents gainers from payment based on probabilities of payment); 'n' is the sample size; 'K' is the ratio of allocation for indemnity payment to sum (a) of the allocation for indemnity payment, (b)profit of the insurance firm and (c)administrative cost; and 'Y_{hec}' is the average yield per hectare.

Data and assumptions used

A simple mail questionnaire was used to collect secondary data from ADAs (seed) with regard to 130 random seed samples of groundnut, which belonged to 8 different cultivation seasons and 8 ADA (seed) regions in Sri Lanka. Information on seed processing and seed testing were collected for a sub sample of 54 random seed samples obtained from the seed processing units of the DOA at Pelwehera and Aluttaramma. Information on the amount of seed received as grade I, grade II and the wastage in 'B' reports and pure seed and un-germinated seed (%), inert material (%), abnormal and normal seedlings(%), dead seed(%), and seeds with insect and mechanical damages(%), and moisture content(%) were collected. The current price paid by the SPMDC for grade-I seed and average farm gate price of grade II seeds were considered as Rs 130 and Rs 50 per kg, respectively. The seed yield per hectare was assumed to be 1,789 kg/ha (DOA) 2009.

RESULTS AND DISCUSSION

The financial viability of payment based on expected value model

The results presented in Table 1 revealed that the average price payable to contract growers based on 'A' report is Rs 119.16 per kg for the SPMDC to be break even. As illustrated in Figure 2, the SPMDC gains (losses) from the proposed method of payment when the grade I % is above (below) the average (89%). The SPMDC is break even on two methods of payment in the expected value model, if the percentage of grade I seed is equal to the mean of 89%.

The percentages of wastage and grade II seed are negatively related to incremental income gain (Figure 3). Hence, the farmer gains from the proposed method of payment if the percentage of grade II seed and wastage exceed their mean percentages of 6.91 and 4.09 in the seed lot, respectively.

Table 1: Breakdown of 100 kilo gram of groundnut seed into quantity and values of grade I, grade II seed and expected prices

Seed Grade	*Quantity Kg*	*Price Rs/Kg*	*Value Rs*
1.Average % of grade I seed accepted for Processing(Q_1)	89.00 (7.90)	130.00	1,570.00
2.Average % of grade II seed (Q_2)	6.91 (88.80)	50.00	345.50
3. Average % of wastage(Q3)	4.09 (50.50)	0.00	0.00
4.Total income from 100 kg of seed			11,915.50
5. Average price payable to contract grower based on 'A' report (P_4) (Rs/kg)			119.16

Values within the parenthesis are the coefficients of variation.

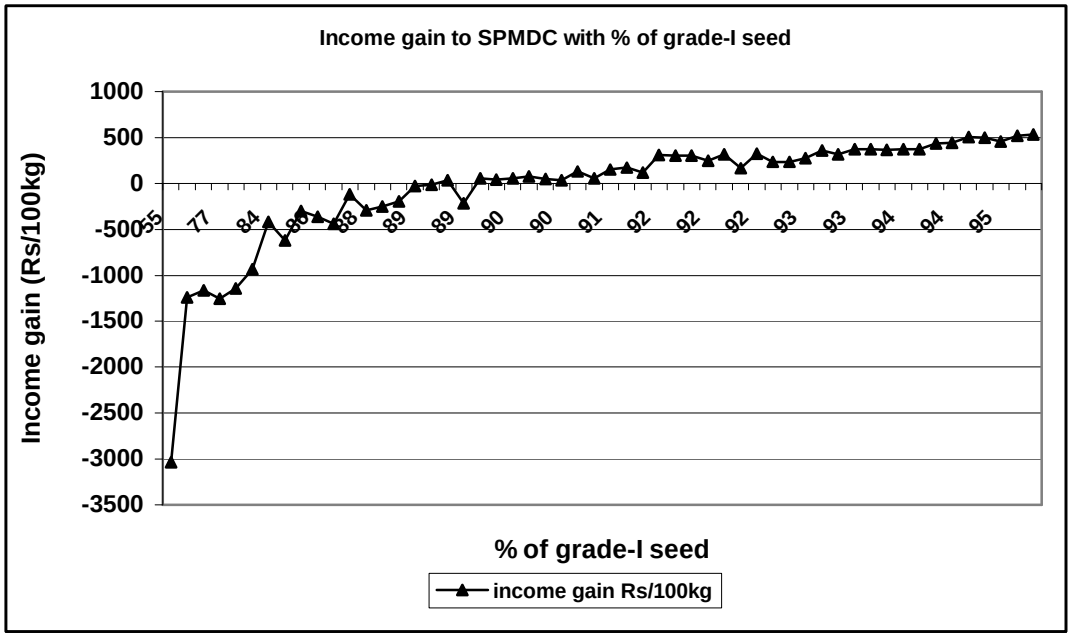

Figure 2. The relationship of grade 1 seed percentage to incremental income gain to SPMDC by paying based on 'A' report

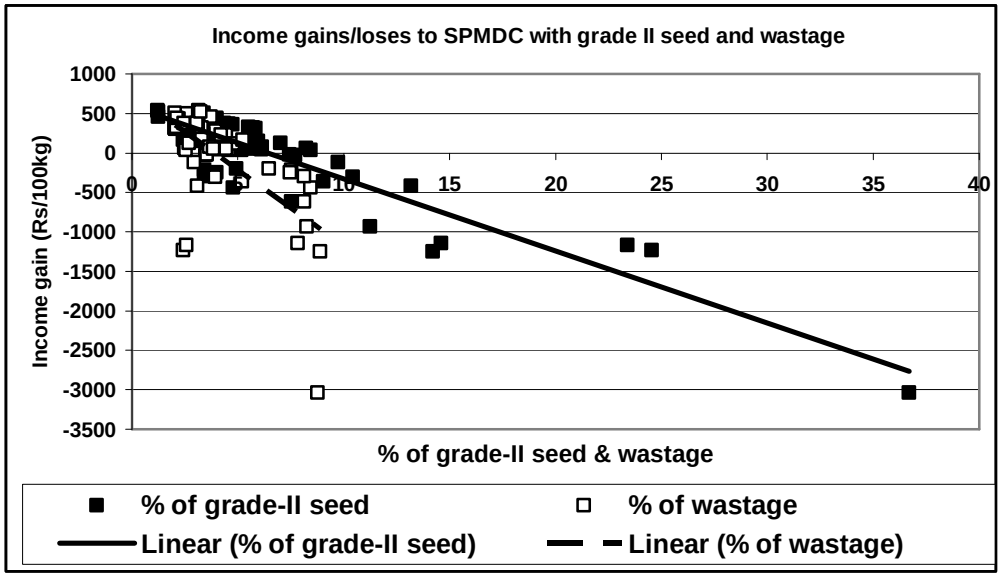

Figure 3. The relationship of grade II seed percentage and wastage percentage to incremental income gain from payment based on 'A' report

Predicting payment based on regression model

In the selected sample, most of the parameter estimates did not show strong relationships with percentages of grade-I (y_1) and grade II (y_2) seed received after seed processing(in order to solve multi-collinearity problem among the independent variables considered in 'A' report, % of dead seed (X_6) was excluded from the regression model). The regression relationships estimated are presented in Tables 2 and 3, respectively.

Table 2. The regression relationships of grade-I seed percentage and parameters in 'A' report.

Dependent variable (grade I seed)	*Predictor variables*	*Coefficient*	*SE coeff.*	*p value*
Y_1	Constant	1953	2863	0.49
	X_1	-18.75	28.67	0.52
	X_2	-19.32	28.65	0.5
	X_3	0.16	0.12	0.16
	X_4	0.38	0.32	0.24
	X_5	0.34	0.16	0.004
	X_7	-3.17	0.46	0
	X_8	-0.08	0.48	0.86
*Significant at p=0.05	R^2 61.4%		R^2 (adj.) 54.1%	

Table 3. The regression relationships of grade-II seed percentage and parameters in 'A' report

Dependent Variable (grade II seed)	*Predictor variables*	*Coefficient*	*SE coeff.*	*p value*
Y_2	Constant	-2204	2629	0.41
	X_1	22.23	26.33	0.4
	X_2	22.37	26.31	0.4
	X_3	-0.15	0.11	0.17
	X_4	-0.26	0.29	0.37
	X_5	-0.42	0.15	0.01
	X_7	3.47	0.42	0
	X_8	-0.15	0.45	0.74
**Significant at p=0.05	R^2 69.4%		R^2 (adj.) 63.6%	

Significant relationships are shown by % of ungerminated seed (X_5) and % of insect and mechanical damage(X_7) with grade I seed. An increase of insect and mechanical damage by 1%, decreases grade I seed by 3.17 %, and an increase in ungerminated seed(X_5) by 1% increases grade I seed by 0.34%.

The percentage of un-germinated seeds (X_5) and the % of insect and mechanical damage(X_7) only showed a significant relationship with the % grade II seed (Table 3). However, the sign of the coefficient of un-germinated seed (X_5) is positive in the case of grade I seed (Table 2), but negative relation to grade II seed (Table 3). The inverse relationship shown between grade I and grade II seed probably justifies receiving this result. The relationship of insect and mechanical damage with grade II seed was also negative. Since most of the seed damaged by insects and mechanical operations are removed as wastage, this result agrees with priori expectations. Increase of un-germinated seed by 1% decreased grade II seed by 0.42 % whereas the increase of insect and mechanical damage by 1% increases grade II seed by 3.47 %.

The estimates of the consequent influences of the % un-germinated seed and % insect and mechanical damage on payable price are presented in Table 4. According to the estimates, an 1% increase of un-germinated seeds increased price by Rs 0.23/kg and the influence on price by 1% increase of insect and mechanical damage raised payable price by Rs 2.39/kg. The variation of the payable price due to increasing percentage of insect and mechanical damage is illustrated in Figures 4.The payable price varies from Rs 117 per kg to Rs 124 per kg.

The figure 5 illustrates that if farmers are paid about Rs. 100/kg in advance and the balance is paid after seed processing report is received, only about 4% of the sample will be paid above the actual payments they should

have received. Therefore, the SPMDC can decide to make early payments as 75% of the expected price (*i.e* Rs.89.37/kg) and pay the actual balance to be paid after the grade I and grade II seed quantities are known. Then the losses to SPMDC will be very low and that loses could be recovered by marginally increasing selling price of certified seed.

Table 4. The influence of un-germinated seed and insect and mechanical damage on price of seed lot

	Independent variables	
	Un-geminated seed % (X_5)	*Insect and mechanical damages %(X_7)*
Mean value	1.15	0.63
(1)% Change in y_1(grade I seed) with 1% change in independent variable	0.34	-3.17
(2)% Change in y_2(grade II seed) with 1% change in independent variable	-0.42	3.47
(3)Change in price due to change in y_1 associated with % change in independent variable	0.44	-4.12
(4)Change in price due to change in y_2 associated with1% change in independent variable	-0.21	1.73
(5) Net price effect due to 1% change in independent variable((3)+(4))	0.23	-2.39

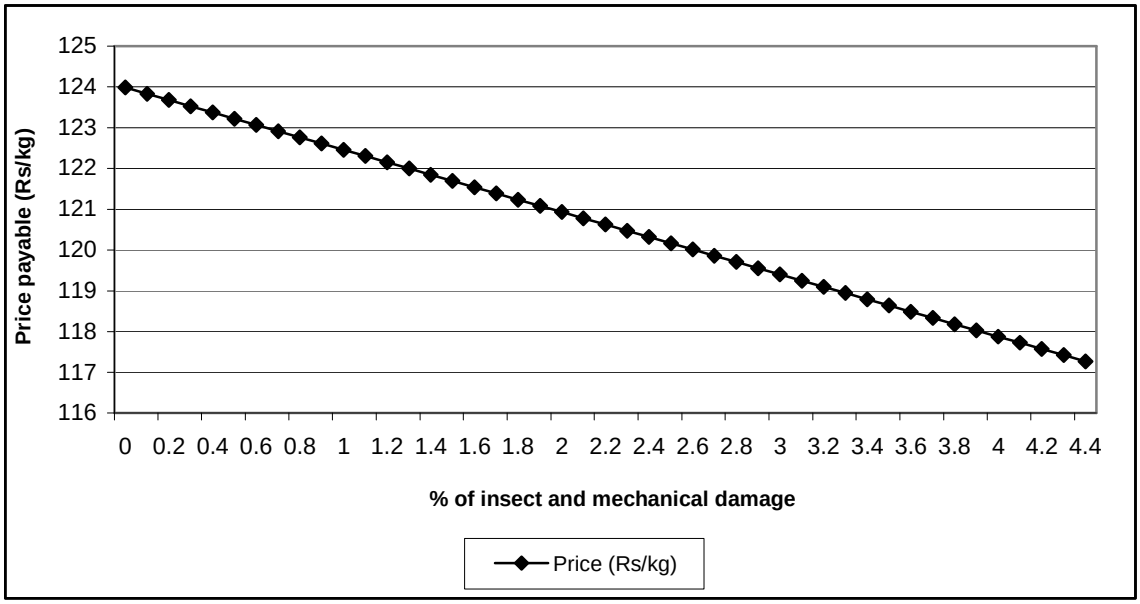

Figure 4. Change of price with the change of insect and mechanical damage percentage

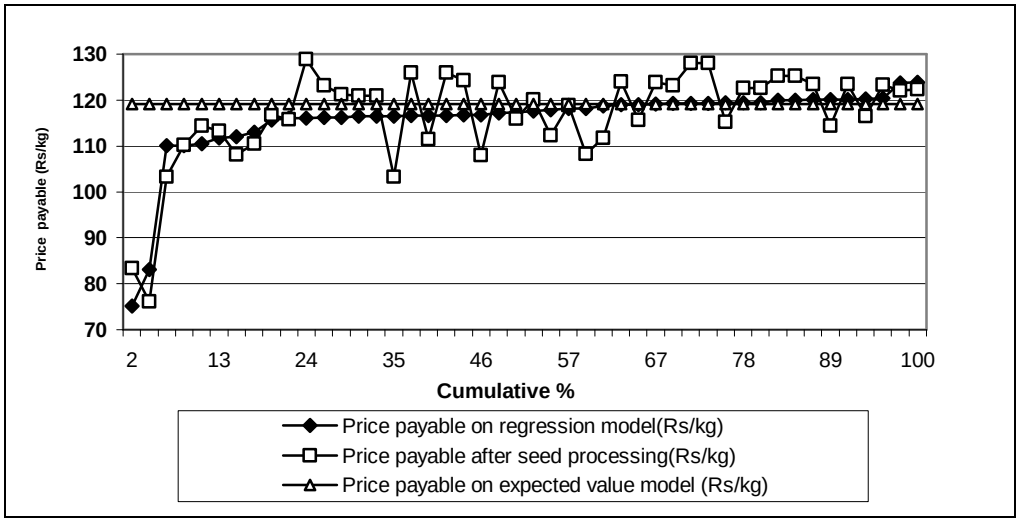

Figure 5: Price distribution within sample with B report estimate, expected value and regression estimates

The possibility of paying the difference between current and proposed payment after receiving 'B' report

By insuring all the contract seed farmers, the losers from the proposed payment system can be paid the difference between the proposed system and the current system after processing is over and when the actual quantities of grade I, grade II seeds and wastage known. The observed probabilities of losses with EVM and regression model are presented in Table 5.

Table 5. The observed probability of losses due to payment based on 'A' report, and the insurance premium needed to compensate.

Loss range Rs/100kg	*Observed probability with expected value model*	*Observed probability with regression model*
Above 3000	0.04	
2000- 2999		
1000-1999	0.11	0.02
700- 999	0.09	0.07
400 -699	0.09	0.13
0 -399	0.15	0.17
Total	0.48	0.39
Average loss for losers	990	508
Average loss for all	473	199
Insurance premium (Rs per 100 kg) seed with 40% administrative cost Rs	788	331
Insurance premium (Rs per hectare) with 40% administrative cost	11716	4920
Insurance premium as a percentage of revenue	6.62%	2.78

If seed farmers are insured, a separate cheque for the difference could be written after seed processing is over and the SPMDC can claim the loss from the insurance firm. It is observed that the probability of loss and average loss decrease for losers by predicting with regression equation results. Further the insurance premium decreases from Rs 11,716/ha to Rs 4,920/ha with incorporating forecasting based on 'A' report. Moreover, the insurance premium to gross income ratio decreases from 6.62% to 2.78%.

CONCLUSIONS

This study focused on the appraising financial viability of advancing payment by about one month in the case of groundnut seed, if papers for payment are processed soon after receiving 'A' report. The result revealed that the SPMDC is expected to be break even with current method of payment if payment is based on mean proportions of grade I seed, grade II seed and wastage in records maintained at SPMDC. However, if payment is based on expected proportions of grade I, grade II seed and wastage, the farmers whose actual payment is better than average tend to loose and below average farmers tend to gain. The un-germinated seed percentage and insect and mechanical damages in 'A' report showed significant relationships with grade I and grade II seed percentages. The regression models explaining relationships with both grade I and grade II seed explained above 60% of the variation in dependent variables. The regression model improves over expected value model in predicting price to be paid to a farmer.

An insurance scheme is proposed to ensure that none of the farmers will be loosing from advancing payment. The insurance premium to be collected from seed farmer was estimated as Rs. 11,716 per ha, with the EVM. The premium reduces to Rs 4,920 per ha with using regression model to estimate grade I and grade II seed percentages. As an alternative to registering farmers with an insurance scheme, a fixed advance payment as 75% of the expected price value is proposed. Then the SPMDC will incur losses only from about 4% of seed farmers. The SPMDC can either bear this lose or increase selling price marginally to cover the cost.

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